High-Tech Urbanism
The Political and Economic Implications of the Smart City

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INTRODUCTION

The smart city concept

“See this little metal dot on the ground?” one of my interviewees asked. “This is one of our parking sensors.” I was standing in 22@, Barcelona’s creatively-named technology and innovation district\(^1\), with the executive director of Urbiotica, a Spanish company that improves urban services through technology. Could this inconspicuous metal circle, easily mistaken for a stray coin, affect the way that cities function merely by providing citizens real-time information on parking? Barcelona, for one, decidedly says yes; sensor technologies, like the one I saw embedded in the asphalt, are expected to be a main component of the so-called smart city. At its most basic level, this term refers to a city that uses technology to improve governance, drive the economy, and enhance quality of life. Not only is the smart city expected to change municipal-level factors, it is also credited with the capacity to address “the challenges of climate change, population growth, demographic change, urbanization, and resource depletion” (Arup, 2010).

Urbiotica’s single parking technology, of course, will not significantly impact these larger goals, but it is part of a much broader framework of smart city infrastructure that is redefining the way that cities prioritize decision-making and spending. Technology-oriented policies are having tangible impacts as well, altering the city’s physical infrastructure and form. Barcelona’s technology district was literally rising before my eyes; behind futuristic, energy

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\(^1\) Poble Nou, the neighborhood that the 22@ district is located in, was historically zoned as 22a, Barcelona’s zoning designation for industrial areas. By naming the technology district 22@, the city has taken ownership of its past while modernizing it for the age of technology and innovation (22 ARROBA S.A.U., 2006b).
efficient buildings were cranes, fenced-off piles of dirt, and signs with visual renderings of the structure eventually to be built.

Globally, the simultaneous trends of accelerating urbanization and worsening climate change have created a sense of urgency that has underscored the importance of the city as arguably the most viable unit of governance to effect efficient and significant change. The widely-cited statistic of the 2008 urban-rural tipping point, which shifted the balance for the first time in history to a world with more urban than rural inhabitants, bears particular relevance to this focus on cities (UN, 2008). Organizations like C40, a network of the world’s megacities, see this as an opportunity to undertake meaningful action to reduce greenhouse gas emissions by sharing best practices, often technologically enabled, to improve energy efficiency (C40 Cities, n.d.). As cities are gaining prominence as the most practical level of government to target, the smart city concept has shifted from being a conceptual framework to becoming an actual urban planning model. The smart city has emerged in this context of dynamic change, offering solutions that go beyond conventional policies and tools by integrating technology and data management into the core components of city life.

This recent upsurge of interest in the promise of the smart city from a practical perspective is what motivates the research reported in this thesis. Given the widespread adoption of smart city policies and initiatives in large, globalized cities, the actual political and economic effects, implications, and challenges of the approach must be studied. That is what I have sought to do in my research. Before taking up these issues, however, it is necessary to further explain what is meant by the smart city and the global setting in which it emerged.

There is no single, accepted definition of the smart city, but it is used broadly to refer to efforts to make the various parts of the city—government, economy, environment,
transportation, people, and energy, among others—“smart” by employing information and communication technology (ICT) to efficiently optimize daily operations and citizen needs. While classic planning schemes have relied on the precise location, scale, and relationship between buildings, smart cities are more concerned with web platforms, mobile technology, and the internal sensors regulating physical spaces. In order to compete in the global economy, cities worldwide are embracing technological innovations across many fields, from energy and healthcare to education and transportation. The use of this real-time data can help cities work towards political transparency and efficiency, as well as drive economic growth. Furthermore, it aids environmental efforts by regulating emissions and reducing redundancies.

Due to these numerous applications, my working definition of the smart city does not focus on the separate components of a city that can be enhanced with technology, but rather how the model operates in practice. For the purposes of this thesis, the smart city is a city that, through public and private sector collaboration, has invested in ICT infrastructure and human capital to drive economic growth, facilitate the exchange of information between sectors, and produce resource-efficient operations that enable high-quality citizen services.

The smart city reality

In the preceding section, I focus on the underlying premise and promise of the smart city concept. In this thesis, however, I am more concerned with the contemporary embodiment of the concept than its longer term trajectory. The smart city as a physical reality is a new phenomenon that, in practice, has been implemented in two forms. The first is the retrofit of current cities to incorporate ICT into existing infrastructure. Referred to as a “brownfield” or “urban retrofit” site, this is the most common form of smart city emerging, especially in Europe. The second type is the “greenfield” smart city, which is built on undeveloped land and tends to be characterized
by an unparalleled level of corporate involvement. This unique way of funding ICT infrastructure—simply up-fronting the costs of construction—is not feasible in older cities. The most well-known of these developments are PlanIT Valley in Portugal, Masdar in Abu Dhabi, and Songdo in South Korea, where ICT is integrated into the fabric of everyday infrastructure.

As brownfield sites are more applicable to the majority of the world’s urban population, though, this thesis will focus on the changes occurring in existing cities that have adopted the smart city as an urban planning model. The rise of the smart city is reflected in the economic value it is expected to produce; Pike Research forecasts that between 2010 and 2020 investment on smart city infrastructure will top $108 billion; at that point, annual expenditures in the smart city industry will reach $16 billion (2011). Smart city policies in existing cities are driven by a combination of local government support and private sector tools, with only a limited amount of influence from national governments. Rather than provide their own municipal broadband or deploy other ICT-related policies, city governments often establish public-private partnerships or simply outsource services to private companies. The most notable private corporations involved in the smart city are Cisco Systems, who provides network infrastructure, and IBM, who specializes in data management and analytics.

Because the smart city is such a recent urban planning model it has not been studied in depth in cities where it has been implemented. In this thesis, I analyze three early adopters of the smart city model—Amsterdam, Barcelona, and New York City—in order to evaluate the practical economic and political effects of its application. I begin with a discussion of the scholarship tracing the potential use of ICT in cities, noting the lack of study of its real-world implications and challenges. I follow this with an overview of the brownfield smart city projects
currently emerging in Amsterdam, Barcelona, and New York City, given their local economic circumstances and the major players in their smart city plans.

Subsequently, in my results chapters, I take a thematic approach to identify the economic impacts and political consequences of the smart city. Chapter 4 addresses the economic implications, while Chapter 5 evaluates the political effects of the model. My findings are based on data I gathered through personal interviews with relevant stakeholders in each city, who ranged from city planners to corporate executives to skeptical scholars. I also draw evidence from private sector reports, government-reported data, and academic criticism of the smart city and technology policy in general. The combination of document analysis and personal interviews allows me to reconcile the intentions of technology policy with the realities of what happens out of public view.

In sum, I argue that cities that have implemented smart city policies are characterized by profit-oriented decision-making that tends to reinforce the principles of economic liberalization. At the same time, the very technologies implemented are simultaneously being used to empower bottom-up efforts seeking government accountability, transparency, and prioritization of citizen needs. Politically, the city’s increasing reliance on technology, unimpeded, appears to worsen inequality. As a result, smart city governments have begun to aggressively combat the digital divide, primarily through broadband penetration initiatives, in order to increase their city’s human capital. Likewise, the knowledge economy is changing the relationship between the private sector and labor, generally at the expense of those traditionally reliant on labor unions. These political and economic changes have called into question the way that 21st century governance should be implemented and which technological tools are most viable to create the equitable, sustainable, competitive city that the smart city model promotes.
It should be noted that while I distinguish between “political” and “economic” implications in the presentation of my findings, in reality, these two dimensions together comprise the more overarching concept of political economy. The point is, invariably the economic aspects of smart city initiatives have important political implications and vice versa. Still, if somewhat false, the distinction between political and economic is useful in helping me organize my results. For the sake of comparison and organization, the chapter on economic implications consists of the evaluation of the neoliberal smart city alongside the discussion of bottom-up efforts; these two sections are paired because they share a strong basis in ideology and economic theory. The digital divide and labor relations, on the other hand, discussed side-by-side in the chapter on political implications, are both defined by concrete policy decisions related directly to the governance component of the smart city. After the analysis of my results, I provide a brief summary of the most significant trends characterizing each of my case studies. Here, I give a more comprehensive assessment of their respective smart city projects and how they compare with one another in a broad sense. As a whole, my findings demonstrate that the application of the smart city model does not inherently rely on top-down or bottom-up planning, but requires critical management and broad participation in order to foster a citizenry fully able to participate in the city and larger economy.
LITERATURE REVIEW AND METHODOLOGY

Prior Theoretical Models of Technologically-Based Cities

To understand the smart city, it is useful to begin with the conceptual relatives of the model. While limited in scope, they set the theoretical framework for the more holistic notion of the smart city currently understood by the urban planning sphere. The foundations of the concept lie in Dutton’s wired city, which promised to use emerging telecommunications technology to provide unprecedented amounts of information to households and businesses through “information highways” that ultimately would create a communications-centric society (1987).

Another precursor to the smart city is the digital city, a technologically-defined city that uses widespread broadband infrastructure to support e-Government and “a global environment for public transactions” (Anthopoulos and Tsoukalas, 2005; Mitchell, 2000). Rather than replace the concrete world with a virtual city, the digital city uses open industry standards to create a “service-oriented computing infrastructure” that serves the needs of urban residents and encourages information sharing and collaboration (Yovanof and Hazapis, 2009). Ishida (2000) documents how Amsterdam and Helsinki—it is not a coincidence that these are two modern smart cities—began digital city projects in 1994 and 1996, respectively, that focused primarily on providing a “democratic forum” for communication among citizens and with the municipality. Foreshadowing the current concerns about a deepening digital divide in the smart city, the theoretical model of the digital city identifies the danger of exacerbating the challenges
of the “information poor”—those who lack knowledge and social capital—despite their goals of social inclusion (Ishida, 2000).

The diffusion of sophisticated technology at the citizen-level, however, is not the only component of the smart city. In his discussion of the continued relevance of the physical city, Glaeser (2011) argues that it is the spatial concentration of human capital—as seen in Silicon Valley, for example—and not the technology itself, that will ultimately be the driver of innovation in the cities of the future. The social capital component is crucial, as clustering of skilled people in metropolitan areas has driven a “brain gap” between “smart” cities and their less skilled counterparts (Berry and Glaeser, 2005; Glaeser and Berry, 2006). While this academic conception of the smart city is limited to human intelligence and creativity—unmistakably related to Richard Florida’s (2002) creative class and magnet cities—the social dimension is a significant part of smart city rhetoric in the policy sphere as well. Not surprisingly, the qualities of equity, accessibility, and just governance are stressed by many political working groups exploring the implementation of smart cities. For instance the North Sea Region Programme’s Smart Cities project aims to deliver better e-services to its constituents in the North Sea region (The North Sea Region Programme, 2012), and the Citizen Card in Zaragoza, Spain allows citizens to use public Wi-Fi, buses, sports centers, museums, libraries, and other services with an integrated smart card (Ayuntamiento de Zaragoza, 2012).

The intelligent city is a more comprehensive concept developed from the combination of the digital city and the knowledge society. It is defined as a “multi-layer territorial system of innovation” made up of digital networks, individual intellectual capital, and the social capital of the city and its institutions, which together constitute collective intelligence (Komninos, 2008). This highly academic definition emphasizes an important point that suggests the move towards
the broader smart city concept: the mere existence of ICT does not guarantee the development of an intelligent city. Economic competitiveness and innovation achieved through the knowledge-based economy mark a city as intelligent, allowing it to generate a “spatial competitive advantage” through industrial districts, regions, and learning clusters that produce sophisticated R&D and are supported by digital networks and artificial intelligence (Komninos 2008). What ultimately makes a city intelligent is its ability to innovate and capitalize economically—an accomplishment that is aided by ICT, but not assured by it. Similar to the intelligent city is the u-city, short for ubiquitous city, which refers to the environmentally-friendly city that incorporates ubiquitous computing in buildings, open space, and infrastructure (Lee et al. 2008).

The environmental aspect of the smart city has been discussed thoroughly in projections about continued urbanization and the increasing demand for resource-depleting commodities. Many variations on the smart city, such as the u-city, have been offered as a panacea to unsustainable levels of urban consumption and emissions. For example, the concepts of the “urban metabolism” and eco-efficiency are the foundation of the eco-tech city, which adopts a new design paradigm that combines information technology with environmental technology to create “ecologically-inspired tools of urbanism” (Bogunovich, 2002). Lim and Liu’s (2010) futuristic “Smartcity” promotes urban agriculture and the integration of nature into the urban form, ultimately allowing the creation of closed cyclical systems. Finally, the recently coined u-eco city approaches a more pragmatic definition of the smart city by combining the use of ICT with green technology to reduce carbon emissions, manage land and water pollution, and track waste (Lee, 2011).

While most discussions of the “green” potential of smart cities are purely theoretical, Hin and Subramaniam (2012) examine the deployment of intelligent transportation systems, such as
electronic road pricing, as a practical solution with ecological benefits through their case study of Singapore’s innovative ICT-based transportation policies. While the authors restrict themselves to the smart mobility component of the model, they acknowledge that the “‘smart city’ is thought to involve the operation of at least six dimensions with the prefix ‘smart’”: people, living, economy, mobility, environment, and governance. This comprehensiveness is the distinguishing factor of the smart city, which integrates a number of physical, institutional, and digital components to create a holistic definition of what smart planning would look like. This recent shift in the use of the smart city as a practical—rather than theoretical—planning term has led to the delineation of the functional characteristics of the model. While no modern smart city has achieved all aspects their entirety, attempts to define these characteristics provide a basis for the continued development of smart cities.

Towards Defining the Smart City

Though the smart city has recently emerged as a widely discussed urban planning model both in the policy and theoretical spheres, there is a remarkable lack of consensus on the term’s definition. In general, the smart city is characterized by the extensive use of internet and communications technology (ICT) infrastructure to drive urban growth through the improved delivery of city services, environmentally sustainable development, and growth of social capital. Much of the literature on smart cities comes from one perspective, however, concentrating heavily on either the technological, environmental, or social element; little attention is paid to the governance component, and it is only recently that more holistic definitions have emerged.

The six characteristics mentioned by Hin and Subramaniam (2012)—people, living, economy, mobility, environment, and governance—were developed by Giffinger et al. (2007) to rank the “smartness” of medium-sized cities across Europe. They broke the six areas into 74
measurable indicators such as the flexibility of the labor market and sustainable resource management. The study was instrumental in attempting to operationalize the smart city rather than study it theoretically, and more importantly, in developing the six criteria often referenced in smart city policies worldwide. Townsend’s similarly holistic model shows the smart city more generally as the intersection of urbanization and ubiquitous digital technology, with four main “intelligent” drivers: the commons, markets, design and planning, and governance (Institute for the Future, 2010). Rather than break the city down into sections—the model of six characteristics recalls the legacy of department-led city governance—this understanding of the smart city identifies the scales at which ICT can impact urban human interactions.

The literature acknowledges the lack of consensus on a single meaning for the smart city and consequently, articles often start with a redefinition of the term (Caragliu et al, 2011; Hin and Subramaniam, 2012; Hollands, 2008; Nam and Pardo, 2011). These evolving definitions make the analysis of the smart city somewhat inconsistent; as a point of departure for productive discussion, then, Schaffers et al. (2011) accept a previously established definition of the smart city: “when investments in human and social capital and traditional (transport) and modern (ICT) communication infrastructure fuel sustainable economic growth and a high quality of life, with a wise management of natural resources, through participatory government” (Caragliu et al., 2011). The smart city distinguishes itself from its predecessors in its emphasis on the specific instrumentation that will enable urban problem solving, specifically embedded systems—sensor technology, mobile phones, smart meters, etc.—and big data—large and complex datasets used to analyze urban life (Schaffers et al., 2011). The most important ICTs that contribute to the physical smart city are widespread broadband connectivity, smart personal devices, open data infrastructures, public interfaces, and cloud computing (Institute for the Future, 2010).
Economic Projections for the Smart City

The economic dimension of the smart city argues that the model is a means to achieve urban economic growth. In particular, the smart city is expected to “sustain the innovation economy and wealth of cities, maintain employment and fight against poverty through employment generation” (Schaffers et al. 2011). Many academics associate smart cities with resilient economies and Richard Florida’s “creative class” (2002). There is extensive literature on regional competitive advantage and what characteristics, beyond technological capacity, make areas like Silicon Valley more resistant to failure, including collective innovation and a culture of openness between firms and a region’s institutions (Saxenian, 1994). A positive correlation exists between urban wealth and the “presence of a creative class, the quality of and dedicated attention to the urban environment, the level of education, multimodal accessibility, and the use of ICTs for public administration” (Caragliu et al., 2011). These elements are seen as the basis for a new strategic agenda for European cities and align with the six-part conceptualization of the smart city—smart people, living (lifestyle), economy, mobility, environment, and governance.

There is much skepticism regarding these economic growth possibilities, however, both from a practical and ideological point of view. At a concrete level, Lee (2011) questions the economic feasibility of ICT-driven urban growth due to institutional resistance to ICT, referring to the difficulty and cost of integrating existing technologies into a single system as a barrier to the implementation of smart cities. The level of government that will drive the knowledge-based economy is also in question because local government often lacks the “policy tools and jurisdictional authority to effectively manage” their new role (Coe et al., 2010). At the same time, the federal government is often too inflexible to adapt to the dynamic economic development patterns generated by ICT (Coe et al., 2010).
The concentration of creative workers anticipated in the smart city could exacerbate existing class divides and cater increasingly to its “smart” workers (Hollands, 2008). Hollands (2008) sees the smart city as a neoconservative scheme that rewards entrepreneurialism at the expense of progressive policies, pinpointing the emphasis on business-led development as a neoliberal characteristic inherent to the smart city. Similarly, through his series on smart cities for Fast Company, Lindsay (2010a; 2010b; 2010c; 2010d) deconstructs the rhetoric behind smart city implementation in PlanIT Valley, Songdo, and several other “instant cities,” revealing that the economic ambitions driving ICT companies may not seek to achieve urban growth as much as corporate growth. Many scholars express distrust at the focus on economic development, instead advocating for more inclusive visions that recognize how new information networks can promote engagement (Coe et al., 2001). These cautionary views, particularly Hollands’ (2008), are widely-cited and disputed within the smart city literature, but they have not been evaluated substantively through analysis of implemented policies, as I will do in this thesis. The theoretical approach characterizing the discussion of smart cities was appropriate when ICT was not implemented at any significant scale, but with the recent growth of ICT use in many cities, it is fitting that the actual economic effects be evaluated based on existing case studies.

**Political Predictions of the Smart City**

While the literature has recently converged, to some extent, upon a common operational description of the smart city, the actual political challenges and consequences of implementing the model have not been widely scrutinized. Andreoli and Medaglia (2010) suggest that a barrier to understanding these effects is the simple lack of implementation of smart city policies. Existing urban systems have been slow to adopt ICT because of the high costs associated with replacing existing—and usually functioning—systems. Furthermore, they explain, there is no
existing model by which to evaluate the effects on traditional policies or the overall return on investment for the municipality. Instead, like economic effects, political implications are discussed in terms of potential impacts.

It is anticipated that smart cities will allow city authorities to offer a safer, greener urban environment, deliver efficient public services to citizens through e-government and smart mobility, engage in participatory and direct democracy, provide widespread digital connectivity, and provide consistent monitoring of urban and environmental data (Schaffers et al. 2011; Topetta, 2010). Smart government goes beyond data regulation and service provision, however, and “interconnects dynamically with citizens, communities, and businesses in real-time to spark growth, innovation, and progress” (Nam and Pardo, 2011). The smart city government’s commitment to a participatory citizenry is discussed as a fundamental shift towards proactive urban governance. Deakin and Al Waer’s (2011) concept of “e-learning” will enable online service applications transfer knowledge to citizens, communities, and organizations that then are able to participate in capacity and consensus building. Similarly, Coe et al. (2001) explore the changing role of government prompted by two consequences of ICT diffusion: the rising importance of the city as an entity and the new possibilities for citizen engagement. This argument contrasts with the belief that smart city governance will inevitably exacerbate the digital divide.

The trends identified in this varied literature are confirmed by the real-world policies being implemented by governments following the smart city model. These policies are increasingly derived from the smart city projects advertised by large ICT companies seeking city contracts to implement their services. The impact that corporate actors have had on the current conception of the smart city and what it should achieve cannot be underestimated. Smart city
publicity campaigns, like those led by IBM and Cisco, offer their “intelligent networking capabilities to weave together people, services, community assets, and information into a single pervasive solution” while minimizing monetary costs and time inefficiencies (Cisco Systems, 2010).

Many of the expected political impacts are ambiguous, leading scholars to question the smart city model. At its most basic level, the “elitist, biopolitical choice of smart city discourse” unfairly designates connected citizens as more informed, and thus more “useful” (McFarlane, 2011). Furthermore, government access to real-time personal information raises the question of who will control the data stream, what purposes the data will be used for, and what safeguards will be necessary to encourage widespread public participation (Institute for the Future, 2010). Also of concern is the potential for government to offload its responsibilities onto its citizens by expecting crowdsourcing technologies to take the place of government regulation (Institute for the Future, 2010).

More seriously, Hollands (2008) harshly critiques the rhetoric behind the benefits of the smart city, including the issue of public-private partnerships that he argues make a city’s prosperity and ability to function dependent on a single company’s services. The very term “smart” city preemptively privileges the use of ICT when compared to other planning strategies by implying a positive result before actually demonstrating success (Hollands, 2008). Prior research lays the groundwork in studying the implementation of smart city initiatives, especially by identifying the dimensions that should be examined closely: the ideological tendencies and political and economic implications of such policies.
Empirically Evaluating the Smart City

Until now, the literature on smart cities has not taken an evaluative approach, concentrating on the framework underlying the model rather than current policy. This pattern is likely a result of the recentness of smart city implementation, making it a fruitful direction of research given the increased publicity that the model has received. On the other hand, there is no lack of real-world assessments of smart cities in less formal media like online magazines or blogs associated with research institutions (Anderson 2011; Atkinson, 2011; Comer and Datu, 2011; Katz 2011; Lindsay, 2010a; Lindsay, 2010b; Lindsay, 2010c; Lindsay, 2010d; Piedmont-Palladino, 2011). These publications identify observations on everything from the smart city sector’s excessive focus on “single solution deployments in specific city departments at the expense of integrated solutions” (Anderson, 2011) to productive smart city policies like integrating ICTs into law enforcement and safety networks (Atkinson, 2011). These articles, videos, and blog posts are indicative of the buildup of attention—both positive and negative—that the applied smart city model has garnered in more mainstream media and show the need for a more academic approach to the topic.

Consulting and think-tank reports provide other valuable assessments of the smart city that, while not peer-reviewed, provide insights into how the business and policy worlds understand the model’s impact. McKinsey’s (2011) report on big data finds that future competitiveness and growth at the level of the firm will depend on the use of big data, with the potential for retailers harnessing big data to increase their operating margin by over 60 percent. In essence, the report describes the smart economy in which big data allows for the “real-time microsegmentation of customers,” location-based services like navigation, and price transparency, all of which contribute to a consumer surplus by better matching needs to products (McKinsey, 2011). Also published by McKinsey is an article that describes ten tech-enabled
business trends, such as sustainability as an important corporate performance metric, the concept of anything-as-a-service, the growth of multisided business models, and innovation from the “bottom of the pyramid” (Bughin et al., 2010). While these publications refer to the benefits that big data and ICT will bring to firms, not cities, they reveal the incentive of micro-level economic development that motivates smart city projects and refer to trends that are applicable to city services as well. Policy research by the Information Technology and Innovation Foundation, for example, recognizes improvements in every ICT-enabled field, including healthcare, education, the environment, public and personal safety, and government, and describes a range of policies such as the Library of Congress’ decision to partner with Flickr rather than build its own online photo archive (Atkinson and Castro, 2008).

Publications of case studies of self-identified smart cities are also prevalent in non-peer-reviewed media (Cohen, 2011; Lindsay, 2010a; Piedmont-Palladino, 2011), but with a few exceptions, have been missing from the academic literature. Mahizhnan (1999) studies the case of Singapore, concluding that its government’s massive investment in creating an “Intelligent Island” has resulted not only in economic growth but the enhancement of quality of life for all citizens. Bakici et al. (2012) briefly assess Barcelona’s smart city project—something this paper does in more depth—and find highly optimistic results of increased cooperation between the public and private sectors, innovative strategic tools, and business development through the implementation of smart services. The smart city planning paradigm has also been recently studied in Thessaloniki, Greece (Komninos and Tsarchopoulos, 2012), Manchester (Carter, 2012), and Helsinki (Hielkema and Hongisto, 2012). This thesis will contribute to the emerging literature on specific smart city case studies, evaluating the practical implications of Amsterdam,

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2 The concept of innovation from the bottom, or grassroots efforts enabled by smart city policy, is examined most closely in Townsend’s (2013) forthcoming book, and Chapter 4 of this thesis.
Barcelona, and New York City’s adoption of smart city policies and initiatives. Through the synthesis of commonalities among the cities, this paper will identify economic and political trends that emerge during the transition to the smart city.

RESEARCH DESIGN AND METHODS

Case Study Selection

My research is based on a comparative case analysis of three cities that have made significant efforts to integrate ICT-based initiatives into their city plans in order to become smart cities. This research design was motivated by a desire to examine contemporary real-life applications of the smart city framework within focused policy areas in order to provide detailed accounts of the broad and complex urban planning model. By studying three cities—Amsterdam, Barcelona, and New York City—I am able to compensate, to some extent, for the unrepresentativeness inherent in the case study research method and design. The process I used to select my case studies was similar to the one used by researcher Robert Hollands, who explained that at the time he began writing, many cities were “jumping on the smart city bandwagon” in order to reinvent themselves, but he concentrated on cities that went beyond self-labeling by actually implementing the smart city model (personal communication, June 27, 2012). Like Hollands, I focused on smart cities taking on large scale, comprehensive changes in policy and infrastructure. Access, time, and language constraints led me to focus on Europe and North America rather than Asia or South America—two regions of increasing importance in the smart city discourse—but these sites would be fruitful for further study.

In determining which cities were most appropriate, I looked for macro-level similarities that would allow them to be comparable: regional prominence, historical importance, and world recognition. Amsterdam, Barcelona, and New York City have long been and remain economic
drivers in their respective regions—Northern Europe, Southern Europe, and North America. Contributing to their continued dominance is a history of adapting to contemporary economic paradigms, which most recently shifted from the manufacturing to the service and innovation economies. While founded in different periods, these three cities represent brownfield and urban retrofit sites, as opposed to new greenfield projects proposed for smart cities to be built from the ground up. Because of this, they face similar challenges of replacing outdated housing stock and transportation infrastructure, legacy communications networks, and even entrenched cultural practices. Finally, Amsterdam, Barcelona, and New York are all recognized as global smart city leaders and are used as models for other cities to emulate. All three are part of City Protocol, a group of cities, partner companies, smart city organizations, and universities working to create “sustainable, efficient, cohesive, innovative and smart cities” through new leadership models and leveraging ICT (City Protocol, 2012). Furthermore, the cities appear consistently in rankings of the world’s smartest cities (Cohen, 2011; Cushman and Wakefield, 2011; Kotkin, 2009). Amsterdam and Barcelona openly identify themselves as smart cities, while New York, interestingly, is branded as a smart city externally by the media more than by local government officials.

The three cities are also different enough in structure to provide meaningful contrasts in terms of the economic and political characteristics that affect smart city implementation. While they all face troubled regional financial systems, their local economies differ in sectoral composition and their respective local governments provide varying levels of budgetary support for smart city initiatives. Furthermore, all three cities have different relationships with their national economies and their smart city platforms are not all affiliated with multinational ICT corporations to the same extent. To make broad generalizations about these differences,
Amsterdam is the most significant contributor to the Dutch economy—a leader in the eurozone—and while its smart city project is linked to the municipality through its Economic Affairs department, it is mainly driven by a public non-profit organization. Barcelona, on the other hand, is part of a much more precarious Spanish economy and has a tense relationship with the national government, but its smart city project receives much more support and funding from various branches of local government. New York City, by many standards the most powerful urban economy in the world, has initiated smart city policies almost exclusively at the level of local government, particularly under the Bloomberg administration. Comparing Amsterdam, Barcelona, and New York City has allowed me to draw commonalities despite these differences and formulate the practical effects of smart city implementation.

**Data Collection**

The main data I collected at each site was in the form of interviews. I used purposive sampling when selecting my interviewees because of the restricted population qualified to answer in-depth questions about government and economic functions. In total, I interviewed 16 individuals between October 2011 and July 2012—of these interviews, two took place in Amsterdam, three in Barcelona, and three in New York. To supplement the data collected at each case study location, I also conducted two interviews in the United Kingdom with university professors (one at Newcastle University, one at the University of Sussex), one in Brussels with a European Commission official, and one in San Francisco with an urban planner, as well as several by phone for those who could not meet in person. These supplementary interviews discussed topics relevant to smart city implementation that were not specifically related to the three case studies, such as European Union ICT policy, worldwide smart city projects, and academic analysis of the smart city model.
My interview subjects included city leaders and staff, urban planners, company executives, and entrepreneurs. These various stakeholders were instrumental in understanding what the city had accomplished locally versus what had been driven by larger government bodies. I was aware that as partners in smart city projects, they would likely be proponents of the model. Because of this, I sought out critical viewpoints, typically drawn from academia and journalism, to obtain as balanced an assessment as possible given my time constraints. A table of my interviewees and their occupations is available in Appendix B, and their relative locations within Amsterdam, Barcelona, and New York City are available in maps in Appendix C.

I spent approximately a week in each location: 7 days in Amsterdam in mid-March, 6 days in Barcelona in mid-June, and 9 days in New York City in early July. The majority of my interviews were held at the office of the respondent, but also included site visits to a Smart Work Center in Amsterdam and the 22@ technology park in Barcelona. Each interview was between 45 minutes and two hours long, with the majority lasting about an hour. I tape recorded and transcribed four of the interviews and took detailed notes for the remainder. I began each interview with a list of targeted questions based on the respondent’s location, occupation, and role in smart city implementation, but I allowed the conversation to follow a natural pace rather than force every question. Language was not a barrier, as the level of English proficiency is incredibly high in the Netherlands, and the international nature of work related to the smart city meant that all of my interviewees in Barcelona spoke English. Additionally, I am fluent in Spanish, so I was able to translate when there were any uncertainties. I acknowledge, however, that interviewing individuals in a language not native to them could have an effect on the results.

Because the primary data for this research paper comes from original interviews, it is necessary to note its limitations. Interviewees may have been influenced by the way I framed my
questions or have limited their responses to topics I asked about instead of expanding on issues more important to them. Their responses also could have been influenced by the desire to appear a certain way; this is true particularly of company leaders, who may have good reason to downplay the profit motive backing their work, and city officials, who are experts in advertising their city’s strengths. Finally, since the responses are directly related to their occupation, interviewees may have felt pressure to respond positively so as to not appear dissatisfied or frustrated with the implementation of smart city policies.

Throughout the data collection process, I took field notes about common themes and responses that were particularly notable. I coded my interviews using the qualitative data analysis software NVivo, using a combination of a priori codes derived from my field notes and a more grounded theory approach that drew codes from the general categories of economic or political implications. The most significant codes then became the basis for my argument.

The interview data is supplemented by document analysis, primarily in the form of local planning documents produced by the three cities and regional planning documents from the European Commission. I also examine reports and studies produced by the private sector, including consulting firms and the ICT companies involved with smart city initiatives, like Cisco and IBM. As one of the basic principles of the smart city is open data, gaining access to these documents via online sources or my interview subjects was not difficult. I used these documents to classify and compare the types of smart city initiatives pursued by each city and identify discrepancies between the original goal and what has been achieved. When put in dialogue with prior academic research, these publications help distinguish between the theoretical possibilities and practical effects of smart city implementation.
RESEARCH SETTING

I conducted the majority of my research in Amsterdam, Barcelona, and New York City. Though I made side trips to Brighton and Newcastle-upon-Tyne in the United Kingdom for supplementary interviews, as well as to Brussels and San Francisco, this section will focus on my case studies since they are the most relevant to my research.

Amsterdam

I. Current economic conditions

Amsterdam is the financial and business capital of the Netherlands and the Northern European region. It is fourth in the ranking of best European cities in which to locate a business and fifth in terms of the business climate facilitated by local government tax policy and financial incentives (Cushman and Wakefield, 2011). Amsterdam is home to many large corporations which are increasingly relocating away from the city center in the canal district to Zuidas, the rapidly growing financial hub in the southern part of the city. Despite its small size and population of 16.7 million people, the Netherlands is the euro zone’s fifth largest economy by GDP due to its stable industrial relations and trade surplus (Central Intelligence Agency, 2012a).

The global recession, however, resulted in a 3.5 percent contraction of the Dutch economy—the first such instance in 26 years of uninterrupted growth (Central Intelligence Agency, 2012a). The euro zone debt crisis has also affected the Netherlands, with the nation’s budget deficit as a percentage of GDP now above the limit required by the European Union (Central Intelligence Agency, 2012a).
II. Major smart city players

Figure 1: Amsterdam’s smart city network

This network diagram (Figure 1) shows the major players in Amsterdam’s development as a smart city. Within Amsterdam’s city government, the agency most closely affiliated with smart city initiatives is the Department of Economic Affairs, which works to stimulate economic activity and urban development particularly related to knowledge, innovation, and sustainability. Small and medium enterprises (SMEs) play a large role in the smart city, which has given Amsterdam a reputation of being a smart city created from bottom up. SME’s generally participate through Amsterdam Innovation Motor (AIM), the public-private partnership that facilitates the relationship between the city and ICT companies. AIM is under the direction of the Amsterdam Economic Board, which operates on the triple helix model—the collaboration of business, educational institutions, and government—to spur economic development in the metropolitan area (I amsterdam, n.d.). Amsterdam’s ICT cluster was organized by AIM and the
Department of Economic Affairs, and organizes regular meetings between the three sectors that make up the triple helix and links technology to new media industries (Amsterdam Innovation Motor, n.d.).

AIM has partnered with Liander, an oil and electricity distributor and grid manager, and KPN, the Netherlands’ largest IT and telecommunications provider, to form Amsterdam Smart City (ASC). ASC is another public-private partnership made up of businesses, local government, research institutions, and residents with the exclusive aim of transforming the Amsterdam Metropolitan Area into a smart city. Within the private sector, ASC has close ties with Cisco Systems, who supports the city’s Smart Work Centers by providing its TelePresence videoconferencing service. IBM, too, has partnered with ASC to provide data management system for Schiphol Airport. Both corporations have been technology partners in specific ASC projects, particularly those related to residential energy management systems and ICT workplace facilities like the Smart Work Centers.

Amsterdam is a member of Open Cities, a project co-founded by the European Union that aims to promote open innovation within the public sector to support smart city development and citizen participation. The City of Amsterdam is the leader of the crowdsourcing “workpackage,” which has the ultimate goal of creating a pan-European platform for crowdsourcing, open data, and open sensor networks. Open Cities manages five additional workpackages led by the other six members of the organization: Barcelona, Berlin, Helsinki, Paris, Rome, and Bologna. As mentioned before, Amsterdam is also a member of the City Protocol Society, a membership-based organization. This group will direct the City Protocol, a global network of cities developing common solutions to urban challenges by leveraging ICT to create new leadership models and innovative ways of engaging society. The City Protocol Society, which will be
described further in the following section on Barcelona, is open to city councils—who are given
the most weight in order to preserve the goal of assisting cities—as well as industry, academia,
and other organizations involved in the transformation of the city (City Protocol, 2012).

III. Smart city focus

Rather than implement technology-based projects to promote a general vision of
progressiveness, Amsterdam has principally focused on using ICT to reach its CO₂ emissions
targets and broader goal of environmental sustainability. Amsterdam has been an environmental
leader for decades, but its smart city project exhibits the new ICT-enabled tactics the city has
developed. ASC tests technologies that specifically lead to the efficient use of natural resources
at project sites that engage the local government, research institutions, and citizens. In fact, 23 of
the 30 projects that ASC has executed are focused on environmental sustainability and the
reduction of CO₂ emissions.

Also promoting environmentalism is one of ASC’s most well-known projects, the
Climate Street, which seeks to develop a blueprint for sustainable shopping streets by converting
the For instance, one of Amsterdam’s greatest challenges lies in retrofitting the existing building
stock, much of which is historic, to achieve energy reductions while preserving their cultural
heritage. To address this, ASC has developed the Groene Grachten (Green Canals) project,
which will supervise the conservation of three houses while exploring technologies that will
enable the city’s Canal Ring to be made carbon neutral (Amsterdam Smart City, n.d.b). One of
ASC’s most well-known projects, the Climate Street, also promotes environmentalism. The
Climate Street seeks to develop a blueprint for sustainable shopping streets by converting the
Utrechtsestraat, a popular street in the city center with shops and restaurants, into a model of
sustainable solutions (Amsterdam Smart City, n.d.a). At the same time, local government does
not only impose ICT-based technology initiatives on businesses and residences; a third
demonstrative project being undertaken by ASC is their effort to monitor municipal buildings to
provide baseline measurements. The municipality of Amsterdam seeks to be carbon neutral by
2015, and the energy management system provided by Liander, an ASC partner, will allow their
improvements to be tracked (Amsterdam Smart city, n.d.c).

The range of projects being realized by ASC is diverse, yet nonetheless has a focused,
common goal. These sponsors are using the smart city as a vehicle to deploy ICT in innovative
ways with the ultimate goal of advancing climate and energy initiatives to drive sustainable
economic and physical growth. That the term “smart” in Amsterdam is affiliated so closely with
sustainability is indicative of the city’s effort to associate its legacy as a forerunner in
sustainability with its newer focus on ICT deployment. The international perception linking
Amsterdam and environmentalism is reinforced by a local government and private sector that are
compatible with one another, as companies develop ICT-enabled products and projects that
complement the City’s sustainability goals. Amsterdam’s rendition of the smart city, as marketed
by ASC, has come to embody and promote the city’s green policies.


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ranked third (Cushman and Wakefield, 2011). The city was also ranked first in terms of the best quality of life for employees (Cushman and Wakefield, 2011).

As a whole, Spain has suffered greatly as a result of the global recession and euro zone crisis. Its budget deficit as a percentage of GDP reached 9.2 percent in 2010 (contrasted with the Netherlands, at 4.6 percent)—three times the European Union limit (Central Intelligence Agency, 2010b). Severe financial problems resulted from the collapse of the construction and real estate industries, and consequently the Spanish government is attempting to boost the economy by cutting spending, privatizing industries, and reforming the labor market (Central Intelligence Agency, 2010b). Catalonia’s history of separatism has only intensified as the euro zone crisis has worsened, with separatists arguing that the tax money from their strong regional economy goes to subsidize poorer regions (Cody, 2012).

II. Major smart city players

Figure 2: Barcelona’s smart city network
Barcelona’s city government is the main driver behind its smart city project, as seen in Figure 2. In 2011, the Mayor’s Office was internally restructured to dedicate one of its five deputy mayors to ICT and sustainability-related urban planning policy. Antoni Vives, the Deputy Mayor for the Urban Habitat, is responsible for fostering holistic and cross-sector city planning and managing Barcelona’s smart city project; he was also co-president of the Smart City World Congress, an international summit of smart city leaders. The Smart City Expo and World Congress, held in Barcelona in November 2011 and 2012, has become a global conference showcasing the transition to sustainable and innovative cities.

Barcelona’s adoption of pro-ICT policies has been widely endorsed by multiple levels of government and labor organizations, which see them as an opportunity to advance local competitiveness and even social cohesion. In 2008, the City Council joined with the Comissions Obreres (trade union) of Barcelona, the UGT de Catalunya (trade union of Catalonia), the Department for the Promotion of Work, PIMEC (the organization that promotes SMEs), and the Government of Catalonia to develop the Agreement for Quality Employment in Barcelona 2008-2011, which establishes a framework and priorities for generating employment (Adjuntament de Barcelona, 2008a). The agreement recognizes the use of ICT as an essential skill for youth to learn and identifies the difficulty that small businesses face in incorporating technological changes as one of the most significant barriers to the creation of “globally positioned companies” (Adjuntament de Barcelona, 2008a).

Attracting and working with technology-related SMEs is also a crucial part of Barcelona’s smart city agenda. The Barcelona City Council manages Barcelona Activa, a local development agency that bridges the public-private gap by actively seeking business and innovation partners. It aligns itself with the entrepreneurial aspect of the smart city and
emphasizes the city’s business-friendly atmosphere and high quality of life. Barcelona Activa’s economic development programs have demonstrated success: in 2011, it supported over 2,400 new projects, installed 139 companies in its business incubator and technology park, and served approximately 14,000 people through entrepreneurship training programs and 21,000 through its professional development services (Barcelona Activa, 2011). One of Barcelona Activa’s most efficacious programs is Cibernarium, a city-sponsored service that offers practical training sessions focused on ICT skills acquisition to individuals and companies (Adjuntament de Barcelona, n.d.).

Barcelona’s most distinctive smart city initiative is its technology park and innovation district, 22@Barcelona, often referred to as a “smart city campus” or simply as 22@. This urban redevelopment project is managed by the 22@Barcelona municipal society, created by the Barcelona City Council in 2000, and has converted two hundred hectares of the historically industrial neighborhood Poble Nou into usable space for knowledge-intensive activities and business incubation (22 ARROBA S.A.U., 2006b). The Barcelona Urban Lab, which, as its name implies, designates a part of the city as an urban laboratory, is located within 22@ and is under the management of the 22@Barcelona municipal society. By providing space for pilot programs that test pre-market technologies relevant to Barcelona’s urban needs, the Urban Lab aims to foster innovation and reduce the time to market (22 ARROBA S.A.U., 2006a).

Throughout its transformation into a leading European smart city, Barcelona has exhibited the strongest relationship with corporations of the three case studies. Cisco is intimately involved in Barcelona’s efforts through its Smart+Connected Communities initiative and numerous sub-projects (Cisco Systems, 2011b). Cisco has partnered with the City to create the Barcelona Institute of Technology (BIT) for the Habitat, the city’s recently announced
research institute and education center (Cisco Systems, 2011a). The institute will explore the ways in which technology can improve city life and provide services through partnerships with the private sector. By contributing human resources, networking infrastructure, foundation fees, and case studies, Cisco is not only BIT for the Habitat’s most important sponsor, but a leader in the project.

This leadership position is similar to the role that Cisco will play in the City Protocol. In addition to being a forum for cities to share their smart city accomplishments, the City Protocol will establish a world-wide standard and certification system to codify the components of the smart city (Cisco Systems, 2011a). The relationship between the City of Barcelona and Cisco is certain to strengthen through the Cisco Innovation Center—notably, to be staffed by Cisco employees—planned for construction in 22@ (Cisco Systems, 2011a). Among other responsibilities, the Innovation Center will develop a physical network infrastructure called Cisco’s Urban Platform Reference Architecture, which will run through city streets and public spaces, to which sensors and mobile devices can securely be connected (Cisco Systems, 2011b). Furthermore, Cisco will assist the City in developing and testing new services ranging from a smart bus network to the “Internet of the neighborhood,” or the promotion of social interaction through ICT (Cisco Systems, 2011a).

Barcelona is engaged with international organizations in addition to the private sector; like Amsterdam, the City is a member of Open Cities and is the leader of several of its “workpackages”. Barcelona Activa is the project lead for the Urban Labs workpackage, Barcelona’s internationally recognized Universitat Pompeu Fabra is leading the project on open sensor networks, and ESADE, Barcelona’s renowned business school, is the lead for open innovation in cities workpackage (Open Cities, n.d.). Barcelona is also the coordinator of a
similar project, iCity, sponsored by the European Commission’s Information and Communication Technologies Policy Support Programme. iCity aims to create an open innovation ecosystem to foster the creation of public services enabled by ICT. To do so, it will make municipal ICT networks of participating cities available to third-party developers, especially SMEs, who will create software to be available on the iCity Open Apps Store (European Commission, 2011).

III. Smart city focus

While Barcelona, like Amsterdam, champions its energy-saving initiatives, its focus is more closely tied to the economic benefits of pursuing entrepreneurialism in the city. Barcelona is overt in its pro-entrepreneurship atmosphere, promoting itself in this capacity much more explicitly than Amsterdam or New York City, where this competitiveness is often concealed by other goals. Central to Barcelona’s goals is changing the city’s economic identity from one of industry to one of technology “and to associate the city with high value and knowledge-led businesses” (Iberian Lawyer, 2011). This rebranding process—changing Barcelona from an industrial manufacturing center to a new technology hub—has necessitated rezoning the 22@ district to promote a new productive and occupational base (Adjuntament de Barcelona, 2000).

Between 2000 and 2009, 44,600 new jobs were created in the district (a 62 percent increase), 26 percent of which were in the ICT sector, 24 percent in design, and 11 percent in media (Piqué, n.d). Barcelona Activa does more than manage the 22@ technology park; it has also launched Barcelona Business Landing, an online platform that offers information and tools to entrepreneurs so that they can start and consolidate their business ventures in Barcelona (Barcelona Business Landing, 2010). The opportunities offered to emerging businesses are numerous: the MediaTIC building, a multipurpose building in 22@, houses both Cibernarium
and a start-up incubator, and the Almogàvers Business Factory offers another municipal incubation space committed to innovation and entrepreneurship. Barcelona Activa’s incubation spaces are home to more than 110 companies, which together have an annual turnover of over €50 million and create 650 jobs per year (European Business & Innovation Center Network, 2011).

There is a strong emphasis on international presence and the attraction of foreign talent, as well. 50 percent of the businesses in the Barcelona Nord Technology Park do business internationally, and 18 percent of employees at the Almogàvers Business Factory were to be foreign in 2011 (European Business & Innovation Center Network, 2011). Rather than measure success in terms of CO₂ emissions reductions, Barcelona uses job growth and the number of companies moving to the city as benchmarks of achievement. The city is developing human capital by importing foreign talent—specifically highly skilled workers that contribute to the technology industry. The smart city put forth by Barcelona’s local government is one largely concerned with a smart economy, specifically one based on entrepreneurialism facilitated by widespread ICT infrastructure.

**New York City**

**I. Current economic conditions**

New York City’s economy is the largest of any city in the world and is projected to maintain this position through 2025 (McKinsey Global Institute, 2010). Along with London, it is one of the world’s most important financial centers and is notable for its high concentration of advanced service sector firms. The New York City metropolitan area contributed a gross metropolitan product of $1.28 trillion in 2010, the highest in the United States (Greyhill Advisors, n.d.).
The impact of the 2008-2009 recession was seen immediately in New York City’s unemployment rate, which rose from 5.2 to 8.4 percent between the end of 2007 and February 2009 (Morningside Area Alliance, 2009). However, the city wasn’t affected as severely as predicted. While job losses were higher in New York City than the national average, it recovered quickly compared to other U.S. cities. This was due in part to the Wall Street bailout, but also to the fact that the city’s economy is diversified, with growing high-tech, health, and media sectors contributing to its resilience (Rainone, 2012).

II. Major smart city players

Figure 3: New York City’s smart city network
As shown in Figure 3, New York City’s pursuit of ICT solutions is led by Mayor Michael Bloomberg and his administration, who have put a great deal of emphasis on technology-driven city services. NYC Digital, an agency within the Mayor’s Office of Media and Entertainment, engages directly with the private sector to provide public services that streamline digital communication. Most importantly, in 2011 NYC Digital developed New York City’s Roadmap for the Digital City, outlining the city’s path towards becoming the “world’s leading digital city” by proposing technological improvements in four key categories: access, open government, engagement, and industry (The City of New York, 2011b). The Bloomberg administration’s commitment to technologically-driven policy was made affirmed only a year after the Roadmap’s release, by which time 80 percent of its goals—including promoting and celebrating the city’s digital sector through events and awards—had been achieved (The City of New York, 2012c).

New York City’s Department of Internet Technology and Telecommunications (DoITT) also exemplifies the importance the Mayor’s places on diffusing ICT use. DoITT is responsible for modernizing government technology, increasing digital literacy opportunities for New Yorkers, enabling more transparent governance, and creating partnerships with technology leaders to better serve the residents of the city’s five boroughs (The City of New York, 2012c). With an operating budget of over $440 million, DoITT serves 230,000 businesses, 8 million residents, and 50 million visitors a year (The City of New York, 2012c). In short, DoITT is the source of New York City’s ICT strategy. It should be noted that despite the fact that New York City does not publicize itself as a smart city, it has incorporated many of the ICT-driven policies that characterize more obvious smart cities like Amsterdam and Barcelona; DoITT’s primary initiatives are the NYC Open Data portal, stimulus programs to promote broadband,
telecommunications franchise services, and CITIServe, a program to facilitate data sharing among agencies by optimizing the City’s IT infrastructure.

While DoITT is provides efficient and reliable IT services for both citizens and businesses, New York City’s Economic Development Corporation (NYCEDC) is specifically dedicated to fostering economic growth within the private sector. NYCEDC, on the other hand, specifically supports SMEs—particularly those related to technology and media, crucial as they are to maintaining the city’s role as a global leader in innovation. New York City accounts for half of the U.S. market share in traditional media, and its media and technology sectors generate $30 billion in annual revenues and 300,000 jobs (Office of the Mayor, 2009). Despite this dominance, the city has captured less than a quarter of the digital and new media markets (Office of the Mayor, 2009). It is in these areas that the City, in collaboration with NYEDC, hopes to expand. Together, in 2009 they launched Media.NYC.2020, an initiative to make New York City the world’s leading media capital by the year 2020. Though specifically concerned with media, Media.NYC.2020 also focuses on four key areas that could apply to a number of different smart city programs: connectivity, innovation, talent and education, and turning the city into an international gateway both foreign and domestic companies (Strauss et al., 2011).

Several notable initiatives have already been implemented as a result of Media.NYC.2020, such as the NYC BigApps Competition, which offers cash prizes to software developers who create the best new apps from open government data. Another initiative, NYC Venture Fellows, provides selective year-long fellowships to the next generation of entrepreneurs. Third, Media.NYC.2020 sponsors the Media and Tech Bond Program, which issues bonds to companies purchasing technological equipment (Strauss et al., 2011). Media.NYC.2020’s most ambitious initiative was its 2010 release of a Request for Expressions
of Interest (RFEI) to create an engineering and applied sciences research campus in the city (Strauss et al., 2011). Cornell University submitted the winning bid in partnership with Technion-Israel Institute of Technology and will receive $100 million in City capital to build a state-of-the-art campus on Roosevelt Island (The City of New York, 2011a). Similar to Barcelona’s focus on entrepreneurialism, a crucial component of the tech campus is a $150 million revolving financing fund to be solely available to New York City startups (The City of New York, 2011a). Moreover, the link between education and the tech industry is so strong that Cornell NYC Tech has been called an “educational start-up”; the campus will be interspersed with office space that can be leased by high-tech companies, and Google has already donated 20,000 square feet of their New York headquarters to the school (Kaminer, 2013).

Like Amsterdam and Barcelona, corporate influence—again through Cisco and IBM—is present in New York City’s smart city initiatives. Cisco has worked with the Metropolitan Transportation Authority (MTA) to develop On-the-Go!, a new interactive touchscreen information access point that uses a Cisco platform to display media, live video, and real-time transit information (The City of New York, 2011c). IBM began its relationship with the City in 2006 when it developed a real-time Crime Information Warehouse—also known as a crime control center—for the New York Police Department (NYPD) that applied the “on demand” business model to NYPD resources and data (IBM Corporation, 2006). More recently, IBM joined with CUNY Ventures, a City University of New York (CUNY) Economic Development Corporation entity, to use its Intelligent Operations Center software to monitor and analyze solar capacity to explore its urban solar energy market potential (IBM Corporation, 2012b).

New York City, too, is a member of the City Protocol Society, but is not affiliated with the European initiatives of iCity or Open Cities. Unlike Amsterdam and Barcelona, New York
City has not adapted the smart city label as a publicity campaign, but rather has attached the NYC acronym to specific ICT-based initiatives, like NYCulture Calendar, NYCityMap, NYCStat, Media.NYC.2020, NYC Digital, and NYC Connected Communities. In this way, rather than depending on the fluctuating meaning of the smart city, New York City associates its technology-driven policies to the very city name. While motivated by economic interests, as ICT initiatives almost inevitably are, New York City’s technology programs tend to be guided by goals of social engagement and public participation fueled by open data and mobile device applications. While Amsterdam is characterized by attention to sustainability and New York City is similar to Barcelona in its entrepreneurial focus, though its alignment with citizen-level technology makes it unique among the three cities.

III. Smart city focus

In New York City, smart city initiatives are largely directed at social engagement and participation. DoITT is involved with many social equity projects, such as extending the fiber optic network to underserved areas through a partnership with Time Warner Cable (The City of New York, 2012a). DoITT has also introduced crowdsourcing initiatives, such as Change By Us and NYC Share, two online platforms that allow residents and tech community members, respectively, to connect with the City of New York to suggest improvements and solve problems (The City of New York, n.d.). Similarly, the more comprehensive Roadmap for the Digital City emphasizes the social orientation of the city’s technology initiatives. Four of the five target areas directly relate to connecting to the community: access, education, open government, and engagement (The City of New York, 2011b). The Roadmap for the Digital City was the first document of its kind, and projects in the community sphere dominate the document. Within the engagement target area, for example, objectives include releasing digital Citizen Toolkits for
engaging with city government online and launching ongoing listening sessions across the five boroughs to encourage public input. Even within the area of industry, citizen needs are prioritized, as exemplified by the objective to expand workforce development programs to support diversity in the digital sector (The City of New York, 2011b).

For New York City, the existence of ICT is not sufficient; wide-scale usability is paramount in order for it to be able to identify itself as a technologically-driven city. New York City’s technology policy focus tends not to be physical, but rather centered on open data and mobile device applications, as exemplified by landmark legislation that requires city agencies to provide data through a single, citywide portal in a machine-readable format by 2018 (The New York City Council, 2010). However, as will be explored in the following chapters, New York City’s most aggressive ICT initiatives that have little to do with the common resident. Small businesses, instead, are the focus. Given the NYCEDC’s prominent role in technology policy, this is not a surprise. The city’s flourishing start-up scene has been energized by the City and NYCEDC’s aggressive efforts to promote economic growth within the tech and media industries. Most, if not all, of the factors that make New York City a smart city are linked—in a not-so-subtle way—to strengthening the city’s economic competitiveness and reputation. As this trend is not exclusive to New York, the next chapter will parse accusations and tensions surfacing as a result of the prioritization of economically-oriented policies in smart city planning.
ECONOMIC IMPLICATIONS

NEOLIBERALISM AND THE SMART CITY

Smart city policies, defined as they are by sophisticated ICTs, inherently give an economic advantage to the corporate technology giants that produce them. Furthermore, the emphasis on economic growth reinforces the profit motive as the driving principle in municipal decision-making. Hollands (2008) has made the most well-known criticism of what he sees as the neoliberal tendencies of the smart city, but the literature has yet to test his indictments against real cases. The neoliberal claim against smart cities is not new; my research builds from it, using the framework of neoliberalism to reveal the laissez faire nature of smart city development in a more tangible way as demonstrated by my case studies. In sum, I found that the smart city reinforces the fundamental components of neoliberalism: the privatization of public enterprise, growth-oriented policy, open markets, deregulation, the maximization of profits, and efficiency.

Fundamentals of Neoliberalism

Neoliberalism, an ideology that maintains that free markets are the innately superior principle by which to organize economic activity (Hassan, 2004), is based on strong private property rights and free trade. Furthermore, neoliberal theory holds that where markets don’t exist (i.e. for natural resources, utilities, education, healthcare, social security), they must be created—by the government if need be (Harvey, 2005). The Reagan and Thatcher periods in the United States and United Kingdom, respectively, are often associated with neoliberalism, but the
ideology’s reach has expanded globally through financial institutions like the International Monetary Fund (IMF), World Bank, and World Trade Organization (WTO).

It is important to distinguish between the different forms of neoliberalism and how it should be understood for my argument. Classical neoliberalism is based on the principle of liberty and “spontaneous order”: the unplanned institutional framework that governs human action and that can secure social well-being and allocate resources better than any artificial design (Hayek, 1991). All aggregated information cannot be understood by any single entity, and thus Hayek (1991) argues that self-organization is more efficient and beneficial to all individuals since all have limited information. Economic neoliberalism, what I refer to when using the term neoliberalism in this thesis, is a right-wing ideology stemming from classical neoliberalism that focuses explicitly on economic freedom and the protection of private property.

Focused on the policy implications of neoliberal thought, economic neoliberalism seeks to establish the principles that should govern the markets. These are summarized in the Washington Consensus, a set of economic policy recommendations promoted by the IMF, World Bank, and U.S. Treasury for developing countries in economic crisis (Williamson, 1990). In his influential article on the subject, economist John Williamson (1990) includes ten policy prescriptions including trade liberalization, privatization of state enterprises, deregulation, and liberalization of inward foreign direct investment (FDI), that make up the Washington Consensus. This neoliberal institutional framework is closely linked with the New Economy, a term popularized in the 1990s that embodies the shift from Fordism to an economy based on ICT networks, flexible production and labor, and globalization (Hassan, 2004).

This ideological link between neoliberalism and the technology that enables the smart city is crucial and has emerged in the theoretical criticism of the model. By examining the
economic and political implications of real-world smart city programs, I will make this connection concrete, revealing the aspects of neoliberal ideology that are reinforced under specific policies for smart city development. Taking six of the components of neoliberalism described above—privatization, growth-oriented policy, open markets, deregulation, maximization of profits, and efficiency—I will show how the framework underlying the smart city, inadvertently or not, caters to a neoliberal agenda.

**Privatization**

Smart city policy often involves the transfer of the operation of city services, including communications infrastructure, emergency response networks, and traffic management, to private companies. ICT corporations have responded to the demand—though it could be argued that they created the demand—with a robust list of services that local governments can contract from them. IBM, perhaps the most significant player in the smart city market, launched its Smarter Planet initiative in 2008. In 2010, the program was expanded into the Smarter Cities Challenge with the focus of operation specifically at the city-level (IBM, 2012). The program aims to help city leaders leverage data to operate effectively and proactively by providing solutions in three areas: planning and management (government and agency administration, public safety, smarter buildings, and urban planning), human services (social programs, healthcare, and education), and infrastructure (transportation, energy, and water) (IBM, 2012). The keystone service package IBM offers is their Intelligent Operations Center, an “executive dashboard” that monitors city-wide data across agencies and departments that can be purchased by cities for a yearly subscription price (IBM, 2012).

Correspondingly, Cisco Systems, the other leading smart city service provider, offers city leaders its Smart+Connected Communities platform. It is split into two programs:
Communities+Connect, which delivers services to homes, businesses, hospitals, schools, and other constituencies, and Community+Exchange, which facilitates back-office daily operations and management (Cisco, 2010). In an interview, Nic Villa, global director of Cisco’s Internet Business Solutions Group, explained that Cisco launched its Connected Urban Development Program—the precursor to Smart+Connected Communities—because it saw sustainability as a business opportunity (personal communication, April 27, 2012). In other words, Cisco capitalized on the relationship between ICT efficiency and environmental sustainability by developing technological solutions to sell to local governments under the emerging smart city model. He explained the three components to Cisco’s role: (1) helping the customer develop their vision and policy objective, which includes free consultations to determine strategies for regulations, business models, development, and management; (2) offering their professional services division for ICT master planning and strategy; (3) putting together bundled Cisco products customized to that city. Despite Cisco’s history as a technology company—not an urban planning firm—we can surmise from the interview that it has entered the smart city consulting business. As evidenced by partnerships with Amsterdam and other cities, also entering the smart city services market are Siemens, General Electric, and Accenture, which offer less comprehensive smart city services that tend to focus on energy efficiency and carbon neutrality.

While these government contracts with ICT companies conceivably fall under the public-private partnership (PPP) model, the lack of financial and operational risk on the side of the private company places disproportionate financial responsibility and public accountability on the city. Unlike the traditional PPP, in which the private company shares both risks and rewards in the public service or project, smart city services require the city to pay the company in exchange for the service, amounting to what appears to be little more than outsourcing. Miraftab (2004)
argues that neoliberals “support PPPs as a market-enabling strategy by which the private sector’s role is supported by the resources of the government, the community, and the NGOs” and that PPPs are therefore a “Trojan horse” for privatizing government responsibilities. Corporate involvement in the smart city not only essentially privatizes municipal services but also creates private markets in sectors that traditionally would be managed by local government, like social programs and public safety. While complete privatization through the transfer of ownership is not achieved through IBM and Cisco’s platforms, the practical effect is that of the privatization of government functions.

This pattern came as no surprise to economist Ed Steinmueller, who argued that while the public can believe in austerity, “there is an ideological commitment to privatization in the United States and United Kingdom,” especially when it comes to initial investments (personal communication, June 29, 2012). Following this logic, ICT infrastructure seems to be predisposed to privatization because of its high initial costs and need for technical expertise. Steinmueller’s reluctance to accept that technology and the free market are the best way to solve societal problems was reiterated by Robert Hollands, who explained that the way that technology is used has become “corporatized” (personal communication, June 27, 2012). For instance, Double U SmartWork Foundation, an organization that manages Smart Work Centers in Amsterdam, was founded by Cisco, the Dutch banks ABN/AMRO and RABO Bank, and the firm Touchdown Center. The partnership also included the City of Amsterdam, whose employees were intended to be some of the principal users of the system. Nevertheless, that one of the highlights of the Smart Work Center is the deployment of Cisco’s TelePresence virtual conferencing technology is suggestive of Ed Steinmueller’s worry that “the dominant discourse on the smart city has to do

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3 Touchdown Center is directed by Peter Kapteijn, one of my interviewees (personal communication, March 21, 2012).
with making cities safe for infrastructure to be built that corporations know how to build” (personal communication, June 29, 2012).

**Growth Orientation**

As alluded to earlier, the smart city can take one of two forms: a greenfield project on vacant land or a retrofit (brownfield) project in an existing city. Greenfield projects, by definition based on physical growth, are also particularly focused on economic growth. Living PlanIT, a technology company that has developed and monetizes an “Urban Operating System” (UOS) that analyzes and manages sensor data in cities, has planned to build PlanIT Valley, a greenfield smart city to be located outside of Paredes in northern Portugal. The project is projected to be completed in 2015 and will eventually be home to 225,000 people. Most of these residents will be employees of Living PlanIT and its technology partners, who will be using the city as a test bed and start-up incubator for smart technologies (Living PlanIT, n.d.). Though the project has been delayed because of the euro zone crisis and especially Portugal’s fragile economic position, Shaie Selzer, then-Head of Corporate Communications, said in an interview, “We have and will maintain this strong Portugal presence until the time that the markets actually open up for that sort of development, or perhaps before that, until equity or noncapital market opportunities present themselves” (personal communication, November 23, 2012). Living PlanIT is neither a developer nor a construction company, he explained, “so the reason that we’re playing with real estate is that we need proving points in real estate to establish the credentials of our technologies” (personal communication, November 23, 2012). PlanIT Valley will be an “operational center of significance” for the company to market its UOS to the world and expand its range of potential clients. The company has a clear and unapologetically profit-oriented approach to its involvement in Portugal focused on developing the city from the ground up as a
showcase piece rather than with civic goals in mind. This approach is problematic as it establishes that the needs of business supersede those of the people, who essentially function as guinea pigs in the company’s pursuit of ICT-related profits.

Retrofit projects, also known as brownfield projects, tend to be less obvious in their growth orientation. However, their emphasis on constantly attracting investment reveals many of the same underlying tendencies that characterize greenfield projects. Moreover, all three cities focus greatly on attracting international companies, following the neoliberal tendency of liberalizing foreign direct investment (FDI). Worldwide, the top sector receiving FDI was software, IT services and communications (Fingar, 2012). In New York, Mayor Bloomberg’s goal of creating “the world’s premier digital city” has been noticed by both the community and tech industry (I. Li, personal communication, July 5, 2012). Attracting technology companies in order to strengthen the economy is not exclusive to the smart city, but using it as the core of economic development is certainly a main component of the model. New York City recognizes its increasing dependence on foreign direct investment, with nearly 15% of growth in the city economy, or one in every seven dollars, attributed to FDI in the period between 2004 and 2009 (Partnership for New York City, 2008). Unlike much of the United States, the Bloomberg administration has been receptive to FDI; the Partnership for New York City explains that federal policy makers and the public must understand that FDI “is a powerful antidote to the loss of jobs from globalization” (2008). This is not to say that FDI is inherently risky or problematic, but that the expansion of the marketplace that FDI enables is closely tied to the development of the smart city.

Amsterdam’s smart city motivations, from the point of view of municipal government, also emerged from the potential of technologically-related economic growth. When asked
whether the city was pursuing ICT for citizens as well as businesses, Katalin Gallyas acknowledged that until then it had primarily been advanced as a way to attract investors (personal communication, March 23, 2012). The city’s ICT cluster, established in 2008, was a way for the city to position itself as the regional international hub of innovation and growth (Amsterdam Innovation Motor, n.d.). While Amsterdam’s motivations have since diversified, its foundation in attracting investment underscores the smart city model’s promise of growth. The current Dutch corporate tax rate is below the European Union average and expatriate workers can receive a tax-free reimbursement of 30 percent of their salary, making it a favorable destination for international companies (Iamsterdam, 2012). Perhaps this explains why the Netherlands was the top destination for United States FDI from 2009 to 2011, with 14.3 percent of its outbound investment directed there; within the Amsterdam Metropolitan Area, more than 750 of the 2,300 international companies are American firms (Iamsterdam, 2012).

One of the most salient examples of the smart city’s alignment with economic growth comes from Barcelona, which, like Amsterdam, has changed its approach since the smart city project’s inception. Joan Batlle, Head of the International Cooperation Department for the City Council of Barcelona, explained that “instead of being focused solely on economic goals, sustainability and quality of life are primary concerns as well” (J. Batlle, personal communication, June 15, 2012). The city’s initial incentives, however, were grounded in the potential to transform the city and its economy. The development of the 22@ district is representative of Barcelona’s goals to physically rebuild obsolete parts of the city and draw companies to lease the technology park’s office space. By replacing the old industrial zone that 22@ used to be a part of, Barcelona is expanding its economic growth capacity. The City Council is strategic partners with Barcelona Business Landing, an international consulting
network that has the specific goal of integrating international companies and institutions in the city (J. Batlle, personal communication, June 15, 2012). Its motto, aptly, is “Barcelona is growth” (Barcelona Business Landing, 2010).

Barcelona also offers financial incentives to facilitate FDI through tax deductions for technological innovation and research and development, as well as loans at low interest rates, microcredits, and support services for start-ups (Barcelona Activa, 2010). In recent years, projects connected to ICT have represented more than 20 percent of FDI in Catalonia. The autonomous region has over 3,100 foreign companies, mostly from the European Union, and over 75 percent of them are located in the Barcelona metropolitan area (Carranza et al, 2009).

Barcelona, like Amsterdam and New York, attributes its economic success and continued growth to their streamlined eGovernment services, widespread ICT infrastructure, and favorable regulatory and tax framework.

**Open Markets**

Stemming from the importance placed on FDI within the smart city’s economy is the tendency for multinational corporations, rather than domestic companies, to be involved in the city’s development. For instance, take the case of the UK-based company, Living PlanIT, achieving an international audience with its contract to build PlanIT Valley in Portugal. The location in northern Portugal is irrelevant; the company is involved in real estate partly because it is “the largest industrial vertical that there is…most particularly, it’s also the industrial vertical that has proved the most resistant to penetration by the technology sector” (S. Selzer, personal communication, November 23, 2012). Living PlanIT, then, is attempting to enter what they see as an untapped real estate market that is already profitable because of its size, but could be enhanced through their ICT products. In other words, by installing their sensor technology,
Living PlanIT hopes to combine the real estate and technology markets to capture unexploited profits and create their own niche market. In Portugal, the real estate and technology markets were open to foreign investment, signaling the low barriers to entry that Living PlanIT faced.

As alluded-to earlier, Living PlanIT is far from the only private technology company to emerge as a player in smart city service provision. A report by Accenture (2011) predicts that “the managed service provider of the Urban OS is likely to extract significant value from the urban services value chain, and so we expect this to be a highly-contested market,” with aggressive competition expected from software vendors, like IBM and Microsoft, system integrators, like Accenture, and infrastructure providers, like Cisco. In this way, not only is it possible for multinational corporations to become part of the smart city development process, but it is very likely to happen because of the apprehension city leaders feel when trying something new; according to Irene Compte, executive director of the smart city technology company Urbiotica, “cities don’t like to be the first to deploy a technology” and instead prefer that other municipalities be used as a testing bed (personal interview, June 18, 2012).

It makes sense that city governments would adopt the models of ICT giants who have had significant international experience rather than attempt to develop their own services.

This is not to say that city leaders have a preference for international parties when developing the smart city. Amsterdam’s smart city project has developed partnerships not only with Cisco and Vodafone but also with Philips, Liander, and dozens of other Dutch companies (Amsterdam Smart City, 2011). But smart city service provision is largely an open market. The 2011 report Information Marketplaces: The New Economics of Cities compares the role of government in smart city services to its role in the development of a shopping center: after providing the basic physical infrastructure, the city cedes decision-making to the private sector
(The Climate Group, et al). The report continues to state that the municipality must “develop the market for digital assets to be reused and recombined in the most efficient manner possible and ensure the broadest possible participation from the private sector in as open a marketplace as possible” (The Climate Group, et al, 2011). Local governments may differ in their level of involvement with the adoption of digital infrastructure, but they nevertheless must participate in the creation of the open smart city market.

In theory, smart city service provision may be well-suited to an open market to encourage private companies to cut costs for the public sector, but the reality is that smart city technology is so new that in many cases, the metrics to determine these cost savings simply do not exist. Furthermore, there is a history of failed public sector IT outsourcing deals—the predecessors of current ICT deals—with the Texas Department of Information Resources’ recently terminated contract with IBM serving as a recent example (Overby, 2012). Although open markets are not inevitably problematic, the difficulties of involving largely unaccountable parties in city service management runs the risk of placing cost reductions above quality and using standardized services in the place of context-sensitive solutions.

**Deregulation**

Deregulation often occurs alongside open markets and privatization because, according to neoliberal thought, in order for companies to compete on even footing, government regulation should not interfere with the efficiency of the market in setting prices or producing the optimal quantity of a good. While deregulation is closely tied to the smart city because of its market-reliant and efficient nature, it is rarely labeled as such, instead called open, interoperable, or seamless. The effect of deregulation, whether intentional or not, is often facilitated by smart city policy and masked by the discourse of openness. To explore this case, I will examine the
deregulation of information, popularly called the open data movement, which has the general aim of achieving transparency and efficiency.

Open data has its origins in the Freedom of Information Act (FOIA), which seeks to disclose (nonsensitive) government data to the public. The first FOIA was passed in the United States in 1966 and applies to executive branch government agencies. Since its passing, dozens of other nations have followed, most prominently the United Kingdom, who in 2000 passed a wider-reaching version that applies to public authorities, publicly-owned companies, and designated bodies performing public functions (Freedom of Information Act, 2000). Open data initiatives are largely synonymous with the more specific term open government data (OGD) because it has been almost exclusively a public sector effort. Though public sector information (PSI) has long been available, the marginal price included in its distribution is being eliminated through OGD initiatives. However, these initiatives can have a deregulating effect on data; when public information is freely released, the government no longer is able to control its reuse. For sake of clarity and reference, the following are definitions of the acronyms I use in this subsection.

- **FOIA**: Freedom of Information Act, or country-specific legislation mandating the disclosure of government data to the public
- **OGD**: Open government data, or data collected or commissioned by government or designated bodies performing public functions that is freely available for reuse
- **PSI**: Public sector information: information produced, maintained, or distributed by government or public institutions

Countries worldwide, from Norway to Uruguay to Australia, have launched open data initiatives, and following the recent smart city trend, there has been a surge of individual
municipalities implementing these policies. Along with San Francisco, Vienna, London, and countless of other cities, Amsterdam, Barcelona, and New York City have initiated aggressive open data initiatives that promise to engage and empower citizens. The winners and losers of these policies, however, reveal the neoliberal effects of open data policies. Ed Steinmueller noted that society needs open data and transparent government, which is achievable, but also transparent corporations, remarking, “Is this possible?” (personal communication, June 29, 2012).

Furthermore, open government and open data, while often linked in smart city rhetoric, are not mutually exclusive. In fact, “a government can provide open data on politically neutral topics even as it remains deeply opaque and unaccountable” (Yu and Robinson, 2012). This disconnect between the apparent motivation behind the deregulation of data and the consequences has also been noted by Bates (2012), who argues that “powerful groups within the state are attempting to shape OGD and use it to force broader agendas wrought by an ideological faith in the primacy of the markets over social provision.” Though this view is somewhat alarmist, Bates (2012) identifies the group that may benefit the most from open data. She acknowledges that while independent, civic-minded programmers have taken advantage of new data, particularly in relation to transport, there is still potential for further corporate control over the infrastructural systems that urban services and utilities rely on (Bates, 2012). Thus, the great unintended consequence of the open data initiatives may be “empowering the empowered” (Gurstein, 2011).

One way to evaluate the validity of these criticisms is to determine who uses open data. Slee (2012) divides the user base into four categories. First are citizen hackers, who seek pragmatic and useful data, like transit timetables, and are driven both by a desire to do good and
an interest in programming (e.g. Code for America); second are civil liberties activists, who promote government transparency by releasing lobbying records, campaign funding data, government operations, and legal acts (e.g. Sunlight Foundation); third are data journalists, a group made up of organizations or individuals who use data as part of their job to hold government accountable (e.g. The Guardian when covering WikiLeaks); finally, there is the public sector information (PSI) reuse industry, which produces commercial products or platforms using government data (e.g. Google, ESRI) (Slee, 2012). All four play a role, but Slee (2012) argues that transparency and activism have been used to disguise the economically neoliberal tendencies of the fourth group.

A review of recent PSI reuse in Europe reveals the potential for this fourth group, the PSI reuse industry, to exploit the value of government data (Vickery, 2011). By using PSI as “raw material” the private sector acts as an intermediary between the public sector and the user by developing new products and services that add value to the data (Vickery, 2011). Vickery (2011) reveals the huge resulting profits in Europe: direct and indirect economic impacts from the PSI reuse market are estimated to be €140 billion per year. This number is likely low, given that it does not take into account more recent PSI initiatives or data distributed at no charge. It is important to note that PSI is not necessarily free data, but instead may be provided at a marginal cost by the government agency that produced it. FOIA policies and the open data movement are increasingly making this data free through OGD initiatives. This shift towards completely open data with no charge or licensing restrictions, while being more democratic in nature, could reduce the funds that governments had collected from PSI reuse in the past. The Netherlands has had a particularly successful PSI reuse market, with government revenues from sales of PSI around €68 million in 2009-10 (Vickery, 2011), but open data policies may empower the private
sector to capture the profits instead through value-added products and services, especially in the areas of meteorological and geospatial data.

One highly publicized use of open data has been implemented in Amsterdam and New York City in the form of government-sponsored apps challenges—competitions to develop applications for mobile devices—that use open data to solve citizen problems. The main participators for these types of competitions fall into the first camp of Slee’s (2012) open data users: citizen “hacktivists” who are well-educated—and well-paid—professionals with a desire to give back. Mayra Madriz, who helped design Goodbuildings.info, a winning app in San Francisco’s Summer of Smart app competition, was part of a team that included web designers, technologists, urban planners, researchers, software developers, among others (personal communication, December 12, 2011). Though this shows that open data certainly empowers some citizens to solve specific problems, it would be an inaccurate to ascribe this benefit to society as a whole.

As of this writing, Barcelona is in the midst of an apps challenge that encourages the combination of various types of open data, explaining that “the technology for creating this kind of novel applications based on data provided by 3rd party APIs and external sources is called Web Mashups” (Open Cities, n.d.). This technical jargon is clearly not comprehensible to the majority of citizens, who likely would not know how to define open data, let alone 3rd party APIs. While apps competitions certainly encourage a wider base of participation by drawing input from professionals outside local government, it is from a very specific sector of the city population and thus cannot be viewed as an inclusive initiative. Despite genuine intentions for open data policies to increase civic participation, only those with the knowledge of how to interpret and build on digital data have been empowered by it, which puts technology companies
with a marketing capacity at an even greater advantage than individual programmers. In theory, the transition from PSI to open data makes government data non-excludable and non-rivalrous, but this discussion calls the non-excludability into question; though anyone can access the information, only a select few benefiting from advanced knowledge and economies of scale can truly use it to their advantage.

**Maximization of Profits**

The smart city, like all models used for economic development, supports the maximization of profits. As described earlier in this chapter, urban development in the smart city is primarily defined by economic growth—growth that must be constant because of the short life cycle of ICTs. As an economic development platform, the smart city facilitates the flow of capital. PlanIT Valley, the quintessential example of this phenomenon, took root because of the Portuguese government’s recognition of the importance of expanding its technological capacity in order to remain economically competitive (S. Selzer, personal communication, November 23, 2011). The project has been designated a Project of National Interest and the Prime Minister is committed to the idea as a means to boost Portugal’s economy and garner international attention—for something other than the euro zone crisis. In their desire to develop PlanIT Valley into a center of innovation and generate profits for the nation’s struggling economy, Portuguese officials have taken a largely hands-off approach that leaves decision-making in the hands of technology companies.

Moreover, much of the smart city’s added-value comes from the production of data that can be exploited for further profits. This capital accumulation, where surplus value is appropriated by the capitalist, mirrors David Harvey’s (2009) notion of accumulation by dispossession. Harvey (2009) argues that power and wealth are centralized by dispossessing the
public of their land or wealth, often through privatization. Analogously, but not to Harvey’s extreme, in the smart city, the private sector captures the profits of ICT infrastructure built for the public, with public funds. Data is gathered through crowdsourcing or sensors, and then used to create added value for the “owner” of the data—the company that collected it—not the producer.

Similarly, Greg Lindsay explained the risk of corporate dominance regardless of the presence of grassroots participation in ICT development. He acknowledged that though it is beneficial for companies like Cisco to be building networks and broadband to create the city’s ICT backbone, it becomes problematic when they shift to the “app store model” (personal communication, July 6, 2012) The so-called “app store,” pioneered by Apple as a business model, creates a revenue stream from the initial developer kit and continuous percentage of sales that Apple collects in exchange for the easy distribution and large audience provided by a centralized “store.” In the smart city scenario, the network company takes a cut of all profits and added-value produced from the bottom, accumulating capital for large technology companies.

Not only does the smart city facilitate this sort of maximization of profit, it can also unintentionally favor large companies over small ones. When asked if there were barriers to testing in Barcelona’s Urban Lab—an inclusive program that accepts applications without limitations on company size, especially encouraging start-ups—Irene Compte noted that companies must have an established economic base because the Urban Lab does not provide funding for project implementation (personal communication, June 18, 2012). Companies must be able to pay upfront for the costs of installation and keep them running with the hope that the city will contract them for their services. Though larger companies tend to be less innovative than smaller ones, the latter group is effectively shut out of ventures like the Urban Lab for
financial reasons. Without financial backing from the City, the practical effect of this initiative is that the Urban Labs model benefits semi- and well-established companies, which undermines the very bottom-up model that it aims to promote.

Furthermore, the role of the small and medium-sized company in the smart city is ambiguous, especially in Barcelona. Start-ups and entrepreneurship are encouraged as a part of the smart economy, but not particularly in terms of smart city service provision. For instance, while Irene Compte’s company Urbiotica produces sensor technology that complements Cisco and IBM’s products, there is no clear role or established role for newcomers, which means players with less power are still finding their place (personal communication, June 28, 2012). In Amsterdam, too, well-established companies have forged working partnerships with Amsterdam Smart City. The two founding members of ASC that are private companies are KPN, the leading telecommunications and ICT service provider in The Netherlands, and Liander, the largest utility company in the country. While ASC has formed partnerships with more moderately-sized companies on individual projects, it is clear that established companies, not start-ups, are the beneficiaries of local government procurement contracts.

**Efficiency**

The notion of efficiency underlies much of the discussion on the smart city, and while not exclusively a characteristic of neoliberalism, it is an important motivator behind many of the ideology’s characteristics. The appeal of privatization, open markets, and deregulation lie in their promise to maximize economic efficiency, which, according to neoliberal ideology, provides society with the best goods and services while using the least amount of resources. As a consequence, data of every type becomes paramount in the smart city. Sensors and apps seek to measure the speed of service delivery, citizen satisfaction, building energy efficiency, emergency
response, transit delays, and countless other elements of city life to inform policymaking. To be clear, this is not a problematic characteristic of the smart city; it is simply a feature that falls in line with the neoliberal ideology. While it is a consequence of the above-mentioned aspects of neoliberalism, city development can certainly benefit from enhanced efficiency and attention paid to measurable outcomes.

The most important thing smart city projects can do is show results, explained Katalin Gallyas (personal communication, March 23, 2012). This explains the rise of big data, a term referring to very large and complex datasets that often require special software to be managed and analyzed. Big data often comes from open data sources or sensor technology embedded in the ICT infrastructure of smart cities, and though it does not constitute value in and of itself, it can be used for smart city management with the aid of sophisticated analytics tools. IBM’s Intelligent Operations Center technology is one example of how big companies can leverage big data, harnessing the data produced by ICTs to enable the government to anticipate problems and lessen the impact of service disruptions. This “executive dashboard” shows real-time, measurable performance indicators about city operations across its different agencies (IBM, 2012). While data at this scale provides the basis for local government to consider real-time information in decision-making, critics claim that it raises questions of privacy. This is not the largest concern with ICT use, however, explains Rit Aggarwala, who argues that data can be made confidential for a certain period time, as is done with the Census, and that IBM has been handling sensitive information since the company’s inception (personal communication, November 2, 2012). While IBM has not handled city-level data before as it does for smart cities, its history explains its dominance of the emerging field.
The concept of efficiency requires benchmarks from which to measure improvements from ICT-enabled policies and infrastructure in the smart city. Ed Steinmueller identifies the conventional metrics, based on a capitalist approach to social welfare, that are used to measure ICT performance: first, the relationship between adoption and productivity (i.e. whether the adoption of a technology leads to increased output); second, the rate of take-up; and third, the digital divide (i.e. inclusion versus exclusion regarding technology use) (personal communication, June 29, 2012). He believes that these conventional measurement techniques will not suffice to assess the impact of ICT. He is opposed to the first metric because it is usually defined incorrectly by assuming that producing more is inherently better—ICT does by this by nature, but the value of an SMS, for example, has not been quantified. Second, he argues that take-up is a misleading metric because the size of an investment in ICT does not ensure its effective use, and furthermore, the consequences of take-up might not be ideal—Walmart and Amazon are efficient retailing models, but not always an appropriate goal to achieve social good. Steinmueller invalidates the third issue of the digital divide because he believes that exclusion is temporary due to the rapid rate of cost reduction for technology. He explains that society has to decide what it is interested in, effectively deciding whether business-as-usual should be restored after the economic crisis or whether social welfare should be redefined outside of income and economic growth (personal communication, June 29, 2012). The development of new indicators to measure the smart city that do not coincide with neoliberal ideology are emerging, however, which will be discussed further in the next section.
THE BOTTOM UP SMART CITY

Alongside the claims of a neoliberal dominance of the smart city has emerged a discourse promoting the small-scale, citizen-driven approach to integrating ICTs into the city’s fabric. There are an abundance of bottom-up initiatives occurring globally, not restricted to the official smart cities of Amsterdam, Barcelona, and New York City, that provide rich subjects of further research. This section contains some of the most relevant, but is by no means representative of the entire range of projects, many of which are emerging particularly in South America and Asia. Bottom-up innovation undermines the neoliberal, growth-centered smart city not by replacing the role of technology corporations, but by challenging their supremacy. Put simply, bottom-up innovation offers alternatives to the prepackaged “city-in-a-box.” Top-down smart efforts, it appears, may be antithetical to the conceptual basis of the smart city, which stresses openness, transparency, and adaptability. Over the past decade, what urbanist Dan Hill somewhat facetiously refers to as an “Urban Intelligence Industrial Complex (led by IBM, Cisco, General Electric, Siemens, Philips et al.)” has emerged, though has had little success when considering the sums of money these companies have spent on marketing; he predicts a “quiet fading away of all those ‘Smarter Planet’ promotional schemes soon” (2013).

While bottom-up efforts have in common an ideological opposition to the reduction of the citizen’s voice in technology-driven planning, they come from a wider range of sources than top-down projects. Recognizing the limitations of the centralized, technocratic system that Hill describes, even companies like Cisco have begun advocating for citizen-driven initiatives. Though these ideological extremes appear irreconcilable, effective smart city initiatives are beginning from this middle ground, redefining the role of the grassroots and employing combinations of public, private, and nonprofit approaches to service delivery.
Advocacy from the “Grasstops”

The nature of smart city development limits the participation of the masses. Monitoring citizen use of public transportation systems by tracking transit cards, for example, is subtle in ways that building expressways is not. Characterized primarily by its generation of data, not physical material, the smart city is often intangible; furthermore, the technology it seeks to disseminate is often unfamiliar to the average citizen. Understanding the resistance to the centralized, corporatized smart city necessitates a redefinition of “bottom-up,” a term that connotes grassroots efforts. In this case, it must be interpreted with more flexibility, suggesting instead advocacy for the grassroots that comes from a position higher on the scale of power than the “true” masses. In the smart city, this movement has originated from the “grasstops,” so to speak. By this, I refer both to community leaders in the conventional sense but also to the leaders of the nontraditional digital and internet communities. Within Amsterdam, Barcelona, and New York, advocacy comes from city leaders and technology experts rather than the electorate itself.

The opposition to the corporate-led smart city model is present both in academic and real-world discourse, and while it has not come from the average citizen, it is very much in defense of him or her. The ideological basis for bottom-up innovation emerged in opposition to technological determinism, a technology-led theory of social change that sees technology as the primary agent of action. In other words, human factors like social arrangements and cultural values, arise in response to technology, having been shaped by technological developments, communications technology, or media (Chandler, 2000). The opposing view is the social construction of technology, also known as social constructivism, which argues that human action shapes technology, and that technology cannot be understood in isolation from its social context. Social constructivists argue that society provides the basis for whether the “technological artifact” will be accepted or rejected (Pinch and Bijker, 1984). While both of these views are
certainly at play in the smart city, bottom-up innovation favors social constructivism over
technological determinism in its recognition of community agency.

In brief, bottom-up innovation identifies itself with leveraging sociability to “[tap] citizens as the source of innovation” (Ratti and Townsend, 2011). Generally, this “civic entrepreneurship” attempts to resist state-led innovation from an ideological standpoint, and can take many forms, such as crowd-funding, pop-up establishments, and platforms engaging in “subtle side-stepping of bureaucracy” (Hill, 2013). With the ultimate intent of enhancing technology’s potential for empowerment and inclusion, this movement seeks to repossess the power of ICT implementation rather than to halt it altogether. As Hill writes, “infrastructure companies, whether cars and highways or screens and routers, look to increase traffic on their infrastructure. It is in their interest. We can hardly blame them for trying—that’s their job” (2013). While some take a more vilifying approach in their conception of technology corporations, the bottom-up movement agrees that the challenge lies in the inequalities that smart city can be permitted to perpetuate, not in the technology itself.

The bottom-up movement can be traced to Douglas Kellner’s broader analysis of the global restructuring of capital and his critical globalization theory, which “leaves room for contestation and struggle, as new technologies also have the potential to promote greater democratization and social justice” (as cited in Pyati, 2005). Because globalization is the foundation on which the smart city is constructed, reclaiming the use of technology is seen as an affront to the dominance of trade liberalization and unrestricted capital flows. The smart city, with its preponderance of ICT tools, is literally built for democratization and social justice to take place, if harnessed successfully. Over the past decade, a significant presence of academic,
activist, and “digerati” resistance to the corporate dominance of technology has emerged, comprising a new form of internationally active civil society organizations.

These organizations, often structured as web-based communities, “can play a role in resisting the Information Society of neoliberal globalization, mainly through the powerful networking potential of ICTs in facilitating global grassroots mobilization” (Pyati, 2005). This effort began in 2003 with the 1st World Forum on Communication Rights, a conference planned to counter the World Summit on Information Society (WSIS). While the Summit was meant to further human and social development by achieving the UN Millennium Goals, critics saw it as a means to advance the neoliberal agenda. For instance, in support of the WSIS principles, European Union developed a “three-pronged approach” for realizing their vision of the Information Society that stimulated research on ICTs, restructured traditional services through ICTs, and developed a regulatory framework that promoted deregulation (Pyati, 2005). In opposition, the 1st World Forum on Communication Rights developed a Charter of Civil Rights for a Sustainable Future, which demanded unrestricted and nondiscriminatory use of knowledge and information. The Charter lists fundamental rights that mandate open technical standards, the availability of information from independent sources, employee rights, privacy, and unlimited and free access to public data (Heinrich Böll Foundation, 2003). Very much an example of grassroots mobilization, the 1st World Forum on Communication Rights served as a symbolic gesture in defense of a society at large generally unaware of or removed from technology policy.

Unexpected Collaboration

On the other side of this ideologically-based resistance are practical programs like TakingITGlobal, an educational nonprofit that engages youth in over 3,800 schools in 142 countries. The organization uses technology to further youth knowledge in three areas: global
citizenship, environmental stewardship, and student voice, and to facilitate school participation, they employ a pay-what-you-can donation-based model (TakingITGlobal, n.d.). The organization’s relationship with the for-profit sector, however, is unexpected; it partners with some of the world’s most powerful technology corporations, including Microsoft, Cisco, Adobe, Best Buy, and Staples, to sponsor their curricula (TakingITGlobal, n.d.). These companies support programs closely related to the use of their product, such as the Adobe Youth Voices Project, which uses digital multimedia tools to empower youth from underserved communities to share their ideas.

Likewise, TakingITGlobal has partnered with one of Cisco’s philanthropic initiatives, the Networking Academy Program, which teaches high school and college students to design, build, and maintain computer networks. Cisco’s Networking Academy Program is a larger project that, with 10,000 academies in 165 countries, reaches hundreds of thousands of students globally and prepares them for industry certifications and entry-level ICT jobs (Cisco Systems, n.d.). While the most cynical might see these corporate programs simply as efforts to expand the potential market for their products, there is truth to the social benefits that the philanthropic arms of these companies espouse. Cisco’s Corporate Social Responsibility philosophy is based on the belief that “impact multiplies whenever human and technology networks combine to solve a problem,” and that it is Cisco’s responsibility to “operate in ways that respect and ultimately benefit people, communities, and the planet we live on” (Cisco Systems, n.d.).

In fact, Cisco seems to be adapting to this bottom-up movement as much as is possible for a multinational corporation. Hill (2013) notes that “Cisco’s more interesting projects, perhaps in a later, more considered mode, are smaller scale discrete experiments in Amsterdam, New York, Barcelona and Nice, which integrate over time.” Furthermore, he specifically identifies
Nic Villa as one of the forward-thinking leaders of Cisco’s Internet Business Solutions Group. In an interview, Villa explained that “to do bottom up, you need broadband. Broadband needs to be centralized” (personal communication, April 27, 2012). Once the challenge of the physical network is addressed, even corporate giants recognize the role of context-based solution-making rather than top-down planning. After all, as Ratti and Townsend write, “the revolutions of Cairo and Tunis played out on a mobile infrastructure built by Vodafone and other global companies” (2011).

**Bottom-Up Planning**

Bottom-up efforts in the smart city are advocated for not only by technologists, but by those directly engaged in city planning. Nonetheless, there are fundamental barriers within the planning profession that must be overcome. Madriz, an urban planner at Arup, explained the challenge of conveying the real goals of the smart city when advertisements from technology corporations stress the novelties of ICT integration: “I think we need to communicate it so that it’s not something elitist and it’s not something that is separated from meeting basic human needs in a good way. It can be seen as if the smart cities are having all these extra technological things that you don’t need, and I think that is a poor interpretation” (personal communication, December 12, 2011).

Many bottom-up initiatives are initiated with the fundamental goal of raising the profile of citizen voices stifled by proprietary software and closed-source ICT. Though Cisco’s networks and IBM’s data management systems have been deployed, for the city to truly democratize, citizen participation must travel through these networks to be analyzed by these systems. Open Plans, a nonprofit technology organization based in New York City that advocates for digital democracy, aims to “build tools to get cities on the path to better
technology, help citizens get the responsive government they should expect, and scale up small
discussions to city-wide change” (Open Plans, n.d.). They take an open-source approach to
deliver tools to the city that crowdsourced public input and effectively engage citizens in
participatory planning. The benefits of implementing citizen-focused initiatives have not escaped
local governments, who, like technology corporations, stand to gain both in terms of reputation
and more importantly, impact.

Local governments are not only relying on private sector recommendations for citizen
participation, they are seeking it themselves. For instance, the New York City Transparency
Working Group (nycTWG) supports New York City government in using information
technology to make itself open and accountable (New York City Transparency Working Group,
n.d.). The organization releases public statements about local tech-related laws and promotes
initiatives like Checkbook NYC 2.0, a City website that discloses how the annual budget is
spent. Member organizations include the NYCLU, the League of Women Voters NYC, Open
Plans, and Common Cause NY. The co-chairs represent the New York Public Interest Research
Group and Reinvent Albany, an organization that promotes the same ideals at the state-level.
These organizations are not, by definition, grassroots efforts, but they represent the interests of
citizens and seek to undermine traditional arrangements of power. Like the proliferation of open
data initiatives worldwide, nycTWG represents City goals of operational transparency and the
provision of resources for effective public participation.

The call for citizen-level participation in technology has coincided with the rejection of
the output-driven business model that does not function with the somewhat inefficient reality of
corporate-driven planning, Ger Baron, the Project Manager for Amsterdam Innovation Motor’s ICT cluster, rationalizes the need for “the
creative destruction of a business model…energy companies have an incentive to sell as much energy as possible. Car manufacturers have an incentive to sell as many cars as possible because this represents revenue for them” (2012). The profit-oriented approach to planning is in tension with smart city goals of sustainability, which inherently requires a scaling back of consumption. Equally at odds with the top-down vision of economic efficiency—using resources in a way that maximizes the production of goods and services—are the goals of the main component of the city: its people. The core of human endeavors, Hill explains, are inefficient: “Would one wish one’s marriage to be ‘efficient’? A dinner with friends to be efficient? A game of football? A great book? A walk in the park?” (2013). He coins the term “productive inefficiency,” ultimately asking “can a city be ‘smart’ and inefficient at the same time?” (2013).

Consequently, the bottom-up movement explicitly values the citizen’s experience in the smart city. At the forefront of this approach is the Interactive Telecommunications Program (ITP), a two-year program at New York University’s Tisch School for the Arts that explores the “imaginative use of communications technologies—how they might augment, improve, and bring delight and art into people’s lives” (Tisch School of the Arts, n.d.). Townsend (2013) describes the projects produced at ITP in terms of their collective significance: “If industry is taking the Robert Moses approach to urban engineering, plowing superhighways through old neighborhoods in the name of progress, ITP’s denizens seem inspired by Jane Jacobs to stitch a thousand little smart gadgets into the social fabric of every street corner” (2013). The results are projects such as #BKME, a platform that “defends the bike lane” by enlisting cyclists to use their mobile devices and Twitter to report cars that are parked in bike lanes, producing a collective, real-time record of violations (BKME, 2012). Another such project is Metrochange, a platform that takes the spare change left on MTA MetroCards—$52 billion of which is lost or discarded
each year—and transfers it to a central fund to be donated to a charity once a month (Metrochange, 2012).

However, ITP’s creative freedom is also its downfall, if considering the useful applications of technology in the city. Projects have also included impractical artistic projects like Cavendish Trebuchet, “a tiny catapult that, when pulled back and released, announces “Banana!” and triggers a video projection of said fruit flying into the wall” (Colombo, 2012). Certainly, not every use of technology must lead to social change, but the huge variety of outcomes generated by any bottom-up movement makes its direction unpredictable. Less pragmatic uses of technology, like apps competitions, recall Greg Lindsay’s concern that “bottom-up is inevitable, but will it be meaningful?” (personal communication, July 11, 2013).

**The interruption of the profit motive**

Government-led smart city development can be viewed as a middle ground between corporate control and true bottom-up power. Even as they seek private sector consultations and products, municipalities—as bodies accountable to voters—demonstrate significant dedication to advancing citizen interests and participation. The precedent of government sponsorship, oversight, and intervention in smart city projects is crucial to checking the power of corporate players; in no brownfield smart city is decision-making divorced from an element of bottom-up innovation. The continuation of Barcelona’s Cibernarium, for example, “is assured because it is seen as a public service, and the municipality will not lose this philosophy” (J. Roca, personal communication, June 20, 2012). Through the Cibernarium, local government is able to assist specific populations that in a purely free market system would fall behind. It is crucial that these efforts be understood as public services rather than profit-seeking initiatives for the smart city to be accepted and sustained by the grassroots. Many of the initiatives that were described in the
previous section as reinforcers of neoliberalism do, in fact, have bottom-up uses and origins. Apps competitions and hackathons seek out non-corporate visions for the smart city, while open data has created unprecedented levels of transparency in government. This increased access no longer only benefits those who can purchase government data. Moreover, entire smart cities, like Amsterdam, can function through a variety of SME-led projects rather than relying on a master plan or “city in a box” scheme.

In the United States, Code for America is becoming an increasingly effective voice in policy circles, calling attention to the need to modernize government bureaucracy. Code for America’s motto is “a new kind of public service: helping governments work better for everyone with the people and power of the web” (Code for America, n.d.) As self-professed web geeks, city experts, and technology industry leaders, Code for America offers city governments technical expertise at below the market rate. More importantly, they operate on web-centric and open platforms that have brought together a network of civic leaders that aim to enable “connected, lean, and participatory” governance (Code for America, n.d.). Katalin Gallyas described Amsterdam’s collaboration with Code for America’s Civic Commons project as a very positive experience and a promising vision of government’s compatibility with technology (personal communication, March 23, 2012). Civic Commons is both an apps market and a best practices platform that makes open-source applications available for use worldwide. Users can see where certain apps are in use—CitySourced, for example, an app much like SeeClickFix, operates in 34 locations at the time of this writing, including international locations—or browse apps by function to find which one suits a city’s particular needs. This is a new model of government intervention that undermines the corporate-led approach by eliminating cost as a limiting factor in local government’s use of technology.
City-sponsored apps competitions and hackathons, too, reveal issues that residents see as most crucial to their everyday life, despite the limited population that participates in them. One resulting app from the NYC Big Apps contest, called Stop-and-Frisk Watch, was created by the NYCLU and allows users to monitor police activity in order to create social change (I. Li, personal communication, July 5, 2012). These efforts, facilitated through government channels and operated on corporate platforms, offer residents a voice in raising awareness of issues that affect them without having to conform to a revenue-generating model. New York City also has a robust nonprofit technical assistance network to maintain the city’s nonprofit sector, which is paralleled at a national scale by the Nonprofit Technology Network (NTEN). NTEN is a membership organization of technology professionals that helps nonprofits use technology effectively to generate a greater social impact (NTEN, n.d.). Government’s creation of avenues for socially-oriented organizations to flourish effectively counters concerns about the smart city contributing primarily to technology companies’ bottom line.

While many bottom-up efforts work through existing government and market systems, a number of smart city projects have also emerged as a blatant rejection of the prevailing neoliberal agenda. One of the first bottom-up efforts to use somewhat subversive techniques was NYCwireless, an advocacy group that promotes open wireless hotspots in public spaces, such as parks, coffee shops, and building lobbies throughout the New York region. The organization particularly emphasizes partnering with public and nonprofit organizations to extend the reach of wireless service into underserved communities (NYCwireless, n.d.). Founded in 2001, they began with small scale efforts to create free Wi-Fi hotspots by opening their own personal connections to the public, “but as industry mobilized, we [NYCwireless] realized that we needed to move beyond guerrilla tactics. The technology was the easy part. We needed partners that
could pay for bandwidth, and give us a place to mount our antennas” (Townsend, 2013). In November 2012, NYCwireless joined with the Electronic Frontier Foundation, an international non-profit digital rights group, and nine other organizations to launch the Open Wireless Movement, which will make it easier for people to open their personal wireless networks to the public without compromising the quality and security of their connection (NYCwireless, 2012). This effort is locally-dependent and community-driven, embodying a grassroots approach to creating change in technology policy. Their actions work within the existing systems of broadband networks as a means to the end of expanding internet access. NYCwireless’s deliberate attempt to shape the impact of technology by giving it a social context and purpose is distinctly different from the objectives imposed by a free market system of broadband.

The European program Periphèria takes its commitment to the citizen to a further extreme. Periphèria is a 30-month pilot program funded by the European Commission that seeks to deploy ICT platforms in peripheral European smart cities, such as Pamela, Portugal, and Genoa, Italy, and sees the evolution of public services eventually reaching a point of “co-production,” with and by the citizens (Periphèria, n.d.). This mission, though sponsored by the business-friendly European Commission, dismisses the private sector as a relevant stakeholder by prioritizing the government-citizen relationship and even recalls a socialist system of production. The mission statement of the Digital Citizen Project, an organization that builds tools and provides tutorials for technology use in the public interest, suggests a similar bottom-up approach: “There are more than enough powerful interests who would be happy to ensure the internet maintains their wealth and power, so you should do something to make sure it grows in a way you like and supports the world you want—a world we all want” (Digital Citizens Project, 2013). With projects advocating the elimination of government censorship and a “virtual picket
an internet browser Add-On that allows users to subscribe to lists that withhold picketed pages from loading until the user decides to either respect the picket line or continue to the site—the Digital Citizens Project is attempting to transmit civil disobedience to the virtual world.

A byproduct of this resistance is the rise of open-source platforms as an alternative to the profit-centered smart city. This became especially clear during the 2011 Occupy Wall Street movement. Grassroots organizers used open-source web-coding tools to create the websites that served as points of contact and information clearinghouses by combining newsfeeds, social media links, manifestos, videos, and crowd maps (Massey and Snyder, 2012). The rejection of corporate media like Facebook and Twitter even became part of the movement’s ideological stance, “as many made a point of using open-source software, sources and methods such as wikicoding” (Massey and Snyder, 2012). Furthermore, once the demonstration was disbanded in November 2011, the Occupy movement came to rely almost exclusively on its web presence as it continued its campaign. The crucial role attributed to social media and the internet in the Occupy movement, as well as in the revolutions of the Arab Spring, has been criticized for being overstated. Certainly, the superficial support of even hundreds of thousands of people via social media networks like Facebook does not necessarily translate to meaningful change, but it is clear that online tools are creating new forms of resistance and opposition to capitalist hegemony. That activists have an alternative to using corporate technology, even without a broad audience, is evidence of the bottom-up movement’s place in the smart city discourse.

It appears that the bottom-up smart city has much less to do with the physical city than top-down approaches; rather than apply ICT to engineering challenges, social services deployment, or emissions reductions, these efforts focus on principles like open platforms and citizen voice. With the exception of Code for America, the discourse against the neoliberal
smart city tends to focus on enabling resistance and suggests strongly that the most important means to countering top-down power is through making technology access and use equitable across social and economic lines.
POLITICAL IMPLICATIONS

THE DIGITAL DIVIDE

The smart city’s promotion of ICT has raised awareness about the digital divide and encouraged local governments to implement a variety of programs geared precisely to reverse the phenomenon. Instead of allowing the digital divide to worsen, city leaders have taken social equity concerns to heart—or, at the very least, have recognized the economic disadvantages produced by exclusion. In fact, local governments view the considerable inclusion initiatives they have undertaken as a measure of success, championing their increasing broadband penetration rates as evidence of the smart city’s effectiveness. In the smart city, however, the conventional metrics that measure the extent of the digital divide—primarily rates of access to technology and information—are becoming less relevant to the quantification of digital inequity. By definition, the smart city seeks to maximize access to ICT by integrating it into the physical environment, and therefore a more meaningful measure of the digital divide is emerging through data on how, not whether, people use technology.

The Digital Divide in the Smart City

The digital divide can be identified at a macro-scale by comparing ICT access between the Global North and South, wealthy and poor countries, industrialized and developing regions, or urban and rural areas. Cities tend to act as a microcosm of the broad patterns identified at larger scales, and show that the same factors—income, age, education, employment status, and density—remain good predictors for the digitally active population at this smaller scale.
Furthermore, these demographic patterns tend to reproduce stereotypes of marginal or vulnerable populations along socioeconomic and racial lines. Conventionally, the data collected to determine the extent of the digital divide refers to physical access to information technology, which is most commonly operationalized through number of personal computer users and rates of internet penetration.

Not surprisingly, Amsterdam, Barcelona, and New York City generally perform well in the overall measure of broadband penetration. While broadband penetration rates do not specifically identify which segments of society are excluded, they do show high levels of access in these cities relative to their surrounding geographies. As of 2011, 67 percent of Catalan households had a broadband connection, which is significantly higher than the Spanish average of 57 percent (Eurostat, 2012). Catalonia has the highest broadband penetration rate of any of Spain’s autonomous communities—even surpassing Madrid—and though city-level data is not presently available, Barcelona’s individual percentage is undoubtedly even higher, as urban centers tend to be.

The same figure in the region of Noord Holland, home to Amsterdam, is an impressive 85 percent (Eurostat, 2012). Ranked fifth in the entire European Union, Noord Holland is only surpassed by the Nordic European regions of Iceland and Western Norway, and the areas surrounding Stockholm and Oslo. Specifically within Amsterdam, the statistics are even more striking: in 2011, 92 percent of residents used internet, with 90 percent having access at home (Municipality of Amsterdam, 2012). Among 16-24 year olds, 95 percent have broadband at home; this figure stays consistently high through 45-54 year olds, with 96 percent penetration, then dropping sharply to 67 percent for the category 65 and older (Municipality of Amsterdam, 2012).
New York City exhibits comparable broadband penetration rates to the European regions. More detailed additional data is available, however, which confirms predictable patterns of uneven distribution at the micro-level. By the end of 2010, 69 percent of households in New York State had broadband, while in New York City this rate was 64 percent (New York State Broadband Program Office, 2012). Interestingly, when the entire downstate region is included—and thus the metropolitan region’s wealthy suburbs are taken into account—the figure jumps to 87 percent, “likely due to the prevalence of higher incomes in that region of the State” (New York State Broadband Program Office, 2012). Across the state, the digital divide by level of income is starkly apparent: 37 percent of New York households with annual incomes $20,000 or below have broadband at home, compared to 85 percent of households with incomes from $60,000 to $100,000 (New York State Broadband Program Office, 2012). Furthermore, 44 percent of high school graduates have broadband, compared 84 percent of those with bachelor’s degrees (New York State Broadband Program Office, 2012). Age, even more than in Amsterdam, represents a dividing line between the “information have and have-nots”: 82 percent of 18-24 year olds have broadband versus 38 percent of those 65 or older (New York State Broadband Program Office, 2012).

However, these mixed results, which show impressive rates of broadband penetration despite the clear presence of a digital divide in New York—a conclusion that likely would have emerged with more complete information on Amsterdam and Barcelona—are only one form of measuring the digital divide. The emergence of the smart city has brought these conventional metrics into question, given that the proliferation of technology by the municipality has made access less burdensome. Consequently, many emerging smart city initiatives assume the widespread ownership of a personal computer or easy access to the internet. Despite the
potentially exclusionary effects of such planning, the declining cost of ICT and the rising social value placed on the internet makes this supposition not unreasonable. Given already-high rates of broadband penetration, a more pertinent distinction, Jung, Qiu and Kim argue, is how technology is used by different segments of society and its effects on existing inequalities, especially the capacity to use internet access “for purposes of social mobility” (as cited in Partridge, 2004).

Likewise, Harper (2003) makes the distinction between two digital divides: the access digital divide (access DD) and the social digital divide (social DD). The access DD is conceptualized in terms of “hardware” and gauged through the traditional metrics described above. Harper is critical of these measures and argues that the presence of computers or Internet access in the household is of little use to educators and policymakers. The social DD, on the other hand, is a cultural phenomenon based on differences in social and psychological perceptions of information technology. These perceptions, which affect an individual’s chance of upward social mobility, are not solved when the barriers to access are removed, and demand a sociological and psychological approach rather than a focus on penetration rates.

Accordingly, it is important to better understand the culture of ICT use and the decision-making process that leads to adoption. This subtly different than merely gaining access. While only 64 percent of households in New York City have adopted, and thus use, broadband, 97 percent have access (New York State Broadband Program Office, 2012). In other words, though internet access is nearly ubiquitous in the smart city, there are complex economic and social factors associated with the decision to adopt broadband. Furthermore, of those who have adopted broadband, internet usage is diverging. An unintended consequence easily hidden by rising computer ownership and broadband penetration rates has been labeled the “time wasting gap”. Studies show that as access to digital devices has proliferated, “children in poorer families are
spending considerably more time than children from more well-off families using their television and gadgets to watch shows and videos, play games and connect on social networking sites” (Richtel, 2012). While useful initial indicators, especially for government, the superficial measures of ICT access can obscure the smart city’s actual effect on the digital divide. By no means exclusive to smart cities, the time-wasting gap and other social effects of increasing digital use could nonetheless be exacerbated in cities so dependent on digital devices.

**Combating the Digital Divide in Practice**

Local governments view the digital divide as a genuine source of concern, and seek not only to prevent its exacerbation, but to reduce the disparities between the “information haves and have-nots.” Interestingly, no large-scale efforts addressing the digital divide have been made in Amsterdam. This perhaps is due to the city’s high-skilled labor force and extremely high levels of broadband penetration—the percentage of those 65 and older with internet access at home is nearly twice as high in Amsterdam as in New York City (Municipality of Amsterdam, 2012). Also impacting Amsterdam’s seeming lack of attention to the digital divide are the demographic characteristics of its immigrants: the city is dominated by its foreign-born population, which, in 2012, made up 50.5 percent of the city’s 800,000 residents (Municipality of Amsterdam, 2012). Significantly, immigration from industrialized countries is particularly high, with approximately 1,000 new immigrants per year, most of whom find work in the services, banking, and ICT sectors (Van Druten, 2002). Western foreigners, who comprise the largest ethnic group of immigrants, have consistently higher labor force participation rates than other immigrant groups or even native Dutch residents (Municipality of Amsterdam, 2012). This pattern leads many non-natives to think of themselves as expatriates rather than immigrants—a subtle distinction not available to many low-skilled immigrants in Barcelona and New York.
Reflecting this distinction, both Barcelona and New York have committed themselves to technological inclusion as a requisite component of their smart city projects. This surprising sense of obligation to the disadvantaged, which seems to counter the profit-oriented, neoliberal paradigm that dominates smart city discourse, is supported by O’Connor’s dual-state model. This theory proposes that the state must simultaneously create an environment conducive to capital accumulation while also being perceived as creating policies that address the social welfare needs of its population (as cited in Stevenson, 2009). This second task, called legitimation, explains government’s dedication to the reduction of the digital divide (Stevenson, 2009).

With digital divide policies as a source of legitimation, smart cities have been able to equate the principle of “universal service” with “universal access.” As Stevenson (2009) explains, “while the state could no longer subsidize home service, it could work toward ensuring that all citizens had access to the new communications medium through local public institutions until such a time as individuals could afford their own access”. By providing widespread access to information technology in libraries and local community centers, as has been done in both Barcelona and New York City, local governments have validated their commitment to public welfare. More importantly, the failure to integrate oneself in the new global information economy has been transformed into an individual failure rather than the result of systemic inequities (Stevenson, 2009). As a result, the acceptance of the principle of universal access as the ultimate objective of bridging the digital divide has had the obscured—and likely unintended—effect of liberating government from the responsibility of ensuring equitable benefits from technology. In this line of thinking, those who do not gain value from ICT simply must not using the resources provided for them.
Municipal efforts to shrink the access DD, however, should not be diminished, as they are the first step in inhibiting the perpetuation of the social DD that has resulted from a history of structural inequalities. Given the increasing support worldwide for the view that internet access is a civil or human right and the legal assertions by Finland, France, Spain, and other countries that require internet service for all residents, it is not unusual that universal access is widely accepted by government as an indicator by which to measure the digital divide (BBC, 2010; London Times, 2009; Morris, 2009). However, while Barcelona and New York certainly focus primarily on the access DD, they have also funded initiatives that seek to translate access into use. What is more, they aim to increase human capital to make the “information have-nots” producers, not just consumers, of technology. These cities demonstrate that facilitating capital accumulation and combating the digital divide are not mutually exclusive, and that a more comprehensive understanding of the digital divide that approximates Harper’s social DD is critical to their identification as smart cities.

Barcelona has had particular success with the Cibernarium, the city-sponsored organization that offers training in ICT skills. The Cibernarium has currently expanded to 11 satellite centers in libraries across the city to provide internet access and educational programming to greater numbers of residents, particularly in far reaching areas (Adjuntament de Barcelona, 2012). Contrary to the activity of most government programs, the Cibernarium actually increased their levels of service during the economic crisis. In 2010, 70,996 residents participated in their programs, up from 53,510 in pre-recession 2007 (Adjuntament de Barcelona, 2011; Adjuntament de Barcelona, 2008). Most impressive, however, is the breakdown of program participants. In 2010, the single program with the greatest number of participants was Inicíate, which, with 40 percent of the total, aims to “break the boundaries” for basic learners by
teaching fundamental computer and Internet skills (J. Roca, personal communication, June 20, 2012; Adjuntament de Barcelona, 2011).

Moreover, 53 percent of Cibernarium participants were unemployed and 63 percent were over the age of 40, demonstrating that digital literacy is seen as an indispensable skill in the current job market and crucial for even society’s adult population (Adjuntament de Barcelona, 2011). These two demographics are crucial to reducing the digital divide since they are typically at risk of falling behind in digital literacy for reasons of cost, age, and custom. Women made up 52 percent of participants, indicating no gender gap in the expectation of which sex should be acquiring information technology skills (Adjuntament de Barcelona, 2011). Finally, 19 percent of participants were foreigners, with a full 15 percent from outside of the European Union (Adjuntament de Barcelona, 2011). While it is not possible to determine where specifically these foreigners are from, it is conceivable that many are immigrants to Europe seeking better employment opportunities.

The success that Cibernarium has had in its service delivery to diverse residents, however remarkable, was not built-in to the organization’s programs. To make universal digital literacy a policy-backed reality instead of a fortunate outcome, the City Council created the Plan for Digital Literacy and Skills 2010-2015. Over the course of the plan’s five year life, the City will offer free courses on computer and internet use for 31,200 people annually (Europa Press, 2010). The plan will also expand the reach of digital literacy resources so that no resident will live further than one mile away from a library’s computer center (Europa Press, 2010). The combination of these efforts will ensure that access to information technology—the first in many steps to closing the digital divide—will be complemented by the knowledge of skills that may lead to adoption. These forward-thinking attempts to combat the digital divide show Barcelona’s
emphasis on human capital and recognition of the social and economic value of sustaining an educated workforce.

Likewise, New York City has made significant strides towards expanding ICT use. The NYCEDC and DOITT have partnered with the City to lead five main initiatives to expose and address gaps in broadband availability (The City of New York, 2012b). The first, ConnectNYC, is a competition among businesses to apply for free build-out of fiber connectivity and targets industrial business zones across the five boroughs. The second is WiredNYC, a building certification program that evaluates broadband infrastructure in buildings, and the third, NYC Broadband Connect Map, is a crowdsourced, dynamic website that businesses can use to learn about connectivity availability in a specific building or neighborhood. Fourth, called Broadband Express, is an initiative to simplify operational issues and regulatory hurdles for Internet Service Providers to expedite broadband build-out. Finally, Citizen Connect is a competition to develop mobile applications that will help residents access workforce development opportunities, job listings, and worker support programs such as childcare, healthcare, and transportation. This last initiative is meant to provide access to job-related resources for low income residents who, given the widespread use of smartphones, may have mobile internet access but no home broadband connection.

With the exception of Citizen Connect—which operates on the questionable assumption that a mobile phone app would be a particularly useful tool in the job search—these initiatives are clearly directed at businesses and blatant in their encouragement of commercial activity. However, they have the overall effect of geographically spreading broadband connectivity and specifically targeting users that are at a disadvantage as information technology continues to proliferate. New York City, regardless of its motivations, is making a substantial financial
commitment to close the gap between access and adoption, and ConnectNYC may even boost the city’s 97 percent access rate even higher by building out fiber connectivity to industrial zones that have been historically underserved by resident-focused services.

The City has also been able to contest the inequities in cable and internet service provision based on neighborhood location. As indicated previously, formerly industrial and manufacturing districts lag behind residential and commercial areas; private cable and telephone companies, who also act as broadband providers, neglect neighborhoods deemed unprofitable because of low residential densities despite the fact that many of these neighborhoods are in transition and also have a high commercial need for broadband service. In response to this problem, in 2008 the City negotiated a contract with Verizon which requires the company to offer cable service to every residence in New York City and expand access by installing a new fiber system in every street by 2014 (The City of New York, 2008). The agreement will create a competitive cable and internet market in a city where “the overwhelming majority of…residents have just one cable television provider available to them” (The City of New York, 2008). The market priorities that dominate New York City’s decision-making are well-known, yet this agreement reinforces that social engagement and spatial equity are also main priorities. As in Barcelona, while the primary target of the contract is the access DD, the City’s proactive stance in removing barriers to participation in the information economy is indicative of its commitment to eliminate the structural and institutional inequalities that led certain neighborhoods to be underserved in the first place.

**For Whom is the Smart City Planned?**

Like all aspects of the smart city’s orchestration, the municipal response to the digital divide can be interpreted in multiple ways. One of the reasons for this is that while the key
components of the smart city are easily identified—the “what” (increased ICT use), “when” (from the 2000s onwards), “where” (cities), “why” (social, economic, and environmental benefits)—the “who” is ambiguous. Competing interests abound in the smart city discourse, ranging from corporations and SMEs to city governments, universities, residents and tourists. Having a common, inclusive language that appeals to these diverse groups in the smart city development process is crucial: “when there’s no connection between that wonderful real-time visualization of data and outcome….that’s when people start thinking that what you’re doing is interesting and nice to see, but ‘we don’t need you because we have real problems we need to solve’” (M. Madriz, personal communication, December 12, 2011). There is an unambiguous lack of cohesion between IBM and Cisco’s smart city visualizations and the social goals they espouse, yet these inconsistencies are present in local government smart city initiatives as well. As a result, investing in a mobile phone application to reduce unemployment among the poor or even expanding digital service in libraries to encourage regular use of the internet may appear to be exercises in futility.

The smart city’s economic priorities, not surprisingly, are the logical connections that reconcile these incongruities. Beneath the veneer of social equity, these initiatives targeting the digital divide are justified by their potential to drive economic growth. This is not to say that the social equity benefits described previously are negated, but that the dominant interests advocating for digital divide policies may not be primarily targeting the digitally underserved. New York City’s digital divide programs, for instance, appear to have been marketed to the private sector under a context of economic growth, not egalitarian ideals. Bill Ruden, Chairman of the Association for a Better New York applauded the City’s efforts to increase broadband connectivity, explaining that “the new WiredNYC program will enhance and market New York’s
tech accessibility, creating jobs, spurring capital investment, and making our city even more competitive in the global marketplace” (as cited in The City of New York, 2012b). Ruden’s notion of competitiveness does not refer to the viability of bridging the digital divide, but explicitly to boosting the city’s tech industry. This perspective falls in line with how Jean-Marie Bemtgen, Project Officer of the European Commission Directorate-General for Energy, identifies the United States: “The U.S. is business-driven, so solutions are seen as things that make money” (personal communication, March 26, 2012).

Business interests are not inherently incompatible with those of underserved citizens, and can, in fact, be managed simultaneously; in fact, many see Keynesian economics in this light. However, the danger of supporting business goals while sustaining that they will also increase the welfare of citizens arises when the means to accomplish economic objectives conflicts with the means to achieve social benefits. The smart city’s economic aims require reliance almost exclusively on the market, while bridging the digital divide requires government intervention. New York City’s five broadband initiatives highlight that the City does not intend to regulate municipal broadband—indeed, their victory with the Verizon contract was opening the broadband market to generate private sector competition. Instead, they depend on market forces through competitions that identify problems, but cannot solve them. Furthermore, initiatives like the NYC Broadband Connect Map could even serve to worsen the problem by concentrating businesses in areas that are already well-connected.

These underlying issues with the response to the digital divide, particularly in New York City, stem at least somewhat from the regulatory frameworks that operate above the level of municipal policy. In the European Union, broadband is regulated, whereas in the United States, it is not. Crawford asserts that the deregulation of the high-speed internet market in the U.S. has
resulted in “neither a functioning competitive market for high-speed wired Internet access nor
government oversight” (2011). On the other hand, governments that regulate the broadband
market have higher rates of adoption at lower costs (Crawford, 2011). For example, in 2001, the
City of Amsterdam decided to intervene by rolling out a fiber optic network when a report
concluded that the market on its own would likely not develop the infrastructure for every home
and business within the following 15 years (Lemstra, 2011). The ability of New York City to
intercede the information technology market as European cities have done is severely
circumscribed by national policy that favors privatization and free markets. While the strong
economic motivations behind digital divide policies seem like an affront to the social goals they
claim to support, some responsibility must be attributed to systemic factors imposed from higher
levels of government.

**The Need for New Metrics for the Digital Divide**

The competing interpretations of policies targeting the digital divide make an evaluation
of how the smart city advances the social goal of digital inclusion challenging. Local government
initiatives to widen broadband penetration can be perceived as valuable and fair-handed at the
same time as they are criticized for emphasizing the wrong problem or exacerbating stereotypes.
Furthermore, the metrics used to quantify social progress in the smart city are arguably the same
as those used to measure ICT performance (E. Steinmueller, personal communication, June 29,
2012). Steinmueller explained that this technocratic method of understanding social welfare
measures tends to use three main indicators. First, there is the relationship between adoption and
productivity, in which the increase in productivity should justify the cost of adoption. The second
metric often measured is the rate of take-up, which assesses the speed at which innovation is
diffused into society. Third, he noted the digital divide, defined by inclusion or exclusion from the technology in question.

Steinmueller was opposed to each of these metrics, in each case citing definitional or operational challenges that limit their usefulness as meaningful measures. In the case of the first, productivity is usually defined incorrectly and in a way that inevitably favors ICT; conventionally, to produce more is better, which ICT inherently does by the creation of big data. In addition, he raised, “what is the contribution of an SMS, and how is that measured?” In refuting the second measure, he noted that the size of investment in ICT doesn’t mean that it is effectively used. More importantly, the consequences of take-up may not be beneficial to society as a whole—Walmart and Amazon use efficient retailing technologies, but their model perhaps is not ideal for a balanced society and economy. Finally, Steinmueller saw the digital divide as “a distant third because exclusion is temporary,” echoing the philosophy of local governments that the rate of cost reduction makes technology accessible over time. To illustrate, in Amsterdam, the only Consumer Price Index group that has decreased by more than 1 percent since 2006 is that of communications (Municipality of Amsterdam, 2012).

Similarly, the targets of roadmaps and models are also difficult to rely on in measuring the success of technology. When discussing the viability of the European Commission’s Energy Roadmap 2050, which relies increasingly on ICT, Bemtgen remarked, “of course the Energy Roadmap is not feasible; it is a model. Garbage in, garbage out. It knows where we want to be and where we are, and draws a straight line between. The reality is that it has been a bumpy road for energy use for 25 years and nothing expected actually happened” (personal communication, March 28, 2012). As functional as targets and indicators are for gauging trends and measuring improvements in isolated efforts, they may be too narrow to be useful in the evaluation of
interrelated social and economic issues. If the comparatively methodological fields of climate science and energy management are not suited to achieving the percentages called for in roadmaps, the ambiguous concept of social welfare can hardly be expected to conform. Even if the smart city achieves universal access to computers and the internet—and thus reaches high levels of productivity at low costs, a 100 percent rate of take-up, and the elimination of the access digital divide—the problem of inequitable *use* of these technologies will remain.

These various challenges confirm that conventional techniques for measuring ICT’s contributions to society are not well-matched to the task of determining something as complex as the benefits of the smart city. New ways of operationalizing the achievements of ICT policy and infrastructure must redefine social welfare outside of income and growth lest the economic motivations for building the smart city be the only means to validate progress.

**RELATIONSHIP BETWEEN CAPITAL AND LABOR**

The transition to the smart city has magnified the importance of the high-skilled sector. This, in turn, has accelerated the labor market’s divergence from the traditional relationship between capital and labor—a phenomenon that can be traced to the shift to globalized markets. The increasingly mobile labor force and specialized nature of the work demanded by high-tech industries are not easily regulated by collective agreements. As a result, white-collar ICT workers interact with capital in a much different—and comparatively profitable—way than the blue-collar workforce that supports smart city operations. Together, the concentration of knowledge-intensive industries in spatial clusters and the increasing flexibilization of labor have led to the accumulation of power on the side of the capital. Not surprisingly, the effect is compounded by the general decline of the influence of organized labor. The internal
contradictions of globalization are heightened in the smart city, spurring inequality and increasing the polarization of the two workforces.

Global Context of Hypermobile Capital

The current wave of globalization was facilitated in the 1980s by the diffusion of low-cost communication. It is characterized by the liberalization of trade and the government’s commitment to the attraction of foreign capital. These policy objectives have led to what has been called hypermobile capital, or the unimpeded flow of assets worldwide through the process of capital accumulation. The OECD has distinguished the current trend of globalization through the following trends: “increasing international trade, deepening economic integration, especially in emerging economies, and greater geographic fragmentation of production processes and more complex global value chains” (2011).

The unprecedented mobility of capital has been followed by the increasing mobility of the educated workforce, especially those related to the ICT industry. Based on 2009 data, 21 percent of Spanish and 19 percent of Dutch doctorate holders had lived or stayed abroad in the previous ten years (OECD, 2011). Studies also show that highly educated migrants “are more highly influenced by the ‘pull’ of economic conditions in host countries,” whereas less educated workers are more highly influenced by “push” factors from their home countries (Globerman and Shapiro, 2006). This suggests that the highly educated workforce has degree of choice in their mobility that is not present in the migration patterns of the less educated. To be sure, the propensity to move to countries with more favorable economic environments is precisely the trend the smart city’s business strategy relies upon.

A more evident result of the mobile labor force is reflected in the increase in contingent workers, or personnel who provide services to a company without being on their payroll, like
contractors, consultants, and freelancers (Deloitte, 2011). In the United States, the Department of Labor studied this trend as early as 1994, stating that “contingent arrangements allow some firms to maximize workforce flexibility in the face of seasonal and cyclical forces and the demands of modern methods such as just-in-time production” while also helping some workers who “must balance the demands of family and work.” Estimates predict that the rate of growth of this temporary workforce will be three to four times that of traditional workforces, eventually reaching 25 percent of the global workforce (Erickson, 2012). Furthermore, the contingent workforce is expected to rise steeply from less than one million workers in 1999, worth $17 billion, to 6 million workers worth $164 billion by 2018 (Emergent, 2012). While this topic will be discussed more comprehensively further in the chapter, it is important to note that the increasing importance of temporary workers represents a supply-side push towards workforce mobility, as the stability of traditional full-time employment is diminishing.

Such flexible and profitable labor agreements depend not only on sophisticated human resource management systems on the part of the company, but the infrastructure to support temporary workers on the part of the city. Even if most workers primarily confine their movement to a single city or region, this mobile labor force explains the rise of flexible workspaces like Amsterdam’s Smart Work Centers. Accordingly, as Peter Kapteijn described, his Smart Work Centers target the independent freelancer and professional that relies on short term availability, service-based pricing, and advanced ICT capabilities like Cisco’s TelePresence to maintain relationships with supervisors or clients (personal communication, March 22, 2012).

At the same time, strategic organizations have emerged to facilitate the transition of foreign companies to the international hubs of business that the smart cities strive to be. Barcelona Business Landing helps international firms, particularly ICT companies, penetrate the
Spanish market and move into the 22@ district (Barcelona Business Landing, 2010). Likewise, Amsterdam inbusiness is the metropolitan area’s official foreign investment agency and is responsible for attracting businesses and helping them take advantage of the city’s tax system, “bred for progress and expansion” (Amsterdam inbusiness, 2011). While these two organizations deal fundamentally with the global mobility of capital, they also indirectly generate the mobility of labor through the physical transfer of company operations abroad. Amsterdam’s Expatcenter, on the other hand, works at the level of the employee—specifically high-skilled migrants. Expatcenter is a regional service that aims “to cut the red tape for internationals and assist in the process of settling in,” and is used by over 800 foreign companies (Amsterdam inbusiness, 2011).

Hypermobile capital, as demonstrated by the success of these organizations, has ironically reinforced the continued relevance of location. A large proportion of leading ICT and life sciences firms—those that represent knowledge-intensive industries—have established themselves “in a limited number of regions…[that] appear to provide particularly conducive environments for business innovation” (OECD, 2011). The regional concentration of patent applications filed under the Patent Co-operation Treaty (PCT) in ICT, biotechnology, and nanotechnology illustrate this point. From 2006-2008, New York received 8,562 tech patents, making it the fourth most productive hotspot in the nation after California, Texas, and Massachusetts (OECD, 2011)\(^4\). Together, these four regions received over half of the United States’ tech patents. The West Netherlands, which includes Amsterdam, received 3,051 tech patents, which represents 17.2 percent of the Netherlands’ total and 44.7 percent of the country’s biotech and nanotech total (OECD, 2011). The South Netherlands region also represents a cluster

\(^4\) For the sake of comparison, California received 33,955 tech patents. Texas and Massachusetts were comparable to New York (OECD, 2011).
of innovation with 75.9 percent of the Netherlands’ total tech patents attributed to its 6,189 patents (OECD, 2011).

Policy makers in other regions have sought to replicate the business environments that these high-performing regions offer by adopting the policies that typify the smart city and knowledge economy. While an increasing number of developed countries have focused on specialized programs to encourage the in-migration of highly-educated workers [HEWs], it may well be that “‘conventional’ public policies focused on promoting long-run real economic growth are more powerful factors encouraging the in-migration of HEWs” (Globerman and Shapiro, 2006). In this regard, policies stimulating deeper trade and investment integration are at the root of the concentration of high-tech patents, the clustering of knowledge-based firms, and increasing rates of FDI (Globerman and Shapiro, 2006). Seen in this light, Smart Work Centers and programs like Amsterdam inbusiness are mere distractions, and have little, if any, responsibility for the global movement of capital to these particular cities. These amenities follow the development of a foreign workforce, but overarching economic strategies are the primary force of attraction.

Economists have noted the expansion of the “blue banana,” a banana-shaped metropolitan axis running from London to Milan that has been Europe’s hotbed of growth and innovation (Hospers, 2003). What has been called the “sunbelt,” or the arch-shaped axis along the Mediterranean from Milan to Valencia, has emerged as another strong region of growth because of its concentration of high-tech and service activities, a qualified workforce, and high quality of life (Hospers, 2003). Barcelona and Amsterdam each fall within one of these geographies and demonstrate the importance of place in attracting a highly-skilled workforce to spur innovation and profit in the context of globally mobile capital.
The Polarization of the ICT Workforce

The increase in technological capacity that accompanies a smart city project requires two distinct labor forces: high-skilled workers to operate the technology, and service-workers to maintain it. Unionization of the latter group is prevalent in the United States, and even more so in Europe. As sophisticated ICT capabilities are integrated into cities, unions representing blue collar workers in the telecommunications construction and service industries have absorbed the associated workers, such as field technicians and call center workers.

Like traditional labor unions, those representing ICT service workers are involved in resolving labor disputes and protecting worker rights in the face of the declining authority of manual workers. In the United States, where unions have historically been weak among white collar workers but remain significant for the blue-collar workforce, Verizon responded to union demands as recently as September 2012. In this instance, Verizon came to an agreement with its main unions, the Communications Workers of America and the International Brotherhood of Electric Workers, that focused on preserving worker benefits, namely pension plans and existing health care coverage (Greenhouse, 2012). One of the principal challenges in the increasingly bifurcated labor market created by ICT and other high-skilled industries is preserving the employee benefits that Verizon chief executive Lowell C. McAdam claims “are not in line with the economic realities of business today” (as cited in Greenhouse, 2012). As such, traditional unions are often forced to acquiesce to the fundamental shifts in the systems of production that have followed the globalized economy.

In Barcelona, for example, local and regional trade unions participated in the Agreement for Quality Employment in Barcelona 2008-2011. This agreement brought together the City Council, the Comissions Obreres (trade union) of Barcelona, the UGT de Catalunya (trade union of Catalonia), the Department for the Promotion of Work, PIMEC (the organization for
promoting SMEs), and the Government of Catalonia to develop a series of objectives to realign
Barcelona’s labor market with the needs of the knowledge economy (Adjuntament de Barcelona,
2008b). The City’s goals of promoting Barcelona as an entrepreneurship capital and attracting
creative and skilled workers will be furthered by the orientation, training, and professional
insertion of workers previously employed in “sectors in difficulties, such as construction,” as
well as vulnerable populations, such as immigrants, the disabled, and the unemployed over 45
years of age (Adjuntament de Barcelona, 2008b). The agreement demonstrates the extent to
which labor goals have had to shift in the smart city economy, where “quality employment” is
unequivocally related to technology and innovation. As traditional labor unions absorb the
shocks of these market changes, they are obligated to adapt to the needs of capital.

The other labor force boosted by the ICT sector, high-skilled workers, has no history of
unionization in the United States. Instead, these workers rely on labor market arbitrage to
determine salaries and benefits—a process that reduces the benefits to the individual (Lee and
Rodriguez-Pose, 2012). In Europe, however, labor market regulation and a tradition of
unionization may allow employee groups of innovative industries to “essentially act as cartels,
restricting entry to others” (Lee and Rodriguez-Pose, 2012). The Netherlands’ largest union, the
Dutch Labor Federation (FNV), shows that among its members, who represent a cross-section of
the workforce, the service sector is growing while the blue-collar manufacturing sector is
decaying (Wolendorp, 2005). While unionization is particularly low in the ICT sector, in 2001,
23 percent of the Dutch ICT workforce was covered by collective agreements despite the fact
only 11 percent belonged to a union (Van Hoek, n.d.).

Union representation of ICT workers has been notable when jobs are at risk; trade unions
forced negotiations in a 2001 disagreement with KPN, the Dutch telecommunications company
that is one of the principal sponsors of Amsterdam Smart City. The dispute arose when KPN announced plans to make 4,800 employees redundant, representing approximately ten percent of the company’s total workforce (European Foundation for the Improvement of Living and Working Conditions, 2002). After negotiations, KPN agreed to reduce the number of compulsory redundancies to 2,800 in exchange for lower pay over a two-year period (European Foundation for the Improvement of Living and Working Conditions, 2002). Whether this represents what Van Hoek refers to as a “revival of sector negotiations,” however, has yet to be determined.

In the discussion of structural matters of the economy—issues deeper than their members’ employment—labor unions representing the ICT sector have not played a significant role. Unlike Barcelona’s traditional unions, who participated in the development of a new employment strategy to fit the needs of the smart city, unions of the high-skilled sector have been absent from the dialogue on the knowledge-based economy. Similarly, in Amsterdam’s discussion on human capital, “a notable lacuna in the bodies for regional dialogue is the representation from labor unions” (SEO Economisch Onderzoek, 2009). This suggests that ICT workers may have other vehicles for participation unassociated with unions.

A Korean study of the effect of ICT use in business on worker participation confirms the rise of employee participation outside of the traditional sphere of labor-capital relations in which the two are increasingly enmeshed (Hwang, Hur and Choi, 2004). While the data does not come from one of my case studies, and is not at the city-level, its use is appropriate because of Korea’s high rates of ICT investment and consumption; in fact, its share of ICT consumption in GDP is the highest among OECD nations (Hwang et al., 2004). The study found a strong negative relationship between union density and both ICT investment and ICT diffusion, which upholds the trends observed in New York City, Amsterdam, and Barcelona (Hwang et al., 2004).
However, a worker’s participation in business as defined by three categories—information sharing, consultations, and decision-making—increased significantly with ICT investment. More specifically, firms in the ICT sector reported higher levels of worker participation than non-ICT sector businesses (Hwang, et al., 2004).

Speed of introduction is also highly significant; the faster that ICT is introduced by a business, the higher the participation of the worker (Hwang et al., 2004). Hwang et. al conclude that these trends affirm the common knowledge that integrating ICT has the effect of lowering time and cost barriers to information generation, storage, and distribution (2004). Consequently, while ICT workers show a tendency not to unionize, their participation directly in the business sector has increased significantly as a result of the ease of communication. It appears that the increase in high-skilled worker participation compensates for their relative lack of representation at the union level. This has united communication between labor and companies to a degree uncommon before the diffusion of ICT.

**Privatization of ICT Labor Relations**

The use of ICT in business operations has facilitated the flexibilization of labor, allowing companies to determine the optimum number of employees to maximize profit and reduce inefficiencies in operations. The previously cited study of ICT in Korea revealed a highly negative relationship between ICT investment and the stability and security of work, as measured by the significant increase in temporary workers (Hwang et al., 2004). Significantly, however, the relationship of ICT investment to the general unemployment rate and the youth unemployment rate is also highly negative (Hwang et al., 2004). ICT diffusion displays the same directionality of relationships, though the unemployment rates drop to moderately negative, indicating that ICT is good for employment (Hwang et al., 2004). The female-to-male wage ratio
is also highly positively related to both ICT investment and diffusion (Hwang et al., 2004). These findings suggest that although ICT investment and diffusion have a negative impact on job stability, they tend to generate increased opportunities for work. The increase in temporary or contingent work may reduce barriers to entry in the workforce, and it is not surprising that unemployment is reduced given the association of ICT and economic growth.

However, this nontraditional workforce is difficult to manage through unionization due to the lack of standardization in worker contracts. Employment has taken on a strictly individualistic meaning, and thus “employees have a great interest in gaining human capital, not so much to assist in their firms’ success than to enhance their own labor market opportunities” (Stone, 2005). The rise of the “boundaryless career,” compelled by flexibilization, prioritizes skillsets that can be transferred from job to job over the seniority-based assignments sought by unions (Stone, 2005). This reveals that labor unions have proven inefficacious in realizing the needs of the new contingent or mobile worker, and their standardized contracts are precisely what ICT is able to replace. Collective agreements, as a result, are made up of minimum standards and an “à la carte” system...in which the individual employer is offered a choice between sets of (secondary) labour conditions” (Van Hoek, n.d.). Van Hoek argues that these changes have “reprivatized” labor relations, generally at the expense of the interests of workers.

These flexible agreements are not only endorsed by business but also by governments seeking the type of employment growth noted in Hwang et al.’s 2004 study. The European Union has encouraged the notion of “flexicurity” through the Luxembourg (1997), Lisbon (2000), and Stockholm (2001) Strategies in order to stimulate job creation. The two mechanisms in operation are the removal of guarantees in working conditions to allow flexible labor markets and the simultaneous protection of workers in job transition through robust Social Security
systems (Colàs Neila, 2011). It should be noted that the strong social net that characterizes European labor relations has, on the other hand, diminished in the United States. A concern raised in the U.S. Department of Labor’s 2004 Commission on the Future of Worker-Management Relations is that the contingent worker will be put in a vulnerable position due to the elimination of the employer’s obligation to make contributions to Social Security, unemployment insurance, workers’ compensation, and health insurance.

In both situations—with and without the social net—flexibilization consolidates the transition to a labor relations system that reinforces “the companies’ position of power, since not only they benefit with the flexibility tools allowed by the legislation, but also the absence of training workers obligations in order to guarantee their employability” (Colàs Neila, 2011). In brief, flexibilization prioritizes the ability of workers to easily obtain a job, but does not advocate for worker welfare or benefits. Unless labor becomes as mobile or flexible as capital, the worker is at a disadvantage as a result of the increasing ability of firms to respond to market conditions while organized labor is progressively marginalized. Computerized production methods and global capital mean that “where migration costs do not fall sufficiently to completely eliminate unemployment, that is, in cases where both migration and unemployment are observed,” the burden is shifted to workers, who are not able to set the terms of their labor (Schöb and Wildasin, 2003). The privatization of the duties conventionally taken on by labor unions in this case does not refer to the shifting of responsibility from the public to the private sector, but instead the transfer of responsibility to the individual—privatization in its most fundamental sense. Excluding minimum labor standards, employee welfare has become the concern of the worker, as collective bargaining no longer fits the model of the innovation economy.
The Contradictions of the Globalized Smart City

The smart city exhibits the internal contradictions that characterize globalization more generally, which highly prioritizes capital, yet is dependent on human-led innovation. At an abstract level, Jessop identifies the fundamental incongruity in seeing the economy “as a de-territorialized, socially disembedded space of flows and as a territorially rooted, socially embedded system of…resources, competencies, and activities” (2001). More and more, with the distinction between global and non-global regions, globalized capitalism has had to reconcile its conceptual foundation in the knowledge-economy—specifically defined by local systems of innovation, structural competitiveness, learning regions, and social capital—and its necessary physical “rootedness.” This discourse could easily be applied to the smart city, which similarly demonstrates the tensions between the importance of intangible high-skilled production and the physical agglomeration of businesses.

In fact, the smart city shares many of globalization’s most distinctive features: (1) the modification of institutional frameworks for international trade and foreign investment; (2) the planning and subsidization of spatial fixes that support the activities of financial, industrial, and commercial capital within and across borders; (3) the deregulation of current state functions by transferring them to public-private partnerships and thereby linking them to market-oriented temporalities; and (4) engagement in the struggle to define the rules for harmonizing or standardizing a wide range of technological, economic, juridico-political, socio-cultural, and environmental issues (Jessop, 2001). These characteristics can be distilled to represent the scaling back of government deployment of public services at the same time that state interference to enable free capital flows increases—indeed, the exact tendencies demonstrated by the smart city. The liberalization of trade and diffusion of low-cost communication has triggered a
paradigm shift in which both national and local governments have renounced their obligations of service delivery, singling out economic development as their primary function.

The smart city appears to be the manifestation of the Stone’s ironic claim that globalization has bred localization (2005). Again, it is worth reiterating that despite the relative ease firms now have in moving to countries with more favorable labor conditions, location is still relevant. While conventional union practices are “vulnerable to the capital flight that increased labor standards can trigger,” businesses are similarly constrained by their dependence on “agglomeration economies,” or the spatial clusters of knowledge-based firms (Stone, 2005). For instance, Amsterdam’s regional dominance of ICT is reinforced by its robust creative industry, strong presence of advertising companies, major financial and logistics sectors, and major international airport (Van Druten et al., 2002). In this sense, then, globalization paradoxically has magnified the competitive advantage of the entrepreneurial city.

Thus, it follows that the trend of massive international capital flows combined with the financial crisis have accentuated structural inequalities intrinsic to the globalized model of international trade. SMEs, which are dependent on early-stage funding through both debt and equity financing, have especially suffered as a result of the crisis, as “venture capital firms moved to later-stage investments where risks are lower” (OECD, 2011). While small ventures are increasingly funded by angel investors, this unpredictable financing mechanism rarely reaches the high investment levels of traditional venture capital. Consequently, while SMEs have found it more difficult to finance their business, established companies have received increasing amounts of venture capital funding. This emerging trend of inequality does not only apply to the business realm, however. A study by Lee and Rodriguez-Pose (2012) determined that innovation in ICT is the main driver of inequality in both Europe and the United States, suggesting that the
benefits of innovation go to “select groups of innovators” rather than to the population as a whole.

This restructuring of labor and capital, which has effectively brought the tenets of globalization to the smart city’s local government, has brought benefits to both companies and high skilled workers yet has left the traditional worker behind. The increasing polarization of tech-driven industries, and thus the smart city’s key workforce, has not resulted in institutions to protect the low-skilled sector; labor unions have been increasingly unable to meet the needs of their constituents. Traditional guarantees to the blue-collar worker, from pensions to health care, are at odds with the retreat of companies from their responsibility to labor. The privatization of these benefits has had much less of a negative effect on high-skilled workers, who, despite having had to relinquish job stability, still possess the technical expertise sought by firms—and in that, a certain amount of leverage. The personalization of contracts derived from the “à la carte” system of labor conditions has extended into workplace activity as well, increasing the opportunity for high-skilled workers to participate in business operations. Furthermore, ICT has offered more opportunities for employment, particularly for youth and women, that are specifically geared towards the highly-skilled. It appears that the smart city’s concentration of economic functions will lead to a new understanding between labor, capital, and the state’s role in regulating the relationship.

NEW CONCEPTUALIZATION OF THE TOOLS OF GOVERNANCE

The smart city has emerged in the context of the ICT-dominated age, a distinctly defined era that differentiates the smart city from previous utopian or deliberately planned city models. Le Corbusier’s modernist city, for example, unmistakably belongs to a previous technological
revolution, as revealed by its dependence on the automobile and mass production, rather than information technology. Carlota Perez’s technical revolution model is useful to identify the unique attributes that the current technological age is associated and reconcile the differing attitudes about the smart city. Figure 4 categorizes Perez’s five technological revolutions and the historical time periods they belong to. Of note is the geographic concentration of the current “age of information and telecommunications,” which is recognized in three continents. If the first Industrial Revolution was geographically confined, the current technical revolution represents the impact of globalization.

Figure 4: Carlota Perez’s technological revolutions

<table>
<thead>
<tr>
<th>Technological Revolution</th>
<th>Popular name for the period</th>
<th>Core country or countries</th>
<th>Big-bang initiating the revolution</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>The ‘Industrial Revolution’</td>
<td>Britain</td>
<td>Arkwright’s mill opens in Cromford</td>
<td>1771</td>
</tr>
<tr>
<td>Second</td>
<td>Age of Steam and Railways</td>
<td>Britain (spreading to continent and USA)</td>
<td>Test of the “Rocket” steam engine for the Liverpool-Manchester railway</td>
<td>1829</td>
</tr>
<tr>
<td>Third</td>
<td>Age of Steel, Electricity and Heavy Engineering</td>
<td>USA and Germany forging ahead and overtaking Britain</td>
<td>The Carnegie Bessemer steel plant opens up in Pittsburgh, Pennsylvania</td>
<td>1875</td>
</tr>
<tr>
<td>Fourth</td>
<td>Age of Oil, the Automobile and Mass Production</td>
<td>USA (with Germany at first vying for world leadership), later spread to Europe</td>
<td>First Model-T comes out of the plant in Detroit, Michigan</td>
<td>1908</td>
</tr>
<tr>
<td>Fifth</td>
<td>Age of Information and Telecommunications</td>
<td>USA (spreading to Europe and Asia)</td>
<td>The Intel microprocessor is announced in Santa Clara, California</td>
<td>1971</td>
</tr>
</tbody>
</table>

Source: Perez (2002)

Each technical revolution produces a new “techno-economic paradigm”, which refers to a set of “best practices” made up of organizational and technical innovations that, over time, become common sense (Perez, 2002). The age of information and telecommunications has generated an array of best practices that have come to define the current techno-economic
paradigm, including decentralized network structures, knowledge as capital, intangible value added, adaptability, segmentation of markets, globalization, clusters, instant global communications, and economies of scope and specialization combined with scale (Perez, 2002). These methods of generating economic activity correspond to the methods of driving growth in the smart city and are closely related to Jessop’s description of globalization mentioned previously. The smart city is merely the application of these best practices to the city-scale, transferring the methods of the private sector to governance.

Perez (2002) describes these phases of technological change as “surges”, instigated by the “big bang” innovations shown in the table and followed a “frenzy” phase of intense growth. This creates a bubble and inevitable market collapse, after which a period of controlled and sustained growth—“synergy”—solidifies the techno-economic paradigm as common sense. As the market saturates, the technological revolution reaches “maturity” and the next revolution begins. If applied to the current age of information and telecommunications, it may be that the financial crisis of 2007-2008 represented the point of collapse and that the global economy is just now emerging into the period of controlled growth. Consequently, the present period of transition displays both the tendencies of the period of frenzy and those of synergy.

**Technological solutionism**

The most visible indications of the frenzy phase are apparent in the high degree of faith many place in technology’s ability to address social challenges. Appropriately, Morozov (2013) calls this “technological solutionism”. There are two components to this phenomenon: cyber-utopianism, or the belief that online communication is in itself emancipatory and that the internet favors the oppressed rather than the oppressor, and internet-centrism, the belief that every important question about society can be framed in terms of the internet (Morozov, 2011). The
principles defining the smart city are heavily influenced by this perspective, and by seeking
attach sensors, screens, and Wi-Fi to all aspects of urban life, policy makers declare their
adherence to the notion that technology is intrinsically a positive, solution-bearing tool.

These new uses of technology are detailed in Gavin Newsom’s recent book *Citizenville: How to Take the Town Square Digital and Reinvent Government*, a play on the popular Facebook application FarmVille. Newsom argues that new technological capacities allow for “government data to be culled and creatively used by entrepreneurs [who] can make government more transparent, [and] lead to a more engaged citizenry” (Abcarian, 2013). This type of thinking embodies the missions of the organizations like Code America, founded by tech-savvy activists and others combatting the digital divide. The enthusiasm and anticipation for the possibilities that technology holds exemplify Perez’s (2002) frenzy phase, and show that the best practices of information and telecommunications have not yet been instilled broadly across society. The smart city transmits the tools that are common sense in the tech industry to City Hall.

The “there’s an app for that” mentality not only promotes proliferation and consumption of technology, it precludes non-technological solutions from being discussed. Where the smart city is concerned, this places the city at risk of widespread economic failure once Perez’s turning point is reached. In Amsterdam, for example, the ICT frenzy led to the creation of thousands of new jobs in the ICT sector, as between 1995 and the first half of 2001, the sector grew by 28 percent (Van Druten et al., 2002). However, the bubble burst in the second half of 2001, leading to a contraction in the ICT sector and job losses, culminating Lucent Technologies’ restructuring and elimination of 2100 jobs over the course of the year (Van Druten et al., 2002). Depending on ICT to be the primary driver of growth led to overinvestment in Amsterdam and revealed the limits of viewing technological investment as the solution to economic development.
Controlled Growth

Countering the trend towards technological solutionism is Morozov’s assertion that “the scandal is in governance, not Silicon Valley”; in other words, that civic leaders are doing society a disservice when they seek a technological fix in everything (2013). Gamification—the use of game-thinking and strategies to incentivize certain behaviors, as done, for example, with social media weight loss applications—is not appropriate to address all social challenges. Marwick questions the application of “a Silicon Valley-derived model of neoliberal, free market principles onto our social organization,” arguing that the status-seeking behavior and the resulting “competitive attention economy” is counterproductive in the realms of governance and sustainability (as cited in Hill, 2013).

Many government officials familiar with the practical operations of the city are also skeptical of technology’s ability to rectify the enduring problems facing cities. Aggarwala said that he sees no fundamental difference between the traditional city and the smart city being pitched by advocates at conferences (personal communication, November 3, 2011). Although they aren’t seen anymore, “in 1990, the bicycle messenger was an inescapable character in Manhattan…Did the city change because of the PDF?” While ICT has surely made business transactions more efficient, the integration of these advances has not profoundly altered the way the city is run, nor have they resolved the basic problems facing local governments for centuries. These are adaptations that have been gradually occurring since the 1970s, and their application to city planning is simply another realm in which digital telecommunications technology has been pragmatic. This point of view stresses incremental growth, where beneficial, and the trend of continuous change that emerges through the wide lens of urban history.

By the same token, the technological solution can only address a challenge if implemented and adopted correctly. Though a leading figure in the energy plan for the entire
European Community, Bemtgen expressed extreme resistance to the idea of connecting his own home to a smart grid and regulating his energy use through a smart meter because of the inconvenience that it would cause. ICT should be a means to an ends, he argued, only where it is most applicable; the mere existence of a technology does not mean that it can practically be implemented (personal communication, March 26, 2012). Likewise, urbanist Dan Hill (2013) describes a “lack of understanding of, or allowance for, the different layers of change regarding domestic technology in domestic spaces”; as city fabric changes slowly, while technology is constantly improved, installing hard infrastructure like smart meters in every house may have the effect of countering future innovation. In describing theoretically positive, yet superfluous uses of technology, Hill comically writes, “Smart buildings have systems that automatically turn off lights in meeting rooms, leading to the absurd sights of people leaping to their feet and waving their arms in the air to trigger a light sensor. Look at what such systems do to us!” (2013).

Together, Bemtgen and Hill’s perspectives emphasize the piecemeal incorporation of the current techno-economic paradigm into the city’s common sense. These tools—knowledge as capital, adaptability, instant global communications—should be used when proven to be beneficial and effective, rather than for the purpose of linking every aspect of the city to the network.

Hill’s 2013 essay *On the smart city; A call for smart citizens instead* is an excellent example of contemporary writing on the intersection of technology and governance, demanding active participation of both governments and citizens to transform the smart city from an exercise in resource optimization into an adaptive, holistic, and productive effort. Compared to professionally-produced online experiences like Facebook, Amazon, and Twitter, both citizens and politicians can see how “embarrassingly bad” municipal efforts are in comparison (Hill, 2013). However, Hill argues that “the issue is with people and culture, not the role of
government itself. It’s not that they can’t do it; it’s that they can’t do it. They literally do not know how to. They are currently not equipped to work in this way, with these tools, skillsets, and attitudes.” Despite the availability of new tools and technologies for governance, municipalities are held captive by legacy information systems and departments that severely limit their ability to compete with technology giants offering software packages.

This skepticism from those that most closely understand local government functions is related to technology’s inability, so far, to address larger issues like the social digital divide or labor relations, which have long been contentious. The smart economy, smart people, and human capital of the smart city have yet to manifest themselves in a way that achieves social goals in an equitable way. That the adoption of ICT has reinforced many traditional areas of inequality is troubling for leaders who are accountable to the public. These new technological tools have led to a reconceptualization of what governance means, how it functions, and how social and economic benefits are prioritized. It appears that residual best practices from the fourth technological revolution—the age of oil, the automobile and mass production—are incompatible with those of the current techno-economic paradigm, leaving groups like blue-collar workers behind. Those that do not have these best practices at their disposal, like the “information-have-nots” are at a disadvantage in the age of information and telecommunications, and the further the city comes to depend on ICT, the more marginalized they become.
DISCUSSION OF CASE STUDIES

This thesis has explored several of the crosscutting political and economic themes that have emerged with the adoption of the smart city model. The possession of power, distribution of resources, and integration of new technological tools, however, are very specific lenses through which to view these case studies. While Amsterdam, Barcelona, and New York City have common overarching goals and technologically-based means of achieving them—generally, by using similar rhetoric revolving around sustainability, competitiveness, transparency, and efficiency—their smart city projects are defined by distinct approaches and priorities. In order to understand the cities individually and holistically, this penultimate chapter briefly ties together the most prominent political and economic characteristics I have discussed thus far to give a cohesive summary of each smart city project.

Amsterdam

A forerunner in the environmental movement and innovation economy, Amsterdam is a logical location for the development of a smart city. Significantly, its development gives a label to the city’s current means of achieving regional economic dominance, which combines innovation, business-friendly policies, and a metrics-oriented sustainability plan. The Netherlands’ small population and concentrated geography has made its adoption of ICT comparatively quick, and nowhere is this attainment more visible than in Amsterdam. The city’s demographic characteristics are marked by a highly mobile and educated population, making it an ideal starting point for a technologically-motivated development plan. The presence of a
highly digitally literate population and the City’s demonstrated commitment to the knowledge-based economy explain Amsterdam’s apparent lack of efforts to address the digital divide.

Amsterdam’s economic environment is among the most conducive to business within Europe and even the world. Offering tax policies that favor businesses and an expat-friendly culture, the Netherlands has consistently been a top destination for United States FDI and the recipient of an impressive number of tech-related patents—two indicators of its economic competitiveness. These factors demonstrate the extent of the global mobility of capital and labor in the globalized economy, seen even more pointedly in the smart city economy. The bifurcated labor market resulting from economies like Amsterdam’s, which is dominated by advanced service provision and the ICT industry, seems to be magnified by the smart city model. The sharp divide between high- and low-skilled workers has led to the diminishing importance of organized labor. While labor unions have traditionally been a strong force in Dutch politics, their influence is decreasing; high-skilled workers tend to negotiate individual contracts rather than rely on collective bargaining, and their absence within existing unions has further decreased the authority of organized labor.

The huge amounts of capital and ideas that flow through Amsterdam do not mean that its economy is dominated exclusively by multinational corporations, however. Amsterdam embodies the most bottom-up elements of the three case studies, as its smart city project is mostly driven by the third-sector. Public-private partnerships like Amsterdam Innovation Motor and the Amsterdam Smart City initiative have spurred the use of technology in hundreds of activities, ranging from public parks to energy usage and building rehabilitation. Through these PPPs, the City has established relationships with corporations like Cisco and IBM, but even more prolifically with Dutch companies, both large and small. Moreover, the economic development
portion of the smart city is seen as a separate issue from the environmental goals the City hopes to achieve by its integration of ICT.

Though the local government admittedly has limited resources for its smart city project, and thus relies heavily on AIM and ASC, it focuses greatly on the potential for citizen participation. Its open data portal and crowdsourcing initiatives are indicators of this commitment. Furthermore, the City is still actively involved in energy regulation, allowing it to be a leader in large-scale projects like fiber-optic networking. However, Amsterdam also has the least developed municipal plan in terms of ICT policy. Instead, AIM and ASC manage individual projects that identify and address specific problems facing the city. In this sense, while the least comprehensively-conceived, it is the most context-sensitive of the three cities. AIM’s leadership on the smart city project is visible especially through Ger Baron, a key figure in the direction of the city’s ICT initiatives and in understanding the changes needed to reconcile ICTs implications with the prevailing growth-oriented business model.

**Barcelona**

Barcelona seems, in a sense, the least likely of the three to become a smart city. While it is rapidly emerging as a site of international economic activity and is rising as the business capital of Southern Europe, it is only in the past two decades that it has reoriented its economy, which had previously been largely dependent on industry. This rapid growth has led to Barcelona’s key position in the “sunbelt” emerging alongside Europe’s “blue banana.” Unlike Amsterdam, Barcelona is not characteristic of its nation as a whole; the city has historically had a tense relationship with the Spanish government, and sees its project as separate from other efforts occurring in Spain. Consequently, Barcelona is significantly ahead of other Spanish autonomous communities and cities in terms of broadband penetration and ICT investment rates.
In regards to public versus private sector smart city planning, Barcelona represents a middle-ground. The City participates extensively in initiatives to spur involvement from SMEs, but also requires corporate sponsorship to raise its international status and legitimize its smart city claims. As a result, Barcelona’s smart city project is driven jointly by the municipality and the private sector, who have partnered as a way to garner international attention and further foreign investment. Barcelona is explicit in its use of the smart city as a marketing technique, and is the site of the largest international smart city conference in the world. Increasingly mentioned in lists of smart cities or profiles of innovation economies, Barcelona has solidified its claim in the smart city movement through its 22@ district. This distinctive model draws technology companies and entrepreneurs into a concentrated area and distinguishes Barcelona from other smart cities. More importantly, it has allowed the neighborhood to transform itself from an industrial center into a technology hub. While its Urban Lab component appears to unintentionally favor established and funded companies over smaller start-ups, this is the result of economic constraints rather than ideology.

Barcelona has taken the most substantial steps to restructure its government in support of smart city development. Deputy Mayor of Urban Habitat Antoni Vives functions as an ambassador for the smart city project, speaking at international conferences worldwide as well as communicating policy and planning changes to residents. The city’s labor organizations have participated in the smart city project out of the necessity to integrate themselves into the technology-driven economy, but, as in Amsterdam, seem more and more out of sync with current economic realities. Economic development is further promoted by Barcelona Activa, whose work has given rise to a large concentration of foreign firms particularly related to technology in the city’s innovation district and technology incubators.
In addition to the clear economic motivations, Barcelona has implemented a strong social education component as well. The City has established partnerships with local universities to expand its reach and encourage entrepreneurialism. Furthermore, these links to educational institutions strengthen Barcelona’s general efforts towards increasing social capital. Barcelona has implemented the strongest digital literacy program of the three case studies, reaching tens of thousands of users a year and doing the most to combat both the access and social digital divides. Seeking to increase its economic competitiveness, Barcelona acknowledges that it must build its human capital to enable bottom-up innovation.

**New York City**

New York City represents the seemingly contradictory extremes of having the most entrepreneurially-oriented policies while at the same time being almost exclusively government-driven and rejecting private sector influence on policy. At the same time, it is unique among my case studies in that it doesn’t strongly identify itself with the international group of smart cities. The City’s ICT projects are the result of Mayor Bloomberg’s aggressive pursuit of growth in the technology industry to keep New York City relevant and more importantly, dominant, in the world economy. It has made bold investments such as Cornell NYC Tech; in addition to creating tangible facilities and bringing technology students to the city, the institution is symbolic of New York City’s commitment to fostering the tech industry. Like Amsterdam, New York City emerged from the manufacturing era decades before Barcelona, and thus has long had well-established services and financial sectors. Its growth towards ICT in the current age of telecommunications and information technology, consequently, is one of its many adaptations to the realities of the current postindustrial economy.
Through key partnerships with the NYCEDC, the City has created initiatives to spur job growth in the media sector and incentivize the use of technology by small businesses. While Barcelona’s smart city project is also directed by its municipal government, New York City is unique in its primary use of public agencies to drive action. Its international renown as a city from which to gauge trends—a bellwether city, so to speak—have made the involvement of corporate actors like Cisco and IBM secondary parts of New York City’s recognition as a leader in the innovation economy. Unlike Barcelona, the city feels it has nothing to prove. Perhaps as a result, New York City appears to be straightforward in its motivations; while Barcelona may claim that it seeks to boost the tech industry to build social capital and Amsterdam may link their installation of ICT to environmental goals, New York City invests in technology primarily to boost its economic competitiveness—importantly, of its own businesses, not multinational corporations.

At the same time, the public sector’s involvement has led to a large number of public participation initiatives, especially through social media and crowdsourcing. New York City has codified its technology goals through its Roadmap for the Digital City, which identifies the key areas of technology growth and stresses the citizen-focused areas of access, open government, and engagement. In the area of open government, New York City has had especially impressive results, with huge numbers of government datasets now available to the public. To use this data constructively, it has held the most successful apps competitions of the three cities. While limited in ultimate impact, they have produced valuable tools for everyday use at no cost to the City and have established a precedent for citizen engagement. Less clear in actual impact are the City’s programs to address the digital divide, which appear to be thinly veiled initiatives to benefit
businesses rather than individuals. As a whole, it seems that the social advantages to technology diffusion are added benefits to the economic gains.

However, New York City is also the site of the most robust bottom-up smart city movement. The city seeks to replicate the entrepreneurial culture of American technology hubs like Silicon Valley through its start-up sector, which develops small scale, citizen-led solutions for the city’s most difficult challenges. This free market ideology is both its strength and its downfall; New York City offers a flexible business environment with few barriers, but local government can be seen as making deals with the private sector because it cannot openly regulate as easily as European cities. Additionally, New York City has been the key site of a reconceptualization of civil society. Organizations like the New York City Transparency Working Group engage with government to achieve socially conscious results through the diffusion of ICT. Overall, New York City shows the influence both an innovative local government and a cohort of highly-skilled contributors participating from the bottom-up.
CONCLUSION

This binds together by a vital cord all the nations of the earth. It is impossible that old prejudices and hostilities should longer exist while such an instrument has been created for an exchange of thought between all the nations of the earth. Such is the vista which this new triumph of the might of human intelligence opens to us. Everyone must feel stronger and freer at the accession of such an increase of power to the human family as has been conferred upon it by the success of the Ocean Telegraph.

(Briggs and Maverick, 1858)

Technological advances have a way of stimulating the imagination, creating idealistic scenarios about more equitable resource distribution, access to education, cultural exchange, and even, as Briggs and Maverick suggest, world peace. This quote, from a history of the telegraph, could just as easily refer to the printing press, the telephone, the television, and most obviously, the internet. Technology, especially that which facilitates the transmission of information, is imbued with the capacity to challenge societal norms almost instantaneously. It comes as no surprise, then, that the smart city is marketed as a model to transform not only urban governance, but the local economy, residents’ lifestyles, and the environmental footprint of a city. If society hasn’t made these advances independently, surely the tools of ICT represent the necessary “increase of power” by which to accomplish them. As this thesis shows, however, this reliance on a technological fix is problematic because of its tendency to favor the powerful over the powerless unless explicitly checked. In light of the rapid adoption of the smart city model by
municipalities worldwide, it is crucial to understand the consequences, intended and not, of such dependence on technology.

The tendency of smart city initiatives to reinforce the neoliberal agenda is troubling, but the rejecting the model altogether is unproductive. The very networks and devices built by technology corporations have enabled a dispersed, yet potent bottom-up movement to emerge, bringing the interests of citizens to the forefront of the smart city discussion. The new tools of government, referred to as Government 2.0, are also of benefit to society as a whole. Smart governance is embodied in efficiently delivered services, more flexible means of participation, and accessible sources of data. In implementing smart city policies, however, the most pressing challenge facing the smart city is ensuring the equitable distribution of its benefits. Undoubtedly, increasing access to technology is paramount to full participation in the modern economy, but underlying disparities in use have yet to be fully addressed. Similarly, the large scale economic changes favoring the educated, mobile, and temporary worker threaten huge sectors of the traditional workforce in a way that must be reconciled with the democratic commitment to social welfare.

There are lessons to be learned from the impressive efforts that smart cities have made to address some of the world’s greatest challenges. The empowerment and legitimation of non-traditional stakeholders like citizen activists who use data and technology to make an impact continues this governance trend at the individual and community level. On the other hand, the economic liberalization underpinning most smart city initiatives goes unnoticed in publicity campaigns launched by technology corporations and city governments implementing the model. A cursory look at smart city projects shows their most vocal proponents not to be ordinary citizens, but stakeholders that have much to gain from the transition to a technology-driven
economy. This identifies a crucial distinction between a smart city and a smart citizenry; the smart city should be designed in deference to the citizenry, not the other way around.

Both the benefits and risks of the smart city must be carefully considered in order to identify the winners and losers of ICT-based policy and decision-making. I have tried in this thesis to shed light on these issues by examining Amsterdam, Barcelona, and New York, but further studies remain to be done on other cities, both on greenfield and brownfield sites, and especially in non-Western countries. Some especially fascinating projects are taking root in Rio, Singapore, Songdo, and Cape Town. China, of course, will also be a focus of study in the coming years, as it attempts to literally build cites to accommodate the largest rural to urban migration in human history. The smart city model is seen as the ideal way to avoid the damages created by the 19th and 20th century industrial cities. When well-implemented and mindful of citizens and context, the smart city initiatives have great promise to enable positive change, but if mismanaged, the potential costs are equally worrisome.

The current hype and excitement surrounding the smart city has brought countless issues to the forefront—only a few of which I have been able to address in this thesis. For instance, smart city skeptics point to the potential vulnerabilities that come with a city dependent on advanced technologies. Critics charge that these tightly coupled technological systems will be inherently vulnerable to human error, intentional sabotage—whether by mischievous hackers or cyber terrorists) or extreme weather events. The smart city’s obsession with efficiency can unintentionally lead to the easy disruption of the technological systems built increasingly into the city’s most essential functions. Moreover, given the tightly coupled nature of many technology systems, the fall of one can lead to the collapse of an entire sector. Redundancy, it seems, is expensive and clumsy, yet safe. Similarly, I have not fully addressed the civil liberties and
privacy issues that appear to arise in the eyes of academics much more glaringly than local government leaders. The age of Big Data evokes, for many, a dystopian or Big Brother future in which a citizen’s technological devices are able to feed information on location, purchases, and web searches not only to the government, but to corporations unaccountable to the public.

The debate is not about whether we need smart cities nor whether they will come about, but the ways in which technology can actually improve the city and the urban experience. The smart city is not dependent on technology, but rather uses it as a tool to transform hopelessly anachronistic systems into functioning, inter-communicating, efficient parts of urban governance. As Richard Buckminster Fuller said, “You never change things by fighting the existing reality. To change things, you build a new model that makes the existing model obsolete.” The smart city is attempting to do this to the Fordist city, replacing limitless energy consumption with efficient resource use, a service-delivering government with a service-enhancing alternative, a manufacturing economy with an innovation economy, and a literate society with a smart and creative citizenry. The challenge, then, is to make sure that the smart city vision is not lost in the process of implementation.

An overarching theme that emerged from my research is the acknowledgement that the city is never in a state of stasis. It evolves—quickly or slowly depending on economic conditions, but developing and progressing nonetheless. As this happens, the discourse promising sustainability, equity, transparency, and an improved quality of life cannot be left behind. Skepticism of the smart city is healthy, as it demands a reevaluation of goals and the means to achieve them. As I finished my research in New York City, I was reminded by an interviewee to “be critical!”—words that have guided my exploration of the smart city’s implications. As Hill suggests, the smart city’s “value might be enabled only when subjected to
considered critique, continuous exploration, asking the right questions and engaging with the outcomes in [an] ongoing, iterative fashion” (2013). The smart city is proving to be anything but trivial; it is both a thing and an ideal, and while the technologies it incorporates will surely evolve, its foundation as the pursuit of a truly smart society must remain.
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APPENDIX A: Glossary

22@: An urban redevelopment project in Barcelona that has converted two hundred hectares of industrial land into an innovation and technology district to house knowledge-intensive activities, including an Urban Lab and future Smart City Campus

AIM: Amsterdam Innovation Motor, the public-private partnership that facilitates the relationship between the City of Amsterdam and ICT companies, and a founding partner of Amsterdam Smart City

Apps challenge: a competition, often sponsored by a local government, to produce applications typically for smartphones, tablets, or computers, that use open data to create a service for citizens

ASC: Amsterdam Smart City, the partnership of businesses, local government, research institutions, and residents to transform the Amsterdam Metropolitan Area into a smart city

Big Data: a large and complex volume of data that necessitates new tools and platforms to be managed and processed beyond traditional software and databases; it includes data collected from sensors and social media

Broadband: high-speed data transmission along multiple channels, associated with internet access and includes both cable and wireless technology

Brownfield development: a project on existing land, often associated with infill development or redevelopment, that must work within existing systems and structures; in the context of smart cities, it is also called urban retrofit and it refers less to contaminated and damaged sites than the broader concept developing within existing cities

Citizen hackers: users of open data who seek pragmatic and useful data, like transit timetables, and are driven both by a desire to do good and an interest in programming; related to “hacktivism,” which involves the nonviolent use of digital tools for social or political causes

Crowdsourcing: a problem-solving technique and emerging business model that gathers feedback, or collective intelligence, from the public

Deregulation: the reduction or elimination of government power from an industry or economic sector to allow for a competitive and efficient marketplace; a fundamental component of neoliberalism

Digital divide: the gap between people with access to digital technology and the internet and those without it, often falling along socioeconomic lines

e-Government: the use of ICT by governments, often including web portals to disseminate information or eliminate in-person transactions, with the aim of streamlining citizen services,
increasing transparency, improving interactions with businesses, and making government operations more cost-efficient

**FOIA**: Freedom of Information Act, or country-specific legislation mandating the disclosure of government data to the public

**Foreign Direct Investment**: when a company or entity in one country invests in a company or country in another country, with the investing company typically having a great deal of influence (by owning at least at least ten percent of the stock) on the investee company

**Greenfield development**: a project on undeveloped land and lacks constraints of prior structures; in the context of smart cities, it refers to cities being built from the ground-up, which typically have a great deal of private-sector influence and funding

**ICT**: information and communications technology; technology that provide access to information through telecommunication, and tends to currently refer to emphasizing real-time information transfer and technologies like cellular phones, computer and network hardware and software, and satellite systems

**Innovation economy**: an economic framework based on technology, knowledge, innovation, and entrepreneurship to raise productivity; it is associated with the New Economy

**Intelligent Operations Center**: a smart city management technology created by IBM; an executive dashboard that monitors city-wide data across agencies and departments that can be purchased by cities for a yearly subscription price

**Knowledge economy**: an economic framework in which knowledge plays an increasingly important role in the creation of wealth, where growth is based on the production and distribution of information, often associated with social capital and knowledge-intensive industries (finance, high-tech manufacturing, telecommunications, health and business services, and education)

**Neoliberalism**: an economic and political ideology that places economic control in the private sector and is based on the open markets, privatization of public enterprise, and deregulation, in order to receive maximize profits and efficiency

**New Economy**: a concept popularized in the 1990s that refers to a post-Fordist economy driven by high-growth technology industries and internet trading, facilitated by ICT networks, globalization, and deregulation

**Open Cities**: a project co-founded by the European Union that aims to drive open innovation and citizen participation within the public sector to support smart city development

**OGD**: open government data, or data collected or commissioned by government or designated bodies performing public functions that is freely available for reuse
Open data: refers to both the idea of data being available and free for anyone to use, reuse, and distribute without restrictions of patents or copyrights, as well as the movement to implement open data as a policy.

Open markets: a competitive market that allows unrestricted trade, also called free markets; a fundamental component of neoliberalism.

Privatization: the transfer of ownership of a property, business, or industry from government to private control.

PSI: public sector information, or information produced, maintained, or distributed by government or public institutions.

Sensor technology: a device that detects, measures, or responds to a real-world stimulus, such as motion or heat, and converts it to digital data.

Smart+Connected Communities: a corporate initiative of the networking company Cisco Systems to create smart, connected, and sustainable cities through the use of their network technology to deliver transportation, health, education, entertainment and security services.

Smart city: a city that, through public and private sector collaboration, has invested in ICT infrastructure and human capital to drive economic growth, facilitate the exchange of information between sectors, and produce resource-efficient operations that enable high-quality citizen services.

Smart grid: an electrical grid that uses digital technology and ICT to make the transmission and distribution of electricity more efficient, reliable, and sustainable by providing suppliers and consumers with information on energy flow.

Smart Work Center: an office center that leases work space for individuals or groups near a residential center with the aim of reducing transportation demands and congestion and providing flexibility to employees, who are able to use ICT to enhance their work experience; in 2008, a network of Smart Work Centers were launched in Amsterdam in mainly as private enterprises in partnership with Cisco’s Internet Business Solutions Group.

Smarter Planet: a corporate initiative of the telecommunications company IBM to create smarter and more efficient cities in cities through data management and instrumented industries and systems.

SME: small and medium enterprises, which are seen to be the drivers of innovation in many economic sectors.

TelePresence: a telecommunications technology produced by Cisco that integrates audio and high-definition video, and is designed to make the two ends of communication appear to be part of a single conference room; used extensively in Smart Work Centers in the Netherlands.
**Urban Lab:** a concept to use the city as a laboratory by providing a space for companies to test their pre-commercial products and services related to the urban sphere; the Urban Lab is a main component of Barcelona’s 22@ technology and innovation district
### APPENDIX B: Table of Interviewees

<table>
<thead>
<tr>
<th>Name</th>
<th>Profession</th>
<th>Location of Interview</th>
<th>Date of Interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rohit Aggarwala</td>
<td>Special Advisor to C40 Chair Mayor Bloomberg; former Director of Long-Term Planning and Sustainability for the City of New York</td>
<td>phone (New York City-based)</td>
<td>11/2/2011</td>
</tr>
<tr>
<td>Marc Musgrove</td>
<td>Global Communications Director, Cisco Systems</td>
<td>phone (San Jose, CA-based)</td>
<td>11/15/2011</td>
</tr>
<tr>
<td>Mayra Madriz</td>
<td>Sustainability consultant and urban planner, Arup</td>
<td>San Francisco</td>
<td>12/12/2011</td>
</tr>
<tr>
<td>Peter Kapteijn</td>
<td>Director and founder, Touchdown Center; founder, W-Work</td>
<td>Amsterdam</td>
<td>3/21/2012</td>
</tr>
<tr>
<td>Katalin Gallyas</td>
<td>Policy Advisor on Open Innovation, Economic Affairs Department</td>
<td>Amsterdam</td>
<td>3/23/2012</td>
</tr>
<tr>
<td>Jean Marie Bemtgen</td>
<td>Project Officer, Energy Technologies and Research Coordination, European Commission Directorate-General for Energy</td>
<td>Brussels</td>
<td>3/26/2012</td>
</tr>
<tr>
<td>Nic Villa</td>
<td>Global Director, Internet Business Solutions Group, Cisco Systems</td>
<td>Phone (Amsterdam-based)</td>
<td>4/27/2012</td>
</tr>
<tr>
<td>Joan Batlle</td>
<td>Head of International Cooperation Department, Urban Habitat Department, Barcelona City Council</td>
<td>Barcelona</td>
<td>6/15/2012</td>
</tr>
<tr>
<td>Irene Compte</td>
<td>Executive Director, Urbiotica</td>
<td>Barcelona</td>
<td>6/18/2012</td>
</tr>
<tr>
<td>Jordi Roca</td>
<td>Director, Cibernarium, Barcelona Activa</td>
<td>Barcelona</td>
<td>6/20/2012</td>
</tr>
<tr>
<td>Robert Hollands</td>
<td>Professor of Sociology, Newcastle University</td>
<td>Newcastle-Upn-Tyne, UK</td>
<td>6/27/2012</td>
</tr>
<tr>
<td>Ed Steinmueller</td>
<td>Professor of Information and Communication Technology Policy and Fellow at SPRU (Science and Technology Policy Research), University of Sussex</td>
<td>Brighton, UK</td>
<td>6/29/2012</td>
</tr>
<tr>
<td>Ivy Li</td>
<td>Digital Communications Director, NYC Digital, City of New York</td>
<td>New York City</td>
<td>7/5/2012</td>
</tr>
<tr>
<td>Luis Palacios</td>
<td>Intern, NYC Digital, City of New York (interviewed with Ivy Li)</td>
<td>New York City</td>
<td>7/5/2012</td>
</tr>
<tr>
<td>Greg Lindsay</td>
<td>Journalist, contributing writer to <em>Fast Company</em></td>
<td>New York City</td>
<td>7/11/2012</td>
</tr>
</tbody>
</table>
APPENDIX C: Locations of Interviews and Case Study Context

AMSTERDAM

PETER KAPTEIJN
Director and founder, Touchdown Center; founder, W-Work

KATALIN GALLYAS
Policy Advisor on Open Innovation, Economic Affairs Department

NIC VILLA
Global Director, Internet Business Solutions Group, Cisco Systems
IRENE COMPTE  
Executive Director, Urbiotica

JOAN BATLLE  
Head of International Cooperation Department, Urban Habitat Department, Barcelona City Council

JORDI ROCA  
Director, Cibernarium, Barcelona Activa

22@ INNOVATION DISTRICT AND TECHNOLOGY PARK 
Urbiotica test site