



## Planning Smart(er) Cities: The Promise of Civic Technology

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### ABSTRACT

Civic technology is an emerging field that typically leverages open data—and sometimes open source software—to address challenges that may be invisible to or neglected by government in a collaborative, problem-centered way. This article describes the goals and values of civic technology, identifies its raw materials and products, and outlines its most visible modalities. We use key informant interviews with stakeholders in Chicago's robust civic technology ecosystem and a brief discussion of the Array of Things (AoT) project to evaluate claims that civic technology can be an effective mechanism for democratizing the Smart City. We conclude with recommendations for urban planners interested in engaging with civic technology to enhance quality of life and further social equity.

### KEYWORDS

Civic technology; urban planning; Smart Cities; civic hacking

## Introduction

The advent of technologies such as social media apps and the Internet of Things (IoT) offers new mechanisms for collecting and sharing information (Townsend, 2013; French et al., 2017) and the use of information technology, from sensors to web-based applications for monitoring and managing urban systems, is at the heart of the current investment in Smart Cities occurring in the United States and beyond (Batty, 2013; Kitchin, 2014). Local governments, policymakers, and scholars face several challenges related to the governance of these new technologies, including how to improve public involvement and understanding of their consequences, while not deepening the digital divide (Irving et al., 1999; Mossberger et al., 2003). Smart Cities have been described as “a conceptual urban development model based on the utilization of human, collective, and technological capital for the enhancement of development and prosperity in urban agglomerations” (Angelidou, 2014: 53) and as a “sociotechnical imaginary” (Sadowski and Bendor, 2019), but definitions like these are too numerous and too broad. Critiques of the Smart City discourse have often centered on the lack of specificity surrounding the meaning of the term (Hollands, 2008), as well as concerns that it represents a return to technocratic modernist approaches to planning and development that ignore or downplay the importance of public engagement, equity, and transparency (Wiig, 2016; Mora et al., 2017). These critiques and anxieties are amplified by the fact that many of the primary advocates for implementing Smart City plans and technologies are

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large corporations that also develop and sell the very same sensors, systems, and technologies that give Smart Cities their name (Shelton et al., 2015; Sadowski and Bendor, 2019).

This study focuses on the emergence of civic technology in the United States and its potential as a framework for urban planners to better integrate emerging technologies and new data into existing practice. The central research questions addressed in this article are:

- What is civic technology?
- How can civic technology and open data be used to advance community goals and enhance wellbeing in the Smart City?

We proceed by describing the goals and values of civic technology, identifying its raw materials and products, and outlining its most visible modalities. We then offer several lessons for urban planning based on key informant interviews with stakeholders in Chicago's robust civic technology ecosystem and a brief discussion of the Array of Things (AoT) project (Catlett et al., 2017). We conclude by evaluating claims that civic technology can be an effective mechanism for democratizing the Smart City by helping to harness its data and tools to enhance quality of life and further social equity.

## What is Civic Technology?

Civic technology refers to both tools and processes that use information and communication technologies (ICTs) to support urban problem solving and improve quality of life (McCann, 2015). Its goals are varied, but often include more efficient use of existing systems and resources; more responsive governance; and more meaningful engagement with residents (Patel et al., 2013). Civic technology is an emerging field that typically leverages open data—and sometimes open source software—to address challenges that may be invisible to or neglected by government in a collaborative, problem-centered way (McNutt et al., 2016).

## Central Tenets of Civic Technology

One of the basic tenets of civic technology is “build with, not for” (McCann, 2015), which underscores an emphasis on inclusion and co-production that—ideally—centers people rather than technology *or* institutional interests. While data analysis skills and technical knowledge are foundational, these resources are only useful when they can be brought to bear on issues of importance to the community. In addition to individuals who bring technical skills like the ability to code, the civic technology framework and ethos requires input and participation from people with insight derived from lived experience as a means of establishing the legitimacy and bolstering the likely impact of the work. The integration of information and perspectives from non-technologists has a grounding effect, while transparency and inclusion are essential for meaningful participation (Arnstein, 1969; Innes and Booher, 2004). A collaborative participation model like that prescribed by the civic technology framework can potentially yield several benefits—greater understanding among stakeholders via dialogue and joint fact-finding, network building and the creation of relationships within and across sectors, as well as enhanced institutional capacity

and shared meaning (Healey, 1997; Innes and Booher, 2004). The structure and leadership of civic technology initiatives also matters, and the degree to which government or industry are perceived as leading or dominating can have an impact on who decides to participate, the specific issues and questions that are taken up, and the possibility of influencing policy or bringing about positive change. Citizen participation is central to effective and legitimate urban planning and is indispensable because “the experience of participating helps to create the kind of individuals necessary to operate a democracy” (Hopkins, 2001: 183). Urban planners are still grappling with the role that new technologies can and should play in community engagement and formal planning processes (Kitchin 2014), but it is clear that the broader framework of collaborative planning is the appropriate place to begin. Collaborative approaches to planning emphasize meaningful participation on the part of “all those in a place who share a concern and/or are affected by what happens there” (Healey, 1996: 223) through discourse that is inclusionary, respectful, and honest.

Many of the same benefits and challenges that have been documented in the participatory GIS (Elwood, 2006) and web-enabled participation (Sieber et al., 2016) literatures are relevant to a discussion of civic technology, but with equally important differences. In contrast to participatory GIS, civic technology moves beyond mapping as a primary focus and may not involve the analysis of geospatial data at all. Rather than examining strategies for augmenting voting, public hearings, and other conventional forms of citizen engagement like much of the web-enabled participation research, civic technology seeks to contribute to broader policy discussions and to identify alternative courses of action by integrating technical and non-technical expertise within an inclusive, collaborative environment. In addition to participatory GIS (Brown and Kytä, 2014) and technology-enabled collective choice research (Desouza and Bhagwatwar, 2014; Afzalan et al. 2017), the citizen science tradition (Devisch and Veestraeten, 2013) has laid a partial foundation for civic technology by engaging and empowering those with less formalized expertise. The partnership of scientists and citizens provides one model for reaching across the digital divide and demonstrates the importance of “understanding that knowledge claims can be expressed in different languages so that accredited expertise is not privileged” (Rydin, 2007: 58). More recently, Kontokosta (2016: 68, 69) argues that a shift in scale from the entire city to individual neighborhoods is also necessary in order to “increase the opportunity to connect and engage local residents in problem identification, data interpretation, and problem-solving” and that data collection in the Smart City “must be driven by community needs and participatory processes that engage residents.” This insight aligns with our argument that civic technology and open data can further government accountability and responsiveness by informing public discourse and mobilizing residents.

The free and open source software (F/OSS) movement also plays an important role in the overall civic technology ecosystem. Software can be a significant and recurring costs for both organizations and individuals, particularly as products shift from the desktop to the cloud and companies increasingly emphasize a subscription or license model with technical support and user services as the leading sources of revenue (Cusumano, 2008). Even in cases where data have been freely available in the past, specialized software and expertise have typically been required to make use of these resources. The emergence of viable alternatives to proprietary geographic information systems (GIS) software like QGIS as well as the increasing popularity of tools like R and Python. There is evidence

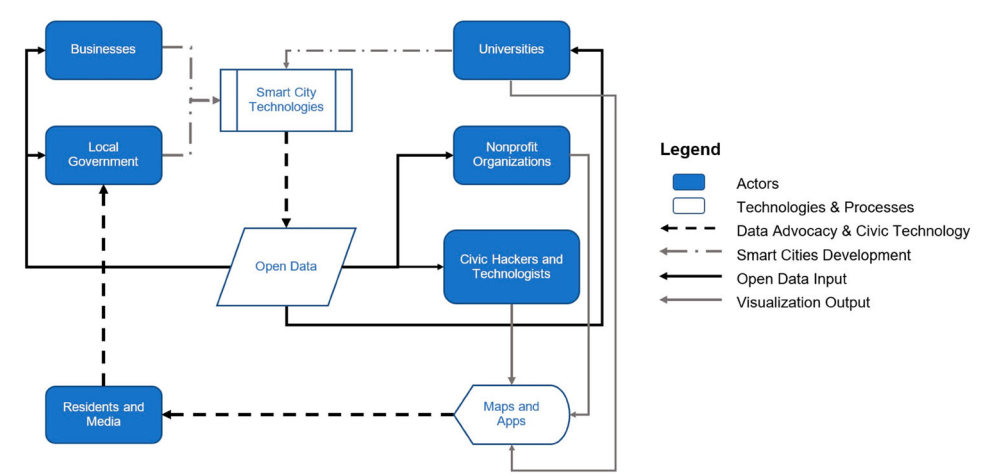
that F/OSS is being increasingly adopted by “a larger group of non-expert users and other advocacy organizations” (Sullivan, 2011: 223), underscoring the potential for civic technology to serve as a useful framework for planners to leverage new data and emerging technologies in their work.

Ultimately, what distinguishes civic technology from smart urbanism, Big Data technologies, data-driven decision-making, and other contemporary manifestations of technology in planning and governance is its emphasis on transparency, meaningful participation, and responsiveness to community needs and priorities (Goldsmith and Crawford, 2014; McNutt et al. 2016). The approach to civic technology that has emerged in Chicago and elsewhere incorporates five core principles that can serve as best practices: (1) focus on people, (2) understand and leverage existing institutions and social networks, (3) respond to the needs articulated by the community, (4) let those needs and desired outcomes drive the technical aspects of the work, and (5) demonstrate meaningful community engagement and participation (McCann, 2015). Latour’s articulation of actor-network theory (ANT) can also be used as a lens for understanding civic technology, its inputs, and its products. Both the open data that serves as the raw material for many civic technology development processes and the digital applications or data visualizations that it produces can be conceptualized as an actor by virtue of their capacity to “make a difference in the course of some other agent’s action” (Latour, 2005: 71).

**A Framework for Civic Technology**

In order to more clearly articulate how civic technology can be used to inform decision-making, enhance advocacy efforts, and democratize the deployment of Smart City technologies, we have developed a visual representation of key actors and relationships.

As shown in Figure 1, local government, technology firms, and universities are typically the key actors involved in designing and deploying Smart City technologies. However, one of the central arguments of this paper and of other researchers is that if information collected by smart transit cards, recorded by sensors, generated by residents in the form of 311 calls to the city, etc. are made available as open data, then it is possible for a range



**Figure 1.** Civic technology framework showing key actors and relationships

of actors to activate those data in the form of maps, visualizations, or apps. While businesses access and use open data resources, their focus is generally on monetizing the products that are derived from or that draw upon those resources. Civic hackers and organizations like Code for America brigades, as well as universities and non-profit organizations play a critically important role in bringing open data to a wider audience when they create digital tools that allow non-technologists to explore and critique open data, as well as the underlying processes and decisions they reflect. Well-crafted visualizations and apps contextualize data, invite questions, and create opportunities for discussion and learning (Hemmersam et al., 2015).

Residents and journalists are key in the formation and maintenance of feedback loops that bridge the supply and demand sides of the open data ecosystem. These connections—through underlying mechanisms like the ballot box, community organizing, and public opinion—can influence the governance of open data initiatives and the deployment of Smart Cities technologies through activism and advocacy. Universities and non-profit organizations build digital literacy and technical capacity among students, youth, and other members of the public, which is an important function, but which also routinely falls outside the scope of what civic hackers and organizations like Code for America brigades are suited for and are able to accomplish. Finally, foundations and other funders provide financial resources to promote innovation and transparency on the supply side, while cultivating technical capacity and advancing digital equity on the demand side of Smart City and open data initiatives. The following sections focus on critically important processes within the civic technology framework represented as dotted, black lines in Figure 1. The first of these centers on the establishment and governance of open data initiatives and the second emphasizes the potential for data visualization to inform public discourse and to influence policy via residents and local media.

***Open Data Provision and Governance.*** Data are the lifeblood of the Smart City (Kitchin, 2014; Ashton et al. 2017) and open data are the raw materials of civic technology. A concise definition of open data is “data and content [that] can be freely used, modified, and shared by anyone for any purpose” (Open Knowledge Foundation, 2017). In the same way that participation in governance creates citizens (Hopkins, 2001), the availability and use of open data are critically important to meaningful participation in urban governance today (Attard et al., 2015).

Open data is a relatively new concept that originated from the related movement for open source software (Chignard, 2013) and it has gained increasing traction in the United States over the past decade. The idea that government data are a common resource that belong to the public is not new,<sup>1</sup> but the open data movement extends this ethos to new arenas and information repositories made possible by sensors, digitized governance processes, and connected handheld devices. In the United States, the federal government under the Obama Administration took a leadership role in the promotion of the open data paradigm with a 2013 Executive Order that established data that are “machine-readable and open the new default for government information” (White House, 2014). The establishment of open data portals like data.gov (maintained by the US General Services Administration), healthdata.gov (maintained by the US Department of Health and

Human Services), and [ncei.noaa.gov](http://ncei.noaa.gov) (maintained by the US Department of Commerce) provides a central repository for users as well as metadata to support a variety of applications. More recently, the Trump Administration has retreated from the earlier commitment to open data at the federal level and has redesigned or taken down many webpages and documents, but to date has not targeted datasets for removal (Sunlight Foundation, 2019). Open data initiatives continue to thrive at the state and local levels with a growing list of cities maintaining their own open data portals including leaders like Chicago, New York, Los Angeles, Boston, and Austin. These portals are often viewed by local government officials as a more efficient way of responding to repeated Freedom of Information Act (FOIA) requests for the same data.

It should also be noted that open data are not all equal and “although data is available in a machine-readable format, such data is not really useful unless it is easily understandable” (Attard et al., 2015: 407). For example, users may or may not be automatically granted the right to modify or redistribute data, and if it is only made available in proprietary formats, the net effect is to constrain the value and impact of the data (Kitchin, 2014). The establishment of standards for storing and sharing data over the Internet has sought to address this.<sup>2</sup> The most familiar of these is the Web Map Service (WMS) which uses Hypertext Transfer Protocol (HTTP) to deliver geo-referenced map images that can be displayed as layers in a web browser or mobile application. The existence of standards also makes interoperability and combining data from a variety of sources less challenging (Kitchin, 2014).

More recently, advocates have called for linked open data which further structures the dissemination of open data on the Internet through the use of Universal Resource Identifiers (URIs) to connect substantively related data, documents, etc. from different sources (Bizer, 2009) using stable identifiers. This essentially means that existing protocols<sup>3</sup> for linking pages on the Internet are adapted to systematically organize data which would make it easier to identify and integrate new data sources and to bridge the silos that continue to characterize the data landscape. This connectivity and categorization is particularly important for the maintenance of open data portals and open data more generally because without public awareness and use of these resources, political and financial support are likely to erode.

In addition to open data, successful civic technology initiatives require a combination of technical and substantive expertise. Collaborative planning and other approaches that draw upon Habermasian notions of rational discourse and communicative action are able to accommodate technical expertise without privileging it, which is key to contextualizing and democratizing emerging technologies and new data.

The role of expertise in this context, where experts act not merely as “participants” with a point of view, is to facilitate the process of learning about and sorting through arguments and claims. It involves asking questions to the discussion members which help to open up meanings, or making links between an issue raised by one member and its potential implications for another. It may also involve offering key organizing ideas to help the discussants focus their thinking. (Healey, 1996: 227)

In urban planning, the nature of participation should rise above mere tokenism (Arnstein, 1969), and the civic technology framework aligns with this and other established planning tenets.



*Civic Technology for Advocacy.* The fundamental inputs of civic technology initiatives include open data and a balance of technical and non-technical expertise. Civic technology products frequently address a specific operational, policy, or planning challenge (Kontokosta, 2018) and may include data visualizations delivered through a stand-alone web application, a mobile phone application, or as part of an online data portal. The goals and intended impact of these products depend on the specific focus of the civic technology initiative and on what is being created, but may include: (1) developing a common fact-base (e.g., government or community managed open data portals), (2) empowerment of users (e.g., web or mobile applications that connect the public with social services or assist visually impaired residents with navigation), (3) facilitating public engagement by collecting information from residents to inform governance (e.g., 311 service calls or participatory budgeting), (4) increasing government efficiency by monitoring relevant indicators (e.g., performance measurement dashboards and civic analytics), and (5) leveraging media coverage and community organizing to advocate for policy interventions (e.g., awareness raising and political influence). The importance of visualization in bridging the gap between the provision of open data and public participation, in urban planning in particular, is noted by Hemmersam et al. (2015: 60):

much of what is available as open public data requires further processing, mediation, and contextualization in order to gain importance and become more accessible for larger groups of the population. This again can be said to create conditions for more dynamic and informed urban deliberation in, for instance, urban politics, governance, and planning.

Visualization of data by civic technologists, non-profit organizations, universities, and other actors make it more accessible and increase the likelihood of it positively influencing discourse and decision-making.

However, what is arguably more important than the specific product (e.g., data visualization or web application) of a given civic technology initiative is its potential to create a network of individuals and/or ecosystem of organizations that is capable of exerting a sustained impact on decision-making and quality of life at the local level. Like urban planning, civic technology development is often a communal experience. Information can serve as a centerpiece for creating shared meaning, building social relationships, and cultivating network power—defined as “a shared ability of linked agents to alter their environment in ways advantageous to these agents individually and collectively” (Booher and Innes, 2002: 225). In order for network power to emerge, the actors in the network must be diverse in terms of the role they play in the decision-making process as well as their interests, knowledge, values, experience, and resources. The actors must recognize that their ability to achieve their goals is enhanced by and depends on cooperation with others in the network. There must be open and honest communication among the actors where “all are empowered and informed and in which sincerity, legitimacy, and accuracy of what people say can be judged” (Booher and Innes, 2002: 226). Finally, the role of open data cannot be overstated because it functions as an intermediary that brings individuals together and makes civic technology communities (i.e., networks, publics) possible (Latour 2005; Le Dantec and DiSalvo, 2013; McNutt et al., 2016).

Barber and MacLellan (2019: 119) provide an overview of one such initiative that leverages open data and “moves beyond a uni-directional flow of information from

government to citizen” by visualizing and mapping quality-of-life indicators at the neighborhood level in Toronto. After conducting interviews with local government and non-profit organization staff, the authors conclude that considerable work remains in realizing the potential for open data to inform democratic and evidence-based decision-making. They specifically caution against relying on data co-production as the litmus test for open data’s civic engagement potential and instead echo Linders (2012: 120) in emphasizing resident participation in “community wellbeing interventions.” In our view, civic technology is most impactful when it focuses on activating open data resources to address important questions or challenges facing a community and helps to identify one or more courses of action for local government. In this way, open data and the tools, processes, and products that are derived from it can support advocacy and government accountability, but only if organizations and individuals exist to do the work of activating those resources.

### ***Modalities of Civic Technology***

Civic hacking “provides a mode of participation in digital infrastructures that debates and confronts the politics of technology for governance” (Schrock, 2016: 594), and civic hackers have also been cast as agents of change and as one particular model of “civic leadership in the design of smart cities” (Townsend, 2013: 225). The term “hacker” has been defined as “computer aficionados driven by an inquisitive passion for tinkering and learning technical systems, and frequently committed to an ethical version of information freedom” (Coleman, 2013: 3). Schrock (2016) describes the historical evolution of the term “hacker” as well as the “progressive roots of civic data hacking” in greater detail, concluding that the latter can be understood as a form of “data activism and advocacy.” Civic hacking can be done by individuals or small groups, but regular meetings that are open to all members of the community are an increasingly common and visible vehicle for building and sustaining a civic technology ecosystem or network.

Many cities around the United States have institutionalized “hack night” or “meetup” events, where a loose confederation of technologists, residents, public officials, and other stakeholders come together on a regular basis to discuss questions, problems, and needs of significance in a given community. While technologists are a constant at these weekly or biweekly gatherings, they are open to the public and aim to attract and sustain active participation that reflects the diversity of the broader community. Data analysis skills and technical knowledge are only useful when they can be brought to bear on issues of importance to the community, and input from people with insight derived from lived experience is critically important to the legitimacy and likely impact of the work. Hack nights differ from hack-a-thons in several important ways. First, hack-a-thons are usually short, competitive events held annually or once, while hack nights are ongoing and provide a forum for collaboration, deliberation, and relationship-building. Second, hack-a-thons tend to have a narrower focus and attract a base of participants that heavily skews towards technologists, engineers, and developers while hack nights are more open-ended in terms of the types of issues that participants work on while actively pursuing diverse perspectives and skillsets. Finally, hack-nights are less rigid in their structure with self-organized “breakout groups” as a common organizational feature.



The hack night model appears to address shortcomings highlighted in an earlier survey by Knight Foundation (Patel et al., 2013), which showed that key democratic norms such as resident feedback and voting were among the least supported capacities. Several larger cities like Chicago and Los Angeles<sup>4</sup> now have standing hack nights each week, while smaller cities like Austin, Texas and Chattanooga, Tennessee have bi-monthly events. In the Chicago's event, called Chi Hack Night, the City of Chicago has been a constant and visible participant with the city's Chief Data Officer as a regular participant. This level of commitment and leadership on the part of local government can be useful in establishing legitimacy and building momentum. Because of repeated interactions and regular meetings, the hack night model can be understood as a community of practice (Wenger, 2000) within the broader umbrella of the social learning approach (Friedmann, 1987). Communities of practice are groups of individuals who share cultural practices and engage in sustained, collective learning:

First, members are bound together by their collectively developed understanding of what their community is about and they hold each other accountable to this sense of *joint enterprise*. Second, members build their community through mutual engagement. They interact with one another, establishing norms and relationships of *mutuality* that reflect these interactions. Third, communities of practice have produced a *shared repertoire* of communal resources—language, routines, sensibilities, artifacts, tools, stories, styles, etc. (Wenger, 2000: 229)

In addition to individual civic hacking, regular meetings of collaborative civic hacking communities, and narrowly focused episodic hack-a-thon events, other modalities of civic technology exist. Government engages in civic technology as a key source of authoritative open data, but can potentially also serve as an advocate for open government and an active participant in the co-production of solutions to local problems (Linders, 2012; Sieber and Johnson, 2015). Non-profit organizations (NGOs) like Code for America (2018) and Data for Democracy (2019) also play a role by helping to institutionalize civic hacking and providing support for these activities in many cities around the country and the world. Other NGOs with missions that fall outside the realm of technology, digital literacy, and data activism also bring substantive expertise and a deep understanding of local policy issues to partnerships with civic hackers, government, and the private sector.

Smart Chicago, for example, was central to the growth of civic technology in the Chicago region, sometimes in collaboration with Chi Hack Night. Smart Chicago emerged around 2007 as a joint effort of the City of Chicago and two foundations—the MacArthur Foundation and the Chicago Community Trust. The primary focus was initially to “improve Chicago’s unequal access to the Internet and technology” and to act as a vehicle for executing a Federal Broadband Technology Opportunities Program (BTOP) grant (D. Eder, personal communication, November 7, 2017). Later when Dan X. O’Neil became Executive Director, the focus shifted to civic technology and “expanding the innovative use of data to improve lives” (Goldsmith and Crawford, 2014: 39). Smart Chicago essentially served as a hub and facilitator between funders, community organizations, and the tech community in the region by administering programs, distributing funding on behalf of its founding and partner organizations, hosting apps created by civic hackers, developing software, and creating business incubators (Smart Chicago, 2017). More formal public-private partnerships also exist whose work sometimes overlaps

with the civic technology space. UILABS describes itself as an “innovation accelerator” and acts as a liaison between universities and industry and through its City Digital initiative, UILABS “use[d] Chicago as a testbed to develop and deploy new technology” that was primarily focused on urban infrastructure by “enabling experiments at scale to develop real solutions for the marketplace” (UILABS, 2017). In the same way that Smart Chicago bridged the non-profit and philanthropic sectors with government, organizations like UILABS connect university researchers with its industry partners like Microsoft, even though neither UILABS nor City Digital were created as civic technology organizations.<sup>5</sup> In addition to philanthropic organizations and technology incubators, universities have also been key players in the development and stability of Chicago’s civic technology ecosystem.

The Urban Crime Lab based at the University of Chicago has garnered considerable attention since its launch in 2008. This research center “partners with civic and community leaders to design, test, and scale promising programs and policies to reduce crime and violence” by leveraging data science. Between 2011 and 2018, the Chicago-based MacArthur Foundation awarded over \$8 million in grants to the Crime Lab (MacArthur Foundation, 2019) and a recent \$10 million grant will fund direct collaboration with the Chicago Police Department (Gorner, 2018). In contrast to the university-led Urban Crime Lab whose focus includes improving the effectiveness of policing in Chicago, the Invisible Institute is a non-profit digital production organization based in Chicago and approaches criminal justice reform from a data journalism and tool development orientation. This organization’s mission is “to enhance the capacity of citizens to hold public institutions accountable” and its Citizens Police Data project compiles and visualizes records of police interactions with members of the public “that would otherwise be buried in internal databases” (Invisible Institute, 2018). In addition to informing the public, data journalism routinely aims to influence policy and decision-making, and closely aligns with the open government movement though its emphasis on transparency and accountability (Chun et al., 2010).

Business-led technology development—defined as direct collaboration between private companies and local government—however, has some important limitations. Critics argue that this is the default approach to deploying Smart City technologies and this view contributes to the anxiety (i.e., privacy, governance, responsiveness) surrounding smart cities and big data. Technology firms tend to focus on what Neirotti et al. (2014) describe as the “hard domains”<sup>6</sup> of smart city initiatives, but are increasingly couching their marketing materials in terms of quality of life and a focus on citizens. A white paper produced by Cisco Systems echoes these themes and suggests that its products can help cities to build “the new public infrastructure” that are critical to economic growth as well as for “making cities livable, clean, and fun” (Barbier et al., 2017). These tendencies can be understood as the next phase in the longstanding relationship between businesses and government that emphasizes efficiency and an entrepreneurial approach to governance (Boyer 1983; Harvey, 1989; Hollands, 2008). However, the emergence of benefit corporations that combine aspects of non-profit and for-profit organizations adds additional complexity to the relationship between government and the private sector (Battilana et al., 2012). Benefit corporations are allowed to earn a profit, but are also legally required to “consider the impact of their decisions on their workers, customers, suppliers, community, and the environment” (B Lab, 2019), which could make it easier to balance the social

welfare and public interest aspects of civic technology work with the need for access to resources and mechanisms for achieving financial sustainability.

## Chicago's Civic Technology Ecosystem

The city of Chicago has been a leader in cultivating civic technology and the origins of civic technology in Chicago can be traced back to the mid-2000s when a small group of civic-minded programmers began scraping incident data from the Chicago Police Department website and centralizing it on the now defunct [chicagocrime.org](http://chicagocrime.org) website. At that time, there was no other means of accessing this information in a systematic and automated way. This initiative grew into a start-up called Everyblock that expanded beyond crime to incorporate real estate listing, news, and other neighborhood-level information to facilitate connections between neighbors and to stimulate civic engagement. Everyblock was led by Adrian Holovaty who in addition to being a web developer, held a journalism position and had previously worked for news outlets including the *Washington Post*. With over \$1 million in funding from the Knight Foundation in 2007 (Knight Foundation, 2017a), Everyblock quickly gained traction and expanded to other cities before being purchased<sup>7</sup> by MSNBC in August 2009 shortly after the grant expired. In addition to revealing the potential financial value of web applications with a civic focus, the Everyblock start-up is now viewed “as the spiritual beginnings of civic technology in Chicago” in that “it clearly demonstrated the need for open data” (D. Eder, personal communication, September 15, 2017).

Members of Chicago's civic tech community were actively involved in Barack Obama's re-election campaign (Madrigal, 2012) and were early advocates for not only open data, but also for transparency in decision-making and governance. Due in part to these efforts, following Rahm Emanuel's election as mayor in 2011 the city “formally subscribed to an open data policy” (D. Eder, personal communication, September 15, 2017) and took on a more visible role in fostering both civic technology and the city's broader technology sector. The availability of machine-readable, easily accessible data from city departments and agencies not only contributed to the growth in for-profit technology firms in Chicago, but also led to an explosion in the number and variety of civic applications developed and deployed. The [chicagolobbyists.org](http://chicagolobbyists.org) website was among the first applications built with open data provided by the city to advance a public purpose—bringing greater transparency to lobbying activity in local government. As more civic applications leveraging Chicago's open data appeared, a collective called Open City was born and the [opencityapps.org](http://opencityapps.org) website was developed to publicize and showcase these applications. The Open City website is still active, and although new civic applications are no longer listed there, it served as a key connector between the early days of civic hacking in Chicago and more recent developments. In June 2012, civic hackers and interested residents began meeting regularly for what became known as Chi Hack Night.<sup>8</sup> As one of the more visible and lasting manifestations of civic technology in Chicago, the hack night model developed there has spread to dozens of cities around the country and has even been adopted in a few Canadian cities.

The mayor's office was instrumental in launching the city's open data portal and formally committing to the open data paradigm. Other important government initiatives include creation of a Chief Data Officer (CDO) position in 2012 and the release of a

formal Technology Plan in 2013. The role of the CDO is to “oversee strategic use of data to improve the quality of life for Chicago’s residents and visitors” and “to improve the efficiency of city operations” by “managing the many parts of city’s IT system”<sup>9</sup> and “growing our civic tech community” (T. Schenk, personal communication, September 21, 2017). The city’s Technology Plan articulates a vision for how data and information technologies would be used to advance “opportunity, inclusion, engagement, and innovation” (City of Chicago, 2013) in the city and began as a vision statement for Chicago to become a leading center of technological innovation alongside a summary of existing initiatives grouped into five distinct categories: (1) digital infrastructure, (2) engagement and digital literacy, (3) open and efficient government, (4) civic innovation, and (5) technology sector growth. According to Tom Schenk, the city’s CDO and most visible liaison with the civic technology community for more than five years, local government’s role in cultivating civic technology has centered on “communication with the public [...] not just throwing things on the data portal, but contextualizing it, explaining it, being there for questions” (T. Schenk, personal communication, September 21, 2017).

In the decade since the launch of the Everyblock start-up, the impact of civic technology in Chicago has become more apparent. Adam Hecktman, the Director of Technology and Civic Innovation with Microsoft Chicago, gives the example of mRelief (Elahi, 2017), which started in Chicago and since “has helped over 100,000 families in 42 states secure food stamps and other public support” (A. Hecktman, personal communication, September 22, 2017). He also cites the Large Lot Program, where “DataMade worked with the City of Chicago and neighborhood groups<sup>10</sup> to improve and scale up a program of selling vacant land back to residents that is being used in other cities now.” Others concur, citing a “very robust community that is prototyping projects and coming at new and old problems with fresh perspectives and novel ways of using data and technology that have an effect on government” (D. Eder, personal communication, September 15, 2017). This, according to Eder, has led the city to hire from the civic technology community and integrate tips and leads into the city’s processes, leading to “a real evolution in terms of both policy and technical aspects on both sides.”

The civic technology ecosystem in Chicago has been successful for a variety of reasons and some of these are place-specific—it is the third largest city in the country with numerous technology firms, academic institutions, and longstanding government commitment—but many of these factors could be cultivated or harnessed elsewhere.

If you take a look at the way any city works, not just Chicago, the ecosystem we are talking about exists at the intersection of technology, programs, policy, and people. (A. Hecktman, personal communication, September 22, 2017)

Maintaining effective coordination between several key stakeholders or agents is key, but advocating for open data, digital literacy, and meaningful public engagement are also important ingredients. The Chi Hack Night event has also played an institutional role in acting as a hub and source of community for what would otherwise be solitary and isolated civic hacking efforts.

One of the critiques of emerging technologies focuses on the degree to which their use is dominated by the private sector and driven by the agenda of corporations and technology firms. However, this concern was not shared within Chicago’s civic technology community. Microsoft’s Chicago office is one of the Chi Hack Night’s private supporters and

has a team devoted to applying the company's "technical and programmatic resources and expertise to Chicago's local priorities" and part of this group's mission encompasses civic technology:

this team is motivated by the fact that Microsoft's mission—to empower every person and every organization on the planet to achieve more—drives our commitment to seeing that technology serves the public good in many different ways. By being part of the conversation, we learn about the breadth of those "many different ways," who they impact, and how technology can work even better to serve those ends. (A. Heckman, personal communication, September 22, 2017)

Derek Eder (co-founder of Chi Hack Night and founder of DataMade) notes that the participants at the Chi Hack Night are there as volunteers who

take on issues that personally affect them that almost always have nothing to do with their day job [...] in fact that is often a reason that people come to Hack Night—maybe they get paid well at their job but they feel like something is lacking in how they are engaging with society—maybe this is an outlet for them to use their skills to give back, but on their own terms. (D. Eder, personal communication, September 15, 2017)

These sentiments are echoed by the former Chief Data Officer Tom Schenk who said,

I don't think there are firms or vendors that are really setting much of the agenda [...] there are large organizations like Code for America that get funding from these organizations but it really hasn't seemed to have influenced what folks are interested in. (T. Schenk, personal communication, September 21, 2017)

Another critique focuses on technology as a barrier to inclusion and our interviews acknowledge that diversity is a challenge for civic technology. While diversity in skills was cited as a strength of Chi Hack Night, on other types of diversity there is room for improvement.

[Chi Hack Night] started out [five years ago] with four white male developers [...] but now 30 to 40 percent of the 100 to 150 attendees each week are participating for the first time and many of these people do not have technical backgrounds [...] to date the focus has been on gender<sup>11</sup> and we don't currently track any other demographics [...] but my goal is for Hack Night to represent the broader population of Chicago. (D. Eder, personal communication, September 15, 2017)

Forums such as Chi Hack Night are also not optimal for advancing basic digital literacy.

we don't have any official program for basic digital literacy as part of Chi Hack Night [...] there have always been breakout groups centered around learning how to code, but we found that it is pretty hard to do that with volunteers because it is draining to teach the same thing over and over again and it is difficult to do well [...] our structure and volunteer orientation doesn't lend itself to this [...] what does work is the experiential learning that comes from working on a project at Chi Hack Night. (D. Eder, personal communication, September 15, 2017)

Achieving diversity and inclusion remains difficult, especially in the technology sector, but by carving out specific roles for community residents and domain experts, Chi Hack Night and civic technology more broadly have the potential to become more diverse and inclusive.

There is evidence that Chicago's civic technology community is also changing how the private sector and government interact in the technology arena and this has been reflected in procurement practices:

public sector technology that was once the domain of larger companies is starting to open up. For example, Mayor Emanuel's administration invited start-ups and small-sized companies to join a pool of pre-qualified vendors eligible for City procurement opportunities. The administration also modernized its insurance requirements to allow for pooled insurance plans. So, if you are a small business or a start-up as part of an incubator like 1871, you may now meet the City's insurance requirements by being part of the group. I thought that was an innovative approach to both lowering the barriers to doing business with the city as well as the city tapping into the significant amount of talent we have in Chicago's start-up and small business sectors. (A. Heckman, personal communication, September 22, 2017)

Similarly, the increased visibility of the civic technology community has enabled it to take on more of an advocacy role:

our group has gained its own notoriety and we've actually started to have our own influence when it comes to policy or advocating for certain ideas [...] we have drafted a pledge for candidates for Illinois governor [...] by signing it they are committing to releasing open data, using data to inform decisions, properly responding to FOIA requests ... we have been flexing that muscle a little and we are doing so not as a corporate group but as a group of individuals who care about a common set of issues ... (D. Eder, personal communication, September 15, 2017)

### **Civic Technology, Participatory Design, and Infrastructuring**

Civic technology offers urban planners a platform to integrate many desirable characteristics of established planning approaches and recent technological innovations while addressing the shortcomings of conventional public participation and community engagement efforts. In fact, civic technology communities, networks, and ecosystems (depending on the favored terminology) can be understood as a distinct public (Dewey, 1927) operating alongside government, business, non-profit organizations, and other stakeholders in the development of Smart Cities. Civic technology centers people rather than technology, and this framework can be useful for urban planners looking for guidance and concrete examples of how to navigate the ethical and practical challenges posed by big data and smart city technologies. The Array of Things (AoT) project that has been deployed in Chicago is useful for discussing the distinctions among civic technology initiatives. Officially launched in 2016, the AoT consists of a network of sensors collecting environmental parameters such as temperature, humidity, and air quality (Catlett et al., 2017) for the purpose of advancing Smart City research and "improving the sustainability, resilience, efficient operation, and livability of cities" (Array of Things, 2016).

As previously stated, the term "Smart City" is not well-defined (Albino et al., 2015) but has come to be "characterized by a pervasive use of Information and Communication Technologies (ICT), which, in various urban domains, help cities make better use of their resources" (Neirotti et al., 2014: 25). The pursuit of greater efficiency in the delivery of public services, particularly with growing budget shortfalls in many states and local governments, has obvious appeal and technology firms that produce hardware, software, and



deliver supporting services have much to gain from the adoption of the Smart City as a mainstream mode of development. However, the benefits of emerging technologies for communities and residents are more tenuous and often discussed as an afterthought, if at all. Which technologies are deployed, what types of data collected, and who has access to those data are all fundamentally important questions that determine to whom the potential benefits of Smart City development are distributed.

Participatory design<sup>12</sup> emphasizes “end-users as full participants in activities leading to software and hardware computer products and computer-based activities” (Muller and Druin, 2012: 1125) and seeks to better understand the “conditions for user participation in the design and introduction of computer-based systems” (Kensing and Blomberg, 1998). The development of tools, processes, and—most importantly—networks of individuals to identify important questions and bring technology to bear on those questions as appropriate are necessary to address the above concerns. These are at the core of the civic technology framework and ethos. Although the AoT project included a public engagement component, this work appears to have primarily centered on managing the privacy implications of the sensors and cameras (Smart Chicago, 2018). The AoT operating policies (Array of Things, 2016) clearly center the research and teaching aspects of the project rather than the co-development of technologies (Linders, 2012) prescribed by the civic technology framework (McCann, 2015; McNutt et al., 2016).

The notion of “infrastructuring” from the participatory design literature is helpful in defining civic technology and distinguishing it from other modes of technology development and deployment. Le Dantec and DiSalvo (2013) note that some participatory design processes aim to create or enhance “useful systems” while others seek to create “socio-technical resources that intentionally enable adoption and appropriation beyond the initial scope of the design, a process that might include participants not present during the initial design” (247). Infrastructuring is “characterized by a continuous process of building relations with diverse actors and by a flexible allotment of time and resources” that is open-ended in terms of what is produced and that adopts a long-term commitment among participants (Hillgren et al., 2011: 180). The creation of the Plenario open data platform (Catlett et al., 2014) and its planned use as one of the mechanisms for sharing data collected by the AoT network of sensors could be understood as an example of infrastructuring for “useful systems” (Le Dantec and DiSalvo, 2013). The University of Chicago, City of Chicago, MacArthur Foundation, and local technology firms have been key participants, but the goal is to expand to other cities to support “research, development, education, prototyping, and demonstration of both open and proprietary technologies and services aimed at improving the sustainability, resilience, efficient operation, and livability of cities” (Array of Things, 2016). Institutions like Chi Hack Night also engage in infrastructuring around the use of open data, but instead emphasize the formation of a community of practice (Wenger, 2000) or the constitution of a public<sup>13</sup> with the resources and capabilities to identify and address immediate or nascent issues in an innovative and collaborative manner (Le Dantec and DiSalvo, 2013).

## Conclusion: The Promise of Civic Technology

While civic technology so far has been more popular in large cities and in select communities, it can benefit planners in a variety of settings for several reasons. First, citizens want

transparency. By leveraging technology to communicate and by making data available for public use, government agencies can simplify compliance with open meetings and FOIA requirements as well as engage the public in clearer and more flexible ways. Second, meaningful participation is a cornerstone of democratic governance (Arnstein, 1969). The percentage of Americans who say they trust the federal government to “do what is right” has decreased consistently since 2001 (Pew Research Center, 2017), which can undermine the credibility and effectiveness of planners on the ground. Technology-enabled participatory platforms<sup>14</sup> can help to build or repair trust in institutions by facilitating the sharing of information and two-way communication between citizens and public agencies (Desouza and Bhagwatwar, 2014). Third, public agencies can help to create new knowledge and empower others to jointly develop solutions (Nath, 2011; Linders, 2012). Cities across the country are creating online portals where residents, businesses, and researchers can access, visualize, and often analyze a wide array of data. Planners must engage more with these efforts and help shape them in ways that are more responsive to community needs. Finally, civic technology can provide a framework for democratizing the data that will be collected and generated by sensors and other Smart City technologies, provided that those data are open. The use of information technology is at the heart of the current investment in Smart Cities occurring in the United States and beyond. Only by directly engaging with emerging technologies can we hope to make them responsive to the needs of communities and individuals. Civic technology, with its emphasis on collaboration and community-focus, can help to direct those efforts towards enhancing quality of life and furthering social equity.

When understood through the lenses of collaborative planning (Innes, 1995; Healey, 1997) and social learning (Friedmann, 1987; Wenger, 2000), civic technology can counter positivist tendencies to planning that dominated much of the twentieth century (Sandercock, 1998). In that sense, civic technology presents an alternative to the dominant Smart City discourse, which “build off a scaffolding of calculation and quantification that connects to longstanding epistemologies of positivist social inquiry or representation” (Ashton et al. 2017: 2). Building digital literacy and exploring how to incorporate data visualization and analysis into planning processes is key to realizing this potential (Afzalan et al., 2017). But most importantly, the technology “must be a facilitator for creating a new type of communicative environment” where the people and the institutions of the city interact and collaborate (Albino et al., 2015: 11).

We have argued that civic technology can be understood as a community of practice or a distinct public where access to data and the maintenance of a forum where diverse actors with an interest in improving the quality of life and addressing local challenges can interact and work together. Since the connections between planning and civic technology communities are not yet automatic, a key task for planners moving forward is to explicitly connect with these communities of practice either as members or leaders. Mandarano et al. (2010) survey how specific digital technologies have been used to facilitate civic engagement and to support public participation in planning processes. But the goals of civic technology are more expansive and can range from joint fact-finding, to policy evaluation and creation, to co-production,<sup>15</sup> to data activism and advocacy. Innes (1995: 185) notes that “social processes turn information into meaningful knowledge and knowledge into action” and civic technology emphasizes collaboration in both cyberspace and physical space among participants. Moreover, as Goodspeed (2016: 3) argues, achieving this

would require planners to move “beyond the realm of communicative rationality and fostering a critical interaction over an extended period of time between technology creators and stakeholders.”

One of the key distinctions with planning processes that have attempted to blend technology and collaborative planning is the structure and duration of the interaction. Goodspeed (2016) describes three cases where a formal planning organization leads a time-constrained workshop or engagement process with a very specific, previously determined focus and is critical of their effectiveness. Where civic technology can be useful is in its maintenance of a community of practice that is open and responsive to the needs of planning and government, but is not dominated by these interests and agendas. Civic technology—through vehicles like a weekly hack night gathering—also becomes a platform for sustained engagement where social relationships, technical literacy, and a shared vision for how the local community or region can be improved can emerge.

Some research has considered civic hacking as primarily a vehicle for procurement of technical services (Johnson and Robinson, 2014). While this critique is valid and must be continually assessed, planning presupposes some capacity for implementation and historically, that has come from planning’s alliance with government or via community power, organizing, and activism. Working with the private sector is not a new direction for planners and a closer relationship with technology firms is not only inevitable, it is desirable. Only by engaging with perceived power brokers can planners, community advocates, and individuals voice their concerns and play a role in shaping how these technologies and data are used. Data and technology can be used for monetary gain, to manipulate, or to justify and reproduce the status quo. Similarly, not every issue or problem has a technical solution or lends itself to this approach, but we have argued that despite these familiar limitations, civic technology offers a promising way forward that can potentially bridge existing gaps between planners and the public (Goodspeed, 2016) and between emerging technologies and planning practice (Schweitzer and Afzalan, 2017). If the data generated by the deployment of Smart City technologies are truly open, we have new opportunities for engagement (e.g., visualization via web and mobile platforms) and evidence-based planning and decision-making (e.g., improved spatial and temporal resolution, leveraging of big data analysis techniques as appropriate).

If planners are to fully exploit the potential of open data and civic technology in order to help cities be more environmentally sustainable, prosperous, and just, fundamental changes to planning education and pedagogy are also required. In part, this means familiarizing planning students with the ethics and practice of working with emerging technologies and data. French et al. (2017) argue that in past, planners have operated within a “data poor environment” where their ability to leverage information for decision-making was constrained by limited computing power and the feasibility of collecting and maintaining very large or very detailed datasets. These technical hurdles have largely fallen away, but what remains are fundamental questions about how to integrate these resources into planning practice in a way that respects our ethical obligations and supports communities (Sawicki and Craig, 1996; Afzalan et al., 2017; Schweitzer and Afzalan, 2017) and civic technology provides a framework towards achieving these aims. Big data, volunteered geographic information, data derived from social media, and to some extent, open data, all require methods and skills to access and make them useful for planning purposes that go beyond what has traditionally been taught in

planning school. Courses that introduce the basics of data science alongside the role of politics and power in planning are needed in order to ease anxieties surrounding the role of technology, while clearly elucidating how information can be both abused and used to empower (Booher and Innes, 2002). This is not to suggest that planners and citizens must cultivate programming or statistical analysis skills, but a basic familiarity with common data formats, visualization conventions, and the tools for critically assessing how data are being used to construct a narrative or to advance a proposed course of action are key. Finally, further research is needed to better understand the impact of civic technology in shaping and sustaining open data ecosystems, as well as the role it plays in planning and governing the Smart City.

## Notes

1. The federal Freedom of Information Act (FOIA) enacted in 1966 codifies this view and requires agencies to disclose requested information “unless it falls under one of nine exemptions which protect interests such as personal privacy, national security, and law enforcement” (US Department of Justice, 2017). Each state has its own Freedom of Information laws that govern which agencies and data are available to public and under what circumstances.
2. The Open Geospatial Consortium (OGC) is an international non-profit organization comprised of government, commercial, academic, and non-profit organizations that has worked to establish and promote open standards specifically for geospatial data since 1994.
3. Universal Resource Locators (URLs) are a subset of URIs that include both the name of resources on the Internet as well as a method for accessing it, such as the Hypertext Transfer Protocol (HTTP).
4. Hack for LA organizes weekly hack night events and is an official Code for America brigade (<http://www.hackforla.org/civic-hack-nights>).
5. Smart Chicago has since migrated under the City Digital umbrella as its mission continues to evolve (A. Hecktman, personal communication, November 6, 2017) and City Digital has been rebranded City Tech.
6. These include “office and residential buildings, energy grids, natural resources, energy and water management, waste management, environment, transport, mobility and logistics” while “soft domains include areas such as education, culture, policies that foster entrepreneurship, innovation and social inclusion, as well as communication between local public administrations and the citizens” (Neirotti et al., 2014: 27).
7. The Knight Foundation subsequently updated its policies and now requires that intellectual property developed by grant recipients “be released to the public under the open-source license most appropriate for [the] project” (Knight Foundation, 2017b).
8. In December 2018, Chi Hack Night incorporated as a 501(c)3 non-profit organization, giving it a more formalized and decentralized structure (Eder, 2018).
9. Specific examples include databases, the open data portal, business intelligence unit, and advanced analytics team.
10. The Local Initiatives Support Corporation (LISC) was instrumental in the Large Lots program, acting as both a funder and community outreach partner (D. Eder, personal communication, November 7, 2017).
11. There is a formal breakout group that has built a tool for tracking male dominance of the conversations at Chi Hack Night (Wiese, 2016).
12. Carroll and Rosson (2007) provide a detailed account of the historical development of participatory design and its application the field of community informatics.
13. Defined here as “one of many unique federations of people who together are influenced or impressed upon by a specific set of conditions” and that “seek to address these conditions and their consequences” no matter if these conditions already exist or are anticipated to arise in the future (Le Dantec and DiSalvo, 2013: 243)

14. Defined as “forums created to source, analyze, visualize, and share information, expertise, and solutions to advance social causes and/or solve social and policy problems” (Desouza and Bhagwatwar, 2014: 26).
15. Coproduction refers to instances where “government treats the public not as customers but as partners” (Linders, 2012: 446).

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