

Design Lessons for Smart Governance Infrastructures *

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Abstract

This chapter provides design lessons on how to take advantage of advances in information technologies that have enabled new governance infrastructures to become both possible and desirable. A *governance infrastructure* is the collection of technologies, people, policies, practices, resources, social norms, and information that interact to support governing activities. Smart governance infrastructures augment society's ability to organize, interact, and govern. Novel instances of smart governance infrastructures already exist and are regularly emerging in distributed organizations and online communities. As we think about rebooting the public square, this chapter is intended to challenge us to move beyond questions of how to best manage government institutions to questions of how to design governance systems with the appropriate incentives and rules to harness and coordinate the diversity, enthusiasm, and capabilities of those governed. We provide several design lessons learned from successful governance infrastructures and propose how they can be applied to address national priorities. This chapter anticipates how the interaction of technology and society can be leveraged to mindfully design problem-defined, participation-based governance infrastructures to return power to the people while increasing accountability and efficiency.

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“It was the first Republican President, Abraham Lincoln, who said the role of government is to do for the people what they cannot do better for themselves.”

President Barack Obama, May 1, 2010, University of Michigan Commencement Address.

Introduction

Everyday people are able to do more for themselves. Dramatic changes in individuals’ ability to connect, mobilize, and collaborate provide unimagined opportunities to do more for themselves, although certainly not by themselves. Spontaneous citizen-led efforts have helped victims of natural disasters find housing and loved ones, neighborhood email lists raise awareness of local public health concerns, grassroots mapping is used in the cleanup efforts of the Louisiana oil spill, and freecycle.com shares unused home goods with those in need. Online patient support groups like PatientsLikeMe.com help those with life-threatening illnesses band together to raise awareness, collect research funds, share best practices, identify competent professionals, and provide social support. Citizen groups like the Sunlight Foundation promote government transparency and accountability, while watchdog groups like Citizens Against Government Waste and Citizens for Responsibility and Ethics in Washington hunt down government waste and corruption. Social networks like LinkedIn help improve the efficiency of the employment market, while open education initiatives provide free access to content from leading educational institutions.

Each of these examples underlay larger societal shifts from government to governance and from citizen participation to citizen production. Instead of paying taxes to government institutions and waiting for them to solve our problems, individuals are directly engaging in community challenges. To foster participatory government through adulthood, a rethinking of government itself is necessary. The goal of this chapter is to advance that rethinking. To do so requires that we see collective action as more than “collective complaint” (O’Reilly, 2010) and

its accompanying expectation that “they the government” provide the solutions rather than “we the people.” It suggests that we move beyond questions of how to best manage government institutions to questions of how to design smart governance systems with the appropriate incentives and rules to harness and coordinate the enthusiasm and capabilities of those governed.

For us, like others (Kooiman 1993; Lessig, 2009; Rhodes 1996), governance is broader than government. We define governance as the interaction of processes, information, rules, structures, and norms that guide behavior toward stated objectives that impact collections of people. These objectives often involve the allocation of scarce resources including public goods, the coordination of diverse participants and stakeholders, the establishment of clear processes for decision-making, and the resolution of conflict. Participants in these efforts can be both paid and voluntary, citizen and non-citizen, professional and amateur, and private and public.

Although we are well into the age of participation (Grossman, 2006), the transformative effects of technology-mediated social participation, particularly on national priorities, are only in their infancy (Shneiderman, 2009). Examples of technology-enabled co-production in the private sector abound: the media is shifting from paid professionals to a vast collection of amateur bloggers; eBay and Craigslist host the transactions of an extraordinarily varied marketplace; Wikipedia distills the collective wisdom of thousands into the most comprehensive tome the planet has ever seen. In each of these examples, the information and communication technologies work with people’s own interests across a governance infrastructure that coordinates constituent participation and contributions. President Obama’s Chief Information Officer Vivek Kundra already aims to leverage technology to create opportunities to cultivate citizen production in the services of traditional government: "Think about Apple and the iPhone. Apple didn't go out and build 150,000 applications. It built a platform, and the innovation

happened...What we need to start doing as the federal government is to tap into the energy and spirit and innovation of the American people" (Originally cited in Gohring, 2010).

As communities struggle with reduced resources, they need to cultivate efforts from new sources. The most untapped potential is in the enormous capabilities of individuals. However, like the potential of solar power, we need to develop pathways to convert the energy into useful applications. Previous efforts of eGovernment, like eVoting, are making services more accessible online, have focused on making government more efficient at what it already does (Lathrop & Ruma, 2010). As we think about the potential of Governance 3.0, rebooting the public square is about more than just paving over existing cow paths; it is about redesigning governance infrastructures to be smarter, more responsive, and more efficient.

Smart Governance Infrastructures

"From antiquity to modern times, the nation has always been a product of information management."

The Economist, 2010, p. 11

Information technology, especially communication and computational technologies, continues to augment society's ability to organize, interact, and govern. To realize the potential of our collective abilities, smart governance infrastructures need to be mindfully designed to facilitate, coordinate, and reward collective action that leads to desired social outcomes. We are familiar with the concept of infrastructure through our everyday use of the state highway system, electrical grid, postal service, and satellites providing GPS. The postal service highlights the fact that infrastructure can include more than just technology, as it includes employees, policies for its appropriate use, standard practices, and expectations of performance.

These examples of government-mediated infrastructures differ from governance infrastructures in the type of activities they support. Instead of supporting the efficient exchange

of power, transportation, or mail, governance infrastructures support governing activities such as the allocation of scarce resources, collective decision-making, public debate, public mobilization, and the resolution of conflict. Thus, a *governance infrastructure* is the collection of technologies, people, policies, practices, resources, social norms, and information that interact to support governing activities. We agree with and expand upon the notion of smart that was used by Kanter and Litow as they discuss the potential of smarter cities:

A smarter city infuses information into its physical infrastructure to improve conveniences, facilitate mobility, add efficiencies, conserve energy, improve the quality of air and water, identify problems and fix them quickly, recover rapidly from disasters, collect data to make better decisions and deploy resources effectively, and share data to enable collaboration across entities and domains. Its operations are instrumented and guided by performance metrics, with interconnections across sectors and silos. (2009, p. 2)

A smart governance infrastructure provides transparency of public efforts, promotes cultural flourishing and can increase accountability. To be accountable is to be held responsible. Ideally, those who are governing will be continuously held directly accountable (Kjaer, 2004). As power is returned to people the responsibility for our actions should be as well. In the last few decades there has been a growing disconnect in the United States between a government of the people and a government to serve the people. Partly, this is due to an increase in the size and scale of government where accountability chains “may simply disappear in such a web of institutions because defining who did what is no longer straightforward” (Rhodes, 2000, 76-7 as cited in Kjaer, 2004). The current governance infrastructure is not a scale free network. As the nation grows, voices become proportionally diminished and additional layers are added to the hierarchies of representation so that individuals increasingly feel they have no influence on government decisions. As the social identity of government continues to be separated from

individuals, the responsibility for solving inherently social problems continues to be separated from society (Catlaw, 2007).

This chapter anticipates how the interaction of technology and society can be leveraged to mindfully design problem-defined, participation-based governance infrastructures to return power to the people while increasing accountability and efficiency. We echo Herbert Simon's claim that "everyone designs who devises courses of action aimed at changing existing situations into preferred ones" and that fields as diverse as engineering, medicine, business, architecture, and government are "concerned not with the necessary but with the contingent – not with how things are but with how they might be – in short, with design" (Simon, 1996, p. iix). Of course designing for social systems is always wrought with unpredictability and imprecision, suggesting that we can (and should) "cultivate" certain behaviors, rather than force them (Wenger, et al. 2002). This is particularly true when dealing with a complex system of self-organizing individuals and institutions. Knowing which "design levers" to pull, whether they involve the market, laws, social norms, or architecture (Lessig, 2006) is a considerable challenge, but one with great promise.

In this chapter we outline design levers into lessons learned from successful examples of novel governance infrastructures that are currently used in online communities, innovative businesses, non-profits, and governments. We discuss the challenges and possibilities of new governance infrastructures that retrofit and complement existing government initiatives or address unmet community needs and national priorities. Additionally, existing concepts in public administration such as citizen co-production become more relevant and viable with advances in technology. This paper explores the possibilities of how smart participation-based governance

infrastructures can be designed to empower, or more appropriately return power to the people while increasing accountability to an active, diverse, and continuously changing populace.

Lesson 1: Organize around specific problems rather than institutions or geography

One of the greatest powers of the Internet is that it has allowed people with similar interests to band together, independent of geography. This makes it possible for those with similar interests, preferences, and problems to find one another (Anderson, 2006). Patients with rare diseases are brought together via the Internet to share resources, provide social support, and advocate for funding or research. Likewise, citizens with unique political or social views find like-minded people to discuss issues, promote agendas, and advocate for causes. Of course, this may not always be good for society, as niche groups can become echo chambers that create and reinforce their own distorted view of reality (Sunstein, 2007).

So, how can we benefit from the Internet's ability to span geographic limitations without creating a more polarized populace? One promising strategy is to use online governance infrastructures that help people with common problems (as opposed to common ideologies) work together to develop solutions (as opposed to commentary). Communities are now only sometimes defined by geography, but many government approaches are implemented through a fixed jurisdiction for a fixed period of time. People's daily interface with government, business, markets, and communities regularly span traditional jurisdictions. Within an hour, an individual can use local government services while purchasing tax-free gifts from across the country for their international colleagues before gambling real money in cyberspace. While geography is still important and highly correlated with citizen interactions, constituents now often organize according to the most appropriate form for the community it serves. Specialized governance

infrastructures can now support particular challenges or communities and do not need to be wrapped into existing, jurisdictionally-bound organizations because of convenience.

A central organizing quality of powerful new scale-free collaborations, like open source software development, is the coordination of individuals working together to advance specific problems (Malone, 2004). As Clay Shirky, author of *Here Comes Everybody*, says in a TED talk:

When you build coordination into the infrastructure, which is the [collaboration] answer, you can leave the people where they are and you take the problem to the individuals rather than moving the individuals to the problem. You arrange the coordination in the group and by doing that you get the same outcome without the institution difficulties... and you shed the institutional costs which gives you greater flexibility. (Shirky, 2005)

This organizational shift is happening in businesses, non-profits, and universities. One government use of problem-focused organization is the Obama administration's appointment of czars to oversee problems such as AIDS, Auto Recovery, Domestic Violence, WMD Policy, and over 20 other problem-focused czars. Although the term czar is not one that conjures up images of collaborative problem solving, the idea of organizing activity around problems rather than existing government agencies is a promising one. Another approach is to facilitate citizen self organization through initiatives like serve.gov, a platform similar to meetup.org that allows for private and public organizations to post volunteer opportunities and enables individuals to search for local opportunities of interest. Each represents another step toward organizing around problems and enabling the coordination of geographically independent public, private, and governmental efforts to address national priorities.

Lesson 2: Crowdsourcing the identification of clear, approachable problems and promising solutions

In our complex, highly interconnected world, it is rare that a single person has all of the information, skills, and insight needed to identify and characterize a problem accurately or

generate the most promising solutions. The first step in solving a problem is to clearly articulate the problem and recognize it as a priority. Those who develop complex software have learned that “given enough eyeballs, all bugs are shallow” (Raymond, 2001). Additionally, a group of diverse individuals regularly outperform small collections of expert individuals (Page, 2007). If there is a large enough crowd identifying problems and recommending solutions, almost every problem can be characterized quickly and a solution will be obvious to someone. While fixing software bugs may be easier than fixing their societal counterparts, the principle is the same. Identifying problems and potential solutions is best done by gathering input from the crowd, with its collection of uniquely skilled and experienced members.

Smart governance infrastructures are needed to effectively harness the unique skills and knowledge that too often lie dormant in the crowd. Outsourcing tasks that are traditionally performed by an employee, contractor, or government agency to a large group of people or community is known as crowdsourcing (Howe, 2006). A range of tools has been adopted in recent years to do just that. Issue tracking systems and related “bug trackers” are used by computer programming companies to help assure high quality service through the systematic collection, aggregation, and follow up of problems. These systems provide a bottom-up approach to problem identification and prioritization, as well as a means for following up on potential solutions. Issue tracking systems that collect, aggregate, and follow up on citizen-identified problems are increasingly possible. Initiatives like FixMyStreet.com have run with this idea by encouraging citizens to document graffiti, broken paving slabs, and burned out streetlights, while tracking their resolution by government. The site has shown strong potential as a proof of concept, although it has been criticized for its lack of connection to government and missing a sense of community among contributors (King & Brown, 2007). Hopefully similar government

issue tracking systems will continue to improve through closer partnerships with relevant government, corporate, and nonprofit organizations.

While crowdsourcing the identification of problems can be fruitful, crowdsourcing is particularly well equipped to identify optimal solutions to known problems. There are many cases where the problem is clear: encouraging exercise, reducing a public health outbreak, cleaning up flood or oil damage, caring for the elderly, and identifying fraud and abuse. In such cases, smart governance infrastructures can tap the crowd for innovative solutions, as well as feedback on others' ideas. A new cottage industry of "innovation solutions" and "crowdsourcing products" such as Innocentive and IdeaScale has emerged in recent years. While these have primarily been used in corporate settings, they are starting to be applied to social and government contexts. For example, community open source problem solving publicly posts challenges and the public is invited to help solve the problem (Schweik, Evans, & Grove, 2005; Goldsmith, 2010). Similarly, online social collectives like amaze.com act as platforms to connect people with shared interests and enable them to coordinate people, organizations, and resources in a variety of collaborative forms. The Open Government Dialog, sponsored by the National Academy of Public Administration, welcomes the public's ideas on specific challenges, providing a forum to refine and vote on the best ones. The most recent challenge was, "How can we strengthen our democracy and promote efficiency and effectiveness by making government more transparent, participatory, and collaborative?" (National Academy of Public Administration, 2009). While new insights may be gained from broad questions such as this one, devising specific questions on approachable problems is more likely to lead to actionable solutions. New governance infrastructures could use decision-making structures like prediction markets or intra-organizational auctions to harness the wisdom of crowds to predict future needs

and challenges, as well as the likelihood of successes and failures (Arrow et al., 2008; Malone, 2004; Surowiecki, 2004).

Lesson 3: Provide clear, but meaningful pathways to contribute

In many cases people have a desire to contribute, but are not sure how. This is often manifest after natural disasters when empathy can overtake logic, leading to the provision of unnecessary supplies that clog up scarce transportation channels. The advent of the Internet has enabled a more coordinated effort where volunteers find meaningful ways to directly contribute, such as offering their home to those affected by Hurricane Katrina or helping join families that were separated. More generally, smart governance infrastructures support clear and meaningful individual contributions that can be aggregated in useful ways.

The challenge is to architect an infrastructure that provides clear options for making meaningful contributions, while allowing individuals enough choice to want to stay engaged. An excellent example of this approach is Kiva, a non-profit organization that helps reduce poverty by helping individuals make micro-loans to people in developing countries. Making a contribution to Kiva is painlessly simple. Donors register, provide money to Kiva through an online transaction, choose loan recipients based on their profile information and photos, and click on a button to lend them up to \$25. Contributing to the alleviation of poverty has never been so simple, or perhaps more importantly, so personal. Like all functioning infrastructures, Kiva's international banking arrangements, legal requirements, technical and personnel support all fade into the background, leaving the contributor one simple, but profound choice: who should I lend to? The clear tie between lender and recipient makes giving infinitely more meaningful than sending money to an agency or nonprofit to administer. There is also a feedback loop for a donor to track both how their specific contribution was used and, in the case of a loan,

how quickly it is being paid back. The availability of this information engages donors and reduces another participation barrier.

While micro-loans illustrate the power of providing clear and meaningful contributions, there are many other examples of meaningful micro-contributions. For example, public volunteers known as clickworkers helped NASA identify craters on Mars by clicking on relevant sections of high-resolution images from the comfort of their own home. Genealogists at FamilySearch Indexing help transcribe 19th century U.S. Census records into searchable databases of genealogical information. Volunteers at Project Gutenberg create free ebooks of public domain works by fixing one “scano” at a time as they read the books themselves. More recently, sites like Grassroots Mapping help citizens resolve disputed flood plain categorizations of individual’s homes or use balloons and kites to produce public domain aerial imagery of the April, 2010 oil spill in the Gulf of Mexico that can be used for environmental study, coordinating volunteer efforts and for legal cases in the future (Sutter, 2010). In all of these examples and many more (such as FixMyStreet already mentioned), the infrastructure makes contributing simple and clear, but also meaningful due to the beneficial nature of the work. In other cases, where the work may not be as socially rewarding, companies and researchers are turning to a diverse and decentralized workforce like Amazon’s MechanicalTurk to have a cadre of human volunteers perform micro-contributions for micro-payments.

Although not all tasks are easily decomposed into clear, distinct, chunks that can be aggregated together into a meaningful whole, there are likely many more that we have not yet considered. Increasingly popular smart mobile devices are creating more opportunities to collect and annotate data, as well as provide opportunities for meaningful micro-contributions while otherwise wasting time in line at the store or at home watching TV.

Lesson 4: Encourage continuous, increasing engagement

Most endeavors cannot be maintained by periodic, micro-contributions alone. They require leaders that are willing to expend significant amounts of time and effort working on solutions to problems. Studies of collaborative systems such as email lists, wikis, and photo sharing sites, support the idea that the majority of contributions are made by a relatively small group of contributors, while a large group of contributors only participate periodically. In cases where participation cannot be mandated, there is a constant need to help some individuals develop from peripheral and passive roles into more central and active roles.

The ease with which we can now collect information on participation increases the feasibility of new metrics and design strategies that can be used to encourage continuous, increasing participation within a community. For example, members of the online community Slashdot can earn increasing levels of responsibilities and rights based on their involvement in the site. Slashdot administrators created a *Karma* system to reward people that constructively contribute to the advancement of the community. If a user posts a comment that others find and rate as valuable, their *Karma* increases. If a user reads a large number of stories, their *Karma* increases. Once the *Karma* increases to a level set by the site administrators, the user earns additional mechanisms for participating within the community. A secondary consequence of such legitimate peripheral participation (Lave & Wenger, 1991) is that participants understand the norms of the community and consequently they learn to make more socially valuable contributions (Lampe & Johnston, 2005). A range of related usability and sociability suggestions intended to move people from “readers” to “contributors” to “collaborators” to “leaders” are provided by Preece and Shneiderman (2009). These include ideas like making user contributions visible to other members, providing low threshold interfaces for easily making micro-

contributions, providing high ceiling interfaces that allow large and frequent contributions, giving awards, matching people with mentors or other experts, and providing conditional privileges.

We see considerable potential in applying some of these approaches to develop governance structures that support a more civically active population. Repeated calls to return power to the people have echoed from American presidents, from Lincoln's "A government of the people, by the people, and for the people," to Kennedy's "Ask not what your country can do for you but what you can do for your country" and now Obama's "We are the ones we have been waiting for." What is unique now is the massive potential to heed the call because of the information age where decreased communication costs, increased information availability, and increased computational power enable individuals to analyze that information and convert it into actionable knowledge (Malone, 2004). The potential avenues to organize and participate are more abundant than ever, and new governance infrastructures include advances in informatics that create new opportunities for citizen engagement, collective action, and representation as discussed throughout this chapter.

New avenues for participation will also help to reconceptualize volunteerism and its relation to government. Initiatives such as Serve.Gov give notifications of volunteer opportunities, but provide relatively few opportunities for people to become more central members of the service community. Perhaps it is time for a service reputation system that would enable friendly service-based competitions between neighborhoods and towns, provide evidence to future employers of social responsibility, and help identify experts that can share best practices? There is now precedent for forgiving student loan repayments for individuals who have been employed full-time for 10 years in public service. While this is helpful in attracting

individuals to work as full-time public servants, it falls short of encouraging all citizens to perform public service. A smarter governance infrastructure for citizen engagement may provide the mechanisms and metrics that would enable a system that would provide strong incentives for encouraging continuous, increasing public service by all citizens. The existing tracking of community service hours by high school students in many states suggests this approach may be viable. An earned participation approach would reframe our relationships in the social contract, returning to the notion that the social contract requires mutually enforceable responsibilities.

Lesson 5: Coordinate decentralized effort, but not diverse value judgments

An individual's incentive to participate in a community is closely aligned with their experiences (Lampe, Johnston, & Resnick, 2007). As organizations and communities become more diverse and active, the nature of leadership must also shift from centralized planning to coordinating (Shirky, 2005). In a new governance infrastructure, instead of controlling the behavior of individuals by predetermining their service options, leaders release the power back to the community through the use of an incentive-centered design that creates conditions for people to customize how they want to participate in their communities. This is a shift from a command and control to a coordinate and cultivate style of management (Malone, 2004).

Online communities like Slashdot.org and digg.com provide a proof of concept for how to enable member participation and co-production to serve key governance functions. From the micro-participation of many, the massive task of allocating and matching resources to appropriate communities and evaluating the performance of public services can emerge. Within Slashdot, hundreds of thousands of unique, daily users provide hundreds of comments on technology stories that are posted every half hour. How to accurately differentiate high quality comments from low quality comments is essential to the survival of online communities that face

massive competition for the attention of their users. The administration of Slashdot quickly realized that the site would grow beyond what they could centrally manage. Instead of hiring additional administrators or adding layers to a bureaucratic hierarchy, they decided to allocate the tasks of finding, categorizing, and moderating new content to the community at large. To address this challenge, Slashdot deployed a *distributed moderation system*. Unlike a centralized moderation system where site administrators evaluate the quality of comments based on established criteria, the system allows a diverse population of experienced participants to rate the quality of the posts they read, pushing each one higher or lower in the queue. The system administrator creates and facilitates the activity of the community but does not pass value judgments on the content within the space.

Recently, the United Kingdom invested in personalized websites for every citizen (Telegraph.co.uk, 2010), enabling a new suite of interaction options with government and each other. These sites may eventually allow individuals to provide feedback on specific government employees or branches, engage in new forms of organization, opt into or out of public services and have their tax obligations modified accordingly, or hold regular online votes for issues more important than American Idol. The sites can also be used to share information about community participation and to share best or common practices. For instance, if you want high use energy consumers to become more energy efficient, reveal what they are spending on the bill, along with what their average neighbor is spending and the use of an energy conscious neighbor, because awareness of social information influences individual behavior (Cameron, 2010). The possibility for innovative group level policies with predictable outcomes also becomes more viable. The most famous example of this approach is the Nobel Prize winning design of micro-loans, championed by Muhammad Yunis, where the responsibility to pay back a loan is shared

among community members. This shared responsibility leads to higher than normal payback rates and is similar to Kiva, which boasts a payback rate above 98% (Kiva.org, n.d.). A false paradox of releasing control to the community is that government officials will have less control over desirable community outcomes.

An example in a government context is the use of human-centered policies, putting the resources in the hands of the individuals to allow their decisions to emerge as the mechanism for change. One example of such a policy is open-enrollment education where education funding is tied to the student and each student is allowed their choice of which school to attend, including private schools. The families then invest time to find schools that match their values, assess quality, gather information on performance, evaluate which options are feasible, and ultimately make a choice according to their preferences and options. Sites like GreatSchools.org, which integrate government reported data on individual schools with comments from parents, students, and teachers, suggest the value of smart governance infrastructures in helping families find the best schools. An important consequence of this self-organization is that it also enables diverse values to co-exist without the need for a central administrator or authority to determine what is the proper set of values. With such facilitative leadership much of the efforts should be on understanding the situation, protecting the participation process, presenting the choices available to parents, and providing mechanisms that encourage collaboration.

The added value of tailoring participation opportunities to those most concerned and affected by the issue at hand is that it avoids top-down value judgments and unnecessary citizen conflict. By giving up administrator control over the specific content of a website site or the existence of particular schools, individuals are able to choose according to their own values and

preferences. The emerging school system then, for example, is accountable to directly reflect the values, preferences, and norms of its participants.

Lesson 6: Provide open access to useful data and tools in usable formats

One of the greatest lessons of the Internet age is that data is power. O'Reilly points out that “Virtually all of the greatest Internet success stories, from eBay, Craigslist, and Amazon through Google, Facebook, and Twitter, are data-driven companies” (2010, p. 31). Data is more valuable than ever, because it can be shared more easily, mashed up with other data more readily, and mined and visualized more thoughtfully. Companies are learning how to extract as much value as possible from their data. For example, in addition to making money through ad revenues, Google uses its ocean of data to provide better search results, learn how to translate languages more effectively, and train speech recognition software. Amazon uses its data to provide personalized recommendations to individuals based on the aggregate purchasing patterns of the masses.

On his first day in office, Obama issued a presidential memorandum ordering the heads of all agencies to make as much information publicly available as possible and when in conflict, give the benefit of the doubt to openness (The Economist, 2010). Unfortunately, in far too many cases our government has not allowed the public to reap the benefits of the data they paid to have collected. Often government faces legitimate, unresolved privacy or security concerns, but it may also simply leave the data in inaccessible or unusable formats. Opening and sharing information is key to unlocking the power of smart governance infrastructures that are transparent. Recent initiatives to make government information available to the public, including data.gov, will enable a new level of transparency and innovation by citizens who can build upon that data. In

recovery.gov, the administration has started an initiative to increase transparency in stimulus money spending. O'Reilly describes his vision of "government as platform" in this way:

Government maintains information on a variety of issues, and that information should rightly be considered a national asset. Citizens are connected like never before and have the skill sets and passion to solve problems affecting them locally as well as nationally. Government information and services can be provided to citizens where and when they need it. Citizens are empowered to spark the innovation that will result in an improved approach to governance. (O'Reilly, 2009)

Several researchers have already strongly argued that a usable data format is at least as important as the fact that it is available in the first place (Lathrop & Ruma, 2010). To be useful, data must be machine-readable and provided via Application Programming Interfaces (APIs) that other programs can call upon to serve up data in a useful manner. The federal government's Chief Information Officer is working to create a culture of accountability through policy and by redesigning how national data is stored and made available. They created the largest data consolidation in history that will reduce government IT operations which are currently distributed over 1,100 data centers, and will develop an information infrastructure that is more efficient, accessible, and secure (Miller, 2010).

Citizens have shown that they will develop tools and resources to analyze and make sense of government data. Some of the most innovative uses of technology to increase transparency through public data are happening at the local level. Integration of data, social media, and visualizations are enabling novel approaches to neighborhood watches, illness tracking, city maintenance, and policing (Catone, 2009). Policy informatics approaches use real-time analytics and data visualization to provide a systems perspective for decision makers that vastly improves the use of micro and macro data for early interventions and policy deliberations (Kanter & Litow, 2009). Dynamic websites like Nation of Neighbors overlays law enforcement information

with maps to empower citizen involvement in keeping neighborhoods safe. The Missouri Accountability Portal (mapyourtaxes.mo.gov) provides the information and the data processing tools to spatially and programmatically visualize where every tax dollar is spent in the state.

Layers of bureaucracy increase the size of government and separate people and government, which creates long accountability chains between action and responsibility, obfuscates mistakes, inhibits scrutiny, and creates more avenues for political influence (Kjaer, 2004). Thus, transparency, the accurate availability of information about performance, is needed more than ever. Theoretically, if an elected representative is responsible for representing all the people in her district, it should not matter what political party she is affiliated with, the people in her district and their interests are the same either way. Yet few deny the influence of lobbyists. And now corporations enjoy the same degree of influence as individuals with the 2010 Supreme Court decision in *Citizens United v. Federal Election Commission* to overrule two precedents that limited corporate spending on elections (*Citizens United v. Federal Election Commission*, 2010). Another challenge of a representation system is the split accountabilities of representatives. Elected officials should be accountable to their constituents, but are now strategically accountable to their party and are incentivized to be accountable to those that subsidize their elections (Lessig, 2009). Although movements like changecongress.org are attempting to create fair election standards, another approach is to increase transparency through an increase of publicly available data. Competitions such as *Apps for Democracy* showcase other examples, as do the tools provided by the Sunlight Foundation to increase transparency in government.

While providing raw data via appropriate means will enable the creation of thousands of novel mashups, mobile apps, and visualizations, there are other valuable government resources

that should be kept open. Most notably, access to scholarly publications funded by the U.S. Government should be made available to all. Historically, this has not been the case, as many publishers retained copyright and included contracts that did not allow authors to re-post articles. A healthy “open access movement” has emerged in recent years, led by The Scholarly Publishing & Academic Resources Coalition (SPARC). Some open access victories were achieved when recent legislation mandated that all National Institutes of Health (NIH) funded research publications be uploaded to PubMed Central within 12 months of appearing in peer-reviewed journals. Current legislation is now being considered that would extend this mandate to other federally funded research papers. These are promising steps in turning our national assets into a valuable resource for citizens.

Conclusion

As government budgets are tightened, a central question is how we make things better without spending more money (Cameron, 2010). The ongoing economic crisis coupled with a political ethos to open government and the widespread use of information and communication technologies have created an environment of accelerated change (The Economist, 2010). As our capacity for useful, flexible information management increases, so does the potential of our nation. If governance is the institutional capacity of a public organization (Kjaer, 2004), the capacity of that system can be increased by the thoughtful application of information technology to increase the role of the public in governing. Smart, participation-based governance infrastructures will be organized around specific problems, identify clear problems and pathways to contribute, coordinate participation while avoiding value judgments, encourage long-term community involvement, and provide open access to useful resources.

Every day technology advances and it enables people to do more for themselves. This chapter only scratched the surface of how we will continue to discover new forms of organizing, to innovate and use new knowledge creatively, and to push the assumptions of what governance infrastructures are and how they can be used. As new technologies like cloud computing, augmented reality, ubiquitous computing, data mining, and whatever follows develop, so will the possibilities for smart governance infrastructures. Investing in smart governance infrastructures identified in this chapter returns power back to the people, but not freely, because greater participation comes with higher expectations, accountability, and responsibility. The evolution of governance is inevitable, but the timeframe and the path are unknown. Instead of stumbling forward and reacting with ad hoc governance fixes as problems emerge or exacerbate, we can engage these challenges as a society by thoughtfully designing systems to act proactively.

Author Biographies

Erik W. Johnston is an Assistant Professor in the School of Public Affairs at Arizona State University and the Co-Director of the Center for Policy Informatics. He is currently engaged in four lines of research: 1) assessing how models and simulations can aid in policy decisions, 2) understanding the policy consequences of implementing and sustaining collaboration in civic, business, and academic contexts, 3) designing and analyzing smart governance infrastructures in distributed organizations, teams, and communities, and 4) applying complex systems methodology and theory using agent-based modeling as a complement to quantitative and qualitative research methods. He is one of the founding members of the Center for Policy Informatics and is an affiliated faculty with the Decision Theater at ASU. Dr. Johnston earned a PhD in Information and a Certificate in Complex Systems from the University of Michigan. He is a two-time NSF IGERT fellow, in the STIET (Socio-Technical Infrastructure for Electronic Transactions) and IDEAS (Institutions, Diversity, Emergence, Adaptation, and Structures) programs.

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