The Transformational Effect of Web 2.0 Technologies on Government

Ines Mergel
Maxwell School of
Citizenship and Public
Affairs
Syracuse University
iamergel@maxwell.syr.edu

Charlie Schweik
Center for Public Policy and
Administration; National
Center for Digital
Government
UMass Amherst
cschweik@pubpol.umass.edu

Jane Fountain
National Center for Digital
Government
UMass Amherst
fountain@pubpol.umass.edu

Abstract:

Web 2.0 technologies are now being deployed in government settings. For example, public agencies have used blogs to communicate information on public hearings, wikis and RSS feeds to coordinate work, and wikis to internally share expertise, and intelligence information. The potential for Web 2.0 tools create a public sector paradox. On the one hand, they have the potential to create real transformative opportunities related to key public sector issues of transparency, accountability, communication and collaboration, and to promote deeper levels of civic engagement. On the other hand, information flow within government, across government agencies and between government and the public is often highly restricted through regulations, specific reporting structures and therefore usually delayed through the filter of the bureaucratic constraints. What the emergent application and popularity of Web 2.0 tools show is that there is an apparent need within government to create, distribute and collect information outside the given hierarchical information flow. Clearly, these most recent Internet technologies are creating dramatic changes in the way people at a peer-to-peer production level communicate and collaborate over the Internet. And these have potentially transformative implications for the way public sector organizations do work and communicate with each other and with citizens. But they also create potential difficulties and challenges that have their roots in the institutional contexts these technologies are or will be deployed within. In other words, it is not the technology that hinders us from transformation and innovation – it is the organizational and institutional hurdles that need to be overcome. This paper provides an overview of the transformative organizational, technological and informational challenges ahead. Presenting such a paper at APPAM will provide us with an important opportunity to vet these ideas to a community of interested scholars, at the beginning stages of a major research program.

APPAM track:
E-Government: Implementation and Organizational Transformation

1. The Emergence of a Web 2.0 Paradox in the Public Sector

Recently there has been an explosion in the use of so-called "Web 2.0" technologies. Examples include web content management systems, wikis, blogs, image and video sharing (e.g., YouTube, Flicker), social networking (e.g., MySpace, FaceBook), news sharing and ranking (Digg, Reddit), social bookmarking (e.g., del.icio.us) and 3-D virtual worlds (e.g., SecondLife). These technologies are moving from the private and business use into public sector domains. Wikis exist or are being developed to help citizens understand legislation (e.g., ReadableLaws.org). "Mashup" applications combine public data, often in a geographic context (e.g., programmableweb.com/tag/government). These types of technologies are now being deployed in government settings. For example, public agencies have used blogs to communicate information on public hearings (e.g., Federal Trade Commission), Microblogging using Twitter to disseminate news (http://twitter.com/dfletcher, CTO State of Utha), wikis and RSS feeds to coordinate work (Environmental Protection Agency), and wikis to internally share expertise (State Department's "Diplopedia"; Department of Defense's Techpedia), intelligence information (Intellipedia), information sharing between soldiers in the battlefield (e.g., CompanyCommand.com and PlatoonLeader.org), and congressional MySpace pages (Hardy, 2008).

The potential for these kinds of innovations create a public sector paradox. On the one hand, they have the potential to create real transformative opportunities related to key public sector issues of transparency, accountability, communication and collaboration, and to promote deeper levels of civic engagement. For example, public sector Web 2.0 applications might initiate a redesign of the official media and communication strategy of government

organizations. On the other hand, information flow within government, across government agencies and between government and the public is often highly restricted through regulations, specific reporting structures and therefore usually delayed through the filter of the bureaucratic constraints. Public sector officials may therefore be adverse to sharing information with others outside the organization (sometimes for very legitimate reasons) and may fear a loss of control over this information. The recent example of U.S. Army soldiers in the battlefield who implemented wiki technology to speed up peer-to-peer information about battlefield conditions is an example in point. The technology was implemented by soldiers in the field which encountered deep concerns by higher level officers about the break in chain-of-command information flow (Rid, 2007).

What the emergent application and popularity of Web 2.0 tools show is that there is an apparent need within government to create, distribute and collect information outside the given hierarchical information flow. Clearly, these most recent Internet technologies are creating dramatic changes in the way people communicate and collaborate at a peer-to-peer production level over the Internet (Benkler, 2006). And these have potentially transformative implications for the way public sector organizations do work and communicate with each other and with citizens. But they also create potential difficulties and challenges that have their roots in the institutional contexts these technologies are or will be deployed within. In other words, it is not the technology that keeps us from transforming and innovating – it is the organizational and institutional hurdles that need to be overcome (Fountain, 2001).

For the purpose of this paper, we rely on O'Reilly's seminal definition of Web 2.0 technologies as: "Web 2.0 is a set of economic, social and technological trends, that

collectively form the basis for the next generation of the Internet – a more mature, distinct medium characterized by user participation, openness, and network effects." (2005). This term indicates the changing trends in the use of World Wide Web technology and web design that aims to enhance creativity, secure information sharing, collaboration and socializing on the web. The key technological difference to the so-called first generation of websites is that it allows users to actively create content and directly interact with each other, instead of a one-directional content dissemination. The sociological difference to Web 1.0 is that users are at the center of all activities and Web 2.0 technologies allow for bi-directional connections with the site creator and other users generating content online (Cormode & Krishanmurthy, 2008). As applications are being adopted in the public sector, the social computing component including user-generated content creation might have hugely disruptive effects on Government and its standard operating procedures (McCarthy, 2007).

This paper is helping us sketch out a research agenda to study this emerging phenomenon in the public sector. The paper is organized as follows. In Part 2, we briefly discuss four main drivers that are creating the explosion of Web 2.0 deployment in all sectors. In Part 3 we specifically focus on some key concepts that are underlying Web 2.0 applications, many of which are probably used by people attending the APPAM conference. Here we are trying to clarify why Web 2.0 is generating such excitement in general and why governments might be interested in deploying applications of their own utilize this interactivity within and across agencies, as well as with constituents. Part 4 provides a review of public sector Web 2.0 cases that we have been able to identify. Our main point here is to show that these are indeed occurring, and there is enough innovation in place that the time is

right for this phenomenon to be studied. Part 5 provides a more thorough discussion about the transformative effects of Web 2.0 in the public sector. Here we focus more specifically on the organizational, informational and technical challenges that may occur. In Part 6, we close the paper with some thoughts regarding establishing a research agenda on the impact of Web 2.0 in government.

2. General Drivers in the Emergence of Web 2.0

We have identified four main drivers which are influencing the current trend of information sharing, access and involvement of citizens when it comes to Web 2.0 and technology in general in government: technological, social, economic and legal drivers.

Technological drivers

Technological drivers for the adoption of new technologies mainly include the rapid diffusion of broadband by households which enable an increasing number of citizens to create their own content, post it, for example, on video or photo sharing websites and in return also download larger content, such as media files. Prior limitations of dialup connections did not allow this development. According to a new PEW study, this trend will become even more widespread when newer generations of high-speed wireless broadband become available more widely (PEW Internet & American Life Project, 2007). Moreover the higher processing speeds and memory capacities, as well as access to higher quality production equipment, such as digital cameras, video recorders and mobile phones, allow almost synchronous production and distribution on-the-go. A past hindrance has been

turned into a facilitator in the Web 2.0 tool generation: tools are more accessible and have a low learning curve, are generating HTML in the background, and enable users to create and share their content without any professional background. These technological drivers have the advantage that they allow a broader audience to create, share and access online content removing barriers of previous Web 1.0 generations.

Social drivers

Social drivers are indirectly reflected in the desire of the generation of the so-called "digital natives" to create user-generated content and share it with their friends and contacts -- oftentimes without hesitations about how their public self will be displayed (Gasser & Palfrey, 2008). Previously, the creation and dissemination of online content was primarily reserved to highly skilled and tech savvy early adopters. This trend is still true when it comes to more professional content such as video production. User-generated videos are still mainly produced by a small number of people, but through the low-tech distribution and access procedures viewed by a very large amount of people. One characteristics of digital natives is that they have the desire to express themselves online without taking potential consequences of exposure or digital online traces into consideration (boyd, 2007, 2008). Moreover, they search for more interactivity online than the traditional media platforms can offer, such as only one-on-one communication via chats, or unidirectional channels such as TV, are building the basis for the development of online communities and collaborative projects. Increasingly, this development is also spreading into other age groups and is no longer unique to the MySpace-generation: especially during the election 2004 and 2008 more and more citizens are involved in social engagement, such political opinion building through

social networking sites and blogs, as well as the integration of online and offline contacts (e.g., Moveon.org, Obama's and McCain's Facebook groups, profiles and causes applications).

Economic drivers

Economic drivers for the rise of Web 2.0 technologies include investments in advertising and investments into the future value of popular social network sites, such as Facebook or MySpace, by corporations such as Microsoft (McCarthy, 2007). Moreover, media companies are actively producing added value to free online services and are therefore catering towards the so-called "long-tail": small quantities of product are distributed cheaply (e.g., applications on Facebook, or the iphone), instead of large investments into expensive software versions and upgrades (Anderson, 2008).

The economic advantage of Web 2.0 application in comparison to traditional software applications is that most of the services are free of charge – mainly because they are labeled as lifelong beta versions (O'Reilly, 2005). Only a few "gated" services charge a monthly fee for premium services.

Legal drivers

Web 2.0 technologies and the accompanying behavioral changes of the users also have *legal drivers:* The emerging distribution platforms allow easy, relatively low-tech creation and sharing of work. The collaborative culture of open source software development, driven by an innovation in the use of copyright law where licenses mandate a sharing culture rather than proprietary protection, has led to a joined product creation in which thousands of

programmers are voluntarily producing a product for free (Lerner & Tirole, 2005). Traditionally software was produced with substantial investments in man-power and organizational overhead by existing media companies. Every new version was connected with a new revenue stream for the creators. The Creative Commons licenses – inspired by the example of open source software production – now allows for flexible licensing and copyright schemes that encourage open access, sharing and the prospect of creating new derivative works in digital content rather than treating information content as closed and proprietary (Creative Commons, 2008). We'll revisit this in the next section when we discuss open source and open content.

The result of these four drivers taken together is a productive and technologically enabled and empowered user community with highly disruptive effects on existing business models, but also high expectations when it comes to access, information distribution and freedom of interaction. As both citizens and civil servants are becoming more tech-savvy and informally learning from each other, innovations are emerging which is solely user driven and increase the level of demand for interactivity with government agencies and public sector units. Let us now turn to a more specific discussion of key underlying concepts that reside "under the hood" of many of the Web 2.0 applications we are familiar with.

3. Key Concepts Underlying the Web 2.0 Phenomenon

We have identified four key concepts that are supporting the Web 2.0 phenomenon in the public sector: peer production, open source and open content, user-generated innovation, crowd sourcing and task granularity.

Peer Production

We imagine almost everyone at APPAM is aware of the web search engine Google.com, or the online bookstore Amazon.com. Perhaps a slightly smaller number are familiar with the web-based encyclopedia Wikipedia, or the video sharing site YouTube.com. An even smaller group may be users of social networking websites like MySpace.com and FaceBook.com, and a roughly equal number may use news sharing sites like Digg.com and Slashdot.com or the web-bookmarking site called "del.icio.us." Regardless of whether our estimates are right, these are all examples of high profile Web 2.0 websites, where users interact to some degree with the site, rather than just read static text.

What many of the high-profile Web 2.0 sites have in common is that they harness the productive power of their users. Yochai Benkler (2006) refers to this as "Commons-based Peer Production." To Benkler, Peer-Production describes a special kind of production system where individuals act in response *to their own needs and interests and in a decentralized manner.* In the case of Google, users are actively searching for things they want to find for whatever work they are doing. But behind the scenes, Google's PageRank algorithm uses the hyperlinks created by individual web authors as a "vote" for the importance of such pages (Google, 2008). We'll return to this in the discussion below on task "granularity".

A similar situation exists with Amazon.com. Users, based on their own self interests, actively search for, review and purchase books. But as this is done, Amazon's technology keeps a database of the kinds of books that you bought and, based on that data, provides recommendations of other books you might like based on the purchase history of others. The review function through which every user can add feedback and book reviews to any page creates a public value for the overall community. The PageRank technology in Google

and the book recommendation system in Amazon are examples of efforts to employ the work of end users who are doing tasks motivated by their own interests to create systems of accreditation and relevance (Benkler, 2006).

The video sharing site Youtube.com is more interactive (at least compared to Google's search system), in that it not only allows people to search and view video (keeping track of how many people watch each one), but it also relies on end users to provide YouTube with actual content (new videos). This is true as well with some of the other high profile sites we mentioned earlier. MySpace, FaceBook, Digg, Slashdot, and others all rely on this idea of peer-production.

The other important attribute of commons-based peer production besides the fact that they rely on users doing things that interest them for content, is that these efforts thrive in "crowd-like" (Surowiecki, 2005) situations where a huge number of potential users exist. Most, if not all, of the high-profile websites listed above have users providing content from across the globe. This leads us to the next foundational topic: open source.

Open Source and Open Content

Open source describes a phenomenon that began in the mid-1980s that has occurred in computer programming.[1] To summarize greatly, open source differs from traditional proprietary software in that the computer source code – the internal logic of the program – is made available for anyone to access and read. This differs substantially from proprietary code that is delivered in a binary format that only computers can read. The great innovation

---

[1] For a history of open source, see Weber (2004). For relatively up-to-date and more detail on the subject, see Deek and McHugh (2008).

made in the early days of open source (what then was called "free/libre" software) was its innovative use of copyright law, a concept sometimes referred to as "copyleft" (Deek & McHugh, 2008). A copyleft license provides the user with the right to copy, modify and redistribute new derivatives of that software, but mandates that the derivative be licensed the same as its "parent" software. This, in and of itself, was a great innovation, and has inspired others to develop similar licenses for digital products other than software. The most famous of these are the Creative Commons licenses developed by intellectual property scholar Lawrence Lessig and others with the organization of the same name (Creative Commons, 2008). Creative Commons licenses are now ubiquitous on the net, attached to products such as papers, images, music, and photographs.

Benkler (2006:63) refers to open source software collaboration as the "quintessential instance of commons-based peer production." As he puts it, open source "depends on many individuals contributing to a common project, with a variety of motivations, and sharing their respective contributions without a single person or entity asserting rights to exclude either from the contributed components or from the resulting whole." The problem we have had with Benkler's depiction of open source as peer-production is the issue of team size. Several recent studies, beginning with Krishnamurthy (2002) and including one of our own (Schweik & English, 2007), have shown that most open source projects are usually small teams. Open source projects typically do not have massive teams of contributors like the peer production websites mentioned above.

User-Centered Innovation

In addition to the copyleft licensing innovation, there are two other surprising points

11

to make related to the open source phenomenon. First, at least until about five years ago, the majority of software developed (which was a sizable amount) was written by *volunteer* developers. These were people with technical skills, who wrote software in their free time, and who may or may not have been gainfully employed. Stebbins (2001) refers to this concept as "serious leisure," a term he coined back in 1982 before the idea of open source existed. Now, however, more developers are *paid,* as businesses, governments and nonprofit organizations have entered the open source game, leading to a significant change in the composition of the "open source participant ecosystem."

The second important point is that historically, the majority of the software produced was developed by programmers who are also *users* of the software (Eric von Hippel & von Krogh, 2003). The idea of users as innovators, adds significantly to the incentives driving people to contribute, as well as the quality of their contributions (E. von Hippel, 2005a). The existence of open source collaborations as "user-centered innovation networks" (E. von Hippel, 2005b), is somewhat a surprise to many, in that these innovators would freely reveal their innovations. But the open source community demonstrates that this indeed happens, and in a major way.

Research over the last 5 years has helped to explain the incentives that drive volunteer contributors to behave this way (Ghosh, 2005; Lakhani & Wolf, 2005). Solving a specific need (the user centric component) is one common motivation. Others include the enjoyment of a challenging problem (serious leisure), learning and skill building through the collaboration with others, and signaling skills to others for ego gratification or possible future job opportunities. In addition, recent studies by Krishamurthy (2002), Riehle (2007) and Deek and McHugh (2008) show how firms are making a profit using a business model

built around or upon open source products. For example, there are businesses who (1) build complete systems to solve a client need (system integrators); (2) provide technical support services; (3) distribute open source products; (4) create new software products built with open source components; or (5) dual-license their software (one open source, one proprietary). For our purposes a detailed understanding of these business models is not important. What is important is that these businesses also have their own "user-centric" needs, and as a result are increasingly committing their own resources (e.g., employees, monetary donations) to open source projects.

Crowdsourcing

The idea of business needs leads us to another relevant concept we touched on earlier – "crowdsourcing" (J. A. Howe, 2006). Howe (2006) defines it this way: "*Crowdsourcing is the act of taking a job traditionally performed by a designated agent (usually an employee) and outsourcing it to an undefined, generally large group of people in the form of an open call.*" In other words, a company posts a problem they are facing on the Internet, individuals submit solutions, winning ideas are rewarded, and the company mass produces the innovation for profit (Brabham, 2008a). Crowdsourcing is an idea that tries to capture the idea of mining ideas from large groups of people, as highlighted by James Surowiecki in his 2004 book *The Wisdom of Crowds.* The idea, in its current form, embraces the peer-production and user centric innovation concepts, but differs from open source in that the request for help comes from a firm and the innovation becomes their product, compared to open source where the product remains in the public domain (Brabham, 2008a). In a more recent study of participants in iStockphoto.com (described below), Brabham (2008b) finds that, like open

source participants, they are motivated by enjoyment and fun, but also, naturally, by the prospect of making money. However, unlike what is thought to be true in open source, they do not appear to participate for peer recognition or to build a network of collaborators. So, there appear to be motivational differences between crowdsourcing and open source. Crowdsourcing also differs from peer-production efforts like Wikipedia, and the other web examples above, in that in the former an organization is creating a kind of contest for help, whereas in the latter, the actions are driven solely by the user's own interests and motivations.

The NASA Clickworkers project (NASA, 2001) is an example of an early crowdsourcing-type effort driven by a government agency's needs with no monetary reward attached. In Clickworkers, volunteers were solicited to help digitize and categorize craters found on images of the Martian surface, taking advantage of serious leisure amateur astronomers. The initial project was successful enough to lead to a second such effort which began in 2007 (NASA, 2008). Other examples of non-monetary compensation peer production crowdsourcing efforts have emerged as well. One, similar to NASA's Clickworkers, is the Digital Proofreaders (DP) project (Digital Proofreaders, 2008), which asks volunteers to help digitize books in the public domain. Serious leisure volunteers utilize a web-based interface to compare one scanned page with the same digital text read by an optical character recognition reader, and to spot and to fix problems with the character recognition process. (The "one page at a time" concept is important and relates to the idea of granularity discussed below.)

Another example is the ReCAPTCHA project (ReCaptcha, 2008), which, like DP is an effort to convert scanned images of books into digital text e-books, but at the same time,

simultaneously helps protect interactive websites (and email addresses) from spam. ReCAPTCHA is the name for a small bit of software code that can be added to interactive websites which is invoked when the user is entering in some information into the website. Similar to DP, ReCAPTCHA requests the user to prove he or she is a human and not an Internet spam "bot" by having them read two scanned words that could not be interpreted correctly by an OCR reader, and type them in. ReCAPTCHA software collects these two typed words for the new digital text version of the book (ReCaptcha, 2008).[2] The people who really have the incentive to use reCAPTCHA are not the end-users of websites but the webmasters who want to protect their systems from spam (although indirectly, this helps the users of their website as well). In other words, ReCAPTCHA's in a way gets "forced" volunteers through webmaster's concerns for Internet security. But like the others, it takes advantage of peer production or a kind of crowdsourcing, to get a problem solved.

One thing related to crowdsourcing that is now becoming apparent is that if it isn't employed in a carefully planned way, it can potentially produce lots of data or products that are not helpful. One such example was the deployment of a crowdsourcing effort on the Amazon.com's Mechanical Turk project (http://www.mturk.com/mturk/), which is an effort to match up people who want to do small tasks in their spare time for pay per task. In 2007, this platform was used to harness the labor of as many as 50,000 volunteers to look through, online, aerial photo images of Nevada for plane wreckage of adventurer Steve Fossett. The effort led to a significant number of false leads sent to the search coordinator,

---

[2] One reason that digital or ASCII text is better than scanned pages is that the digital text takes up less computer memory, making it easier to be used in equipment like e-book readers.

with no helpful results (Friess, 2007).[3]

Recently, Lukensmeyer and Torres (2008) proposed to apply the idea of crowdsourcing to government citizen engagement efforts. They acknowledge there are several reasons to be cautious or skeptical. First, citizens are more sensitive when it comes to privacy when dealing with their government. Second, government problems are often more challenging compared to problems found in the private sector. Third, getting acceptance of government agencies toward these kinds of innovative practices is harder than in the private sector. Fourth, the present "policy framework" for citizen engagement and its potential reform moves at a glacial pace, making it hard to implement such a radical idea. But they also note one reason to forge ahead: the gap between how citizens and industry use the Internet and government will continue to widen, leaving a disenchanted citizenry. The authors emphasize this point with the example that a very useful peer production-like application during the Katrina hurricane disaster, called "Peoplefinder," a relatively simple "GoogleMaps mashup" application to help people locate family and friends, was implemented by a company rather than a government agency.

Task Granularity

The final foundational concept we wish to introduce is "task granularity," which is embedded in all of the examples we have discussed so far. Benkler (2006) reminds us that in

---

[3] In this research we read through some comments to the story posted by Freiss (2007)by actual participants who conducted the search about this outcome. Some were arguing that the crowdsourcing idea was a good one, but from their perspective it wasn't implemented correctly, for example, in terms of the instructions that were provided. Another point was that end users who were doing the searching were bypasses a kind of "chain of command" when they found what they thought was a lead. Instead of contacting the Mechanical Turk people or the people that funded the project, they were contacting the search and rescue official directly via email and phone.

terms of systems of production, we face two primary scarcities: (1) human creativity, time

and attention, and (2) the computation and communication resources used in information

production and exchange. Computing and the Internet, of course, have greatly reduced the

cost of the latter. But this hasn't changed the fact that human creativity, time and attention,

is a scarce commodity. We all are constantly making decisions about how we use our work

and leisure time. This is why the concept of task granularity is especially important.

Task granularity refers to "the size of the modules, in terms of the time and effort

that an individual must invest in producing them" (Benkler, 2006). It is an important concept

in peer-production commons, because it influences people's decisions on whether to

contribute or not. Task granularity "sets the smallest possible individual investment

necessary to participate in a project," and "if this investment is sufficiently low, then

'incentives' for producing that component of a modular project can be of trivial magnitude"

(Ibid).

In Table 1, we provide some common tasks found in some of the peer production

websites referenced earlier. In this table we build upon Benkler's granularity concept by

introducing a 5 category ordinal scale. At one end, is the "extremely coarse grained task,"

which will require the participant to use a large amount of his or her time. Examples we

provide are taking the lead author role in a Wikibook (collaborative writing of an entire book

using wiki technology as the authoring mechanism), or participating as a lead developer in an

open source programming project. These kinds of tasks will require a significant time

commitment over a substantial time period. At the other end of the ordinal scale is a term

we call the "Transparently Grained" task. These are tasks that peer production participants

undertake unknowingly; that is, the technical infrastructure they are using takes advantage of

the information they are providing to create new information that is useful for another

purpose.

Insert Table 1 about here

This brings us back to the examples that opened this section of the paper. As we

mentioned earlier, the Google PageRank search formula capitalizes on web page authors' use

of hyperlinks. Web page authors don't link to other pages to help Google's search system

operate better. They place hyperlinks on their web pages because, for some reason, it is

useful for their own purposes. It is this work that the web authors do for their own self

interest that Google capitalizes on. Google reads these hyperlinks and builds PageRanks

from that information. A similar situation exists with Amazon.com. Their site keeps track of

the buying activities of other users undertaking their own self-motivated book purchases,

and uses this information they capture to recommend books you might want to read.

Amazon users don't buy books to help Amazon make recommendations to others. But

Amazon takes advantage of the situation by collecting and managing that information. The

same "transparently grained" type tasks exist in the ReCAPTCHA or DP examples we

described earlier as well. Tasks that have transparent granularity are ones requiring (usually)

very small bits of time and are accomplished by technology taking advantage of work you

would do anyway.

Table 1 provides examples of tasks that fall between the two extremes of "extremely

coarse grained" peer production tasks and "transparently grained" tasks. Peer production

efforts that can modularize and create fine-scale or no grained tasks will have a higher

likelihood of success compared to ones that require coarse-grained efforts.

In short, these fundamental concepts – peer production, open source and open content, user centered innovation, crowdsourcing, and task granularity – drive much of the excitement with regard to the potential of Web 2.0 in all sectors. It raises questions related to how and in what circumstances can government take advantage of these new opportunities, primarily:

- Gaining "wisdom from the crowd"; utilizing Web 2.0 to gather information from constituents or other government employees to make decision-making more inclusive or to gather larger, more collective and aggregated insight;

- Creating new forms of production following the open source or open content collaborative paradigm;

Finally, in both of these types of circumstances, attention to task granularity is likely important for the effort to work effectively.

Moreover, the emergence of these kinds of interactive, networking and collaborative technologies, leads to two pressures on the public sector to harness these technologies – one internal, and one external. From an internal to the organization perspective, technological entrepreneurs inside government, likely through their own personal use of these external systems, witness the productive potential of these Web 2.0-based systems of production. It is likely that some within government are innovators who see many situations where such peer production, open source-like or crowdsourcing approaches might be applied to solve public sector problems whether it be harnessing the productive capabilities between internal government employees, across levels of government, or between government employees and citizens. From the external organizational perspective, citizens witnessing or participating in productive Web 2.0-based systems implemented in private

sector domains may be asking, "why can't government agencies take advantage of this kind

of interactivity and collaborative production?" A good example of this latter point is the

rapid deployment by private sector individuals to utilize Web 2.0 technologies to help locate

victims of the Hurricane Katrina disaster (see for example, the I'm-OK website at

http://katrina.im-ok.org/about/). The question invariably was asked by many – why didn't

government agencies innovate in this way?

4. Current applications of Web 2.0 technologies in Government

But indeed, in some areas of government, Web 2.0 deployments are occurring.

However, the degree of adoption of Web 2.0 technologies in government or in general in

the public sector is only indirectly measureable – using the potential of Web 2.0

technologies that were so far mainly harnessed in the corporate sector. Technology analysts,

such as the Gartner Group predict the potential of online citizen social networks for the

creation of public value (Stevens, 2008) and indicate that the potential of Web 2.0

technologies has been underestimated in government so far.

Table 2 gives an overview and a very preliminary classification of current adoption

of Web 2.0 applications in the public sector. Currently, there are a number of innovators

and early adopters who are trying out either single application solutions, such as blogs or

Twitter with some degree of synchronous interaction with their stakeholders, and others

who have started to introduce a full Web 2.0 suite in an internal, more or less controlled

learning environment. The innovators are characterized by a handful of highly innovative

Public CIOs and CTOs, for example in Washington DC and Alabama (Brabham, 2008b;

Lynch, 2008). The most part of government has to be characterized as reluctant followers or

even laggards resisting user-generated content.

<div align="center">

Insert Table 2 about here

</div>

The extent of the adoption of Web 2.0 is characterized by two different sets of technologies: asynchronous and synchronous. Asynchronous technologies are characterized by uni-directional information dissemination, with little to no interaction and exchange with the stakeholders. Examples include websites (with contact forms), mass emails, daily news updates on Website, and Blogs without commenting functionality. Synchronous technologies allow bidirectional interactions with stakeholders and include functionality of the "social web", allowing citizens or employees to create profiles and interact with the agency and other users. Examples include (micro)blogging, Wikis, Podcasts, RSS feeds, etc.

Some of the initiatives listed in Table 2 are clear examples of peer production. They are efforts to harness either internal to government or external to government (e.g., citizens) to help in some way. Others, like the NASA Clickworkers example, are clear examples of the use of crowdsourcing. But which applications in the list actually take advantage of the user-centric innovation as an incentive for participation – that is, employees or the agency contributing to the interactive website content because they themselves use the content to get work done – is an open empirical question. The same is true about how the concept of task granularity relates to this list. We might hypothesize that synchronous Web 2.0 sites with very fine scale task granularity (e.g., tasks that take very little time to accomplish) may be more successful and productive than ones that require lots of effort by website participants. But again, this is an open empirical question that is yet to be answered.

5. Transformative effects of Web 2.0 in the public sector

Web 2.0 technologies can have hugely disruptive effects on the existing organizational and procedural elements of any kind of organization. Examples for these disruptive effects can be found in the publishing industry: the blogosphere has created an immense threat to the existing business model of news creation and distribution in the corporate sector. Information sharing about news and events is no longer reserved to the traditional news channels such as TV, Radio and print media. On the contrary, especially the publishing industry has suffered an immense drop in subscriptions and sales (Carr, 2008; Journalism.org, 2008; Thottam, 1999): there is a tendency, that news are nowadays becoming more reliable when they are replicated and verified through citations and linkages on blogs.

In addition, a new information paradigm is emerging in the public sector. Several recent developments within government, such as FOIA - Freedom of Information Act (U.S. Department of State, 2007), Information sharing strategy of the intelligence community (Director of National Intelligence, 2008), or the "Knowledge management act of the army" (The United States Army, 2008) are slowly softening the traditional "Need to know" culture and replacing it by a "Need to share" attitude, and in some rather surprising organizations. These new information creation and sharing developments within government are accompanied by a wide variety of web 2.0 technologies (see Table 2) on all levels of government.

The transformative effects can be divided into organizational and cultural, informational and technological challenges.

Organizational and cultural effects of Web 2.0

An important characteristic of Web 2.0 technologies is the emerging collaborative and integrative element: tools like Intellipedia, a Wiki application in the intelligence community are grew faster than Wikipedia during the same time period due to the contributions of a set of highly motivated and engaged employees (Gross, 2006). One of the challenges for an agency that has identified to integrate a wiki into their daily routine of knowledge creation and knowledge dissemination is how to motive employees to voluntarily share their knowledge with everyone in the organization. Web 2.0 technologies such as Intellipedia are challenging the organization as whole: standard operating procedures might have to be reengineered, or are completely scrutinizing well-established routines. Therefore it is difficult to engage a critical mass to contribute to an additional system (Mergel, Lazer, & Binz-Scharf, 2008). As Behn states, it is difficult to motivate public sector employees' to go the extra mile beyond the established job descriptions and immutable payment structure (Behn, 1995; Kirlin, 1996). In order to increase the motivation to participate it is necessary to go beyond traditional incentive systems: User-centered innovation is a potentially important one. Web 2.0 applications that are developed and put in place by employees who are trying to solve work challenges or improve the functioning, collaboration or interaction of employees and other stakeholders will be one major incentive. A focus on task granularity demands in these systems will be another. Ones where interaction is quick and easy will more likely succeed over ones requiring lots of work by individual contributors. Incentivizing needs to focus on the Baby boomers and digital immigrants who have little to no experience with Web 2.0 applications. The Intellipedia example shows that SWAGs ("Stuff we all get", such as coffee mugs, lanyards, or shovels) work as initial incentives to

activate and reward the first generation of users. After these low value rewards are phased-out and cannot incentivize the more resistant parts of the organization, additional needs-based incentives might have to be considered: professional development rewards, to satisfy the needs for self-esteem and self-actualization; or recognizing contributors as experts based on the number of articles added to a wiki. In addition, an official measurement of efficient knowledge sharing using Web 2.0 tools can be integrated into the performance review and annual evaluation systems. This increases the official character and top management buy-in into new routines and the importance. In all forms of organizations, but especially in government there is a culture of maintaining the status quo and employees might take on a defensive approach against innovation. The biggest challenge is therefore to understand what motivates individual employees to contribute and adapt the existing HR policies and systems accordingly.

Web 2.0 technologies have the advantage that it is widely distributed and accepted in the private arena. Tools such as YouTube, Wikipedia, Flickr, or Facebook lowered the learning curve for content production and sharing online and therefore lowered the barrier to use new forms of technology. There is the potential danger and opportunity that the public might shape emerging communities: the ease of usage stimulates self-regulation and self-organization. : Web 2.0 as additional tools and channels for citizen participation and interaction with elected officials. This has potentially disruptive effects on power balances in the sense that it might undermine government's mandate and sovereignty. Examples for this tendency can be found especially in areas where information is provided online by government and mashed up using Google Maps or Google Earth (see for example

applications listed at http://www.programmableweb.com/tag/government citation & example needed). The result of many undirected interactions usually result in the appearance of structure and patterns than consolidate over time and become the new status quo, which O'Reilly calls the "Architecture of participation" (2004). The degree to which government controls information is changing and traditional notions are challenged.

This challenge can be extended to third parties and contractors outside of government. The potential of Web 2.0 tools to support ease of collaboration and informal horizontal and vertical information sharing among all collaborators also bears the challenge to coordinating, managing and controlling information dissemination. The challenge here is that governmental actors might feel the thread of losing control over the information creation and dissemination process.

Technological challenges of Web 2.0

Government is facing technological challenges on several levels: On the one hand pre-Web phase types of agencies, such as the FDA have the challenge that existing IT systems are not integrated and knowledge cannot be accessed and shared in an efficient way (Brewin, 2008). The result is that the FDA cannot fulfill its mandate. Adding an additional layer of challenges might hinder the adoption and brand government as technophobe.

In a situation as described above adding Web 2.0 technologies to the mix might overwhelm an agency to the extent that the generated information might not be used efficiently. Providing additional channels to interact with citizens and third parties might lead to an information overload: new channels of citizen interaction creates a higher degree of

inflow of information into Government – agencies might not be prepared to fully digest the amount and type of information that is now available. Comments on Blogs, entries on a Wikis are creating a public value in from of aggregated wisdom of the crowds (Surowiecki, 2004). In turn this might lead to new information silos with information stuck in specific channels. The backend might not be designed in a way that it can efficiently integrate the incoming information in an effective knowledge management system. A meaningful extraction of the created knowledge and the integration into the existing knowledge base can turn the provided information into actionable knowledge. So far there are only limited possibilities to automatically extract and combine the created knowledge.

Informational challenges of Web 2.0

As mentioned earlier the new information paradigm in government is moving information access and dissemination towards a "need to share" culture and away from the "need to know" tradition. This challenges standard operating procedures of traditional information creation and access for the public: so far information was kept in specific information channels, such as email, shared hard-drives, condensed into reports and memos and stored in isolated databases that have proven to lock information within agency silos (Wylie, 2007). This traditional view is now challenged and might be enhancing or disrupting information flows on three different levels: (1) Access rights of existing information by the public; (2); creation of information and knowledge through citizen participation and (3) archiving and searching needs.

The new FOIA law states that any person has the right to request access to federal

agency records or information. Government agencies are required to disclose records upon receiving a written request, except those records that are protected from disclosure pursuant to nine exemptions and three exclusions (U.S. Department of State, 2007). This extends the access rights of citizens to an unknown dimension and has therefore implications on the way information has to be archived and made searchable for quick access and dissemination.

In addition, Web 2.0 technologies have the ability to dramatically change the way information is publicly created: for example, applications like wikis or blogs are providing opportunities for external stakeholders to easily add information, or submit opinions and questions. Thereby, Web 2.0 applications with the participation of citizens are creating new information that has to be integrated into the existing knowledge base. To date there are little archiving and distilling functionalities that would automatically and in a meaningful way take over this task. Moreover, the question arises as more knowledge is created publicly and through the peer production processes of the citizens: Who owns the content created by the citizens? Is the privacy of those who contribute protected? and, Who determines how the content or data is used? The current information proprietary rights do currently not provide an answer to this question and are challenging existing assumptions about transparency of government.

6. Towards a research agenda of Web 2.0 transformational effects

In this paper we have noted the emerging technological advance commonly referred to as Web 2.0 that is making its way into public sector organizations. We have tried to summarize drivers pushing for these technological advances, and explained fundamental rather transformative collaborative developments outside of the public sector (peer production, open source and open content, user centric innovation, etc.) that are underlying rather dramatic changes in the way information is searched for and shared, and collaboration is accomplished using the Internet and web-based interactive technologies as the infrastructure driving this change. We inventoried cases where Web 2.0 is being embraced in the public sector, with some surprising examples (e.g., Department of Defense, Intelligence gathering). We then noted that because of this phenomenon, some sectors have been radically changed by this technological phenomenon (e.g., journalism and broadcast media in general), and that in the case of the public sector, the emergence of these technologies – because of the ease of their implementation and the easy reach they can have both internal and external to government organizations – will likely cause organizational and cultural, technical and information management challenges.

On the one hand, viewing what has happened over the last five or so years in society as a whole and in the business sector, the ubiquitous use of the Internet in this first decade of the 21st century and the emergence of these interactive technologies do appear to be substantively transformative. This coincides with an increasing list of social and environmental problems requiring collaboration both within and across governments and sectors. These days we often hear phrases like "the Network Society," Networked

Governance," "Collaborative Public Management," the "Conductive" public organization, etc., which signal the real interest in collaboration in general (see for example Bingham & O'Leary, 2008; Koontz, et al., 2004; O'Leary, Gerard, & Bingham, 2006) and Internet-based collaboration more specifically.

On the other hand, it is important not to get caught up in the hype that new technological developments bring. It is important to look not at the technologies themselves but the underlying fundamental structures and processes that they might affect. So in short, with the foundation provided above, the fundamental questions we are asking are:

1. Are Web 2.0 technologies "transformative" from an organizational and institutional perspective?

2. Can they dramatically affect key public sector concerns such as transparency, accountability, communication and collaboration, and promote deeper and richer levels of civic engagement?

Recent review work by longstanding public information technology scholars Kenneth Kraemer and John Leslie King (2003) suggest that the answer to these questions may be "no." In this work, the authors reflect upon their 35 years studying IT in government and provide a review of much of the literature on the "IT reform hypothesis" – that IT is a catalyst for administrative reform. In this review summary, they provide four conclusions, which taken as a whole, reject this proposition (2003:10):

1. Technology is useful in some cases of administrative reform, but only in cases where expectations for reform are already well-established. IT does not <u>cause</u> reform (their emphasis);

2. IT applications have brought relatively little change to organizational structures, and seems to reinforce existing structures;

3. The potential benefits from information technology have not been evenly distributed within government organizational functions: the primary beneficiaries have been functions favored by dominant political-administrative coalitions in public administrations, and not those of technical elites, middle managers, clerical staff, or ordinary citizens.

4. Government managers have a good sense of the potential uses of IT in their own interests, and in cases where their interests coincide with government interests, they push IT application aggressively.

For the most part, we agree with these conclusions. But up to just recently, even the use of the Internet required technical capabilities by government employees, and stakeholders they interact with. What has fundamentally has changed with Web 2.0 technologies coupled with the Internet, is the ease in which interactive collaboration can occur between organizations or between individuals with very little technical know-how. This, in our view, is foundational change. Moreover, we are seeing examples where individuals armed with relatively simple technologies, can deploy collaborative technologies in instances where they are desperately needed (recall the examples of the search for loved ones during Hurricane Katrina or the need for quicker collaboration between field soldiers in the battlefield). At the very least, this potentially changes the third finding by Kraemer and King, above; many of the potential benefits can potentially occur at lower ranks within organizations. There is the potential to harness peer-production and have these innovations occur at much lower levels of the administrative apparatus. Our other point is that this capability, may lead to deeper changes in organizational structures. The battlefield Web 2.0 applications with direct communications between field commanders is an example of a gradual shift away in some communication from the traditional chain of command culture (Rid, 2007).

But this potential comes up against what we call the "Public Sector Web 2.0 Paradox." Very often information flow within and across government agencies, between levels of government, and between government and the public is highly restricted through regulations, and through bureaucratic constraints. Public sector officials can be averse to sharing information with outside traditional channels (sometimes for very legitimate reasons) and may fear a loss of control over their information (Sternstein, 2006). Kraemer and King (2003) argue that this is quite reasonable and justified.

> "… Most government organizations are bureaucracies with hierarchically organized distributions of authority, resources and responsibility flowing downward to work units, and information about organizational performance flowing back upward as a means of control. Most government managers want to keep organizations that way, for good reasons. The bureaucratic form is highly refined from many decades of continuous study and improvement. It has evolved a comprehensive set of conventions that work quite well at doing complicated tasks with reasonable performance on a sustained basis for many years. Government managers understand this form of organization, which makes them experts at using it to accomplish government objectives."

Kraemer and King close their arguments by saying first, that "IT might lead to new administrative structures; in practice it does not and probably should not" (2003:11). They also note that much of the evidence they present in analysis is from government IT studies made prior to the era of the Internet. But they note that work since then, including some by one of the coauthors of this paper, suggest that IT change does not result in fundamental changes in administrative reform.

Kramer and King's (2003) review paper is, in our view important for another reason. They note (p. 12 footnote 8) and in their conclusion that through the 1990s up until now, there has been very little systematic study of the use and impact of IT in government in

general, and empirical research on the impacts of more recent technologies (e.g., the web, etc.) in particular. While we agree with the arguments they have made above, the changes that are occurring as a result of Web 2.0 do have a feel of being foundational and dramatic. The difference between this "phase" of government IT and past phases such as the move from centralized mainframes to desktop PCs or the move from stovepiped organizations to ones connected via email and the uni-directional web, is the ease at which organizations can interact and the ease at which these technologies can be deployed, often by people with very low technological abilities.

So we think it is worth asking the question "To what degree *is* Web 2.0 transformative?" Traditional IT and government work suggests it shouldn't be, but at the same time it has been very transformative in other aspects of society (e.g., business and culture in general). It is time to begin to undertake a research design that systematically looks at this question. In the space we have left, we will briefly summarize the beginnings of a research strategy.

David Garson, another prolific researcher on information technology in government, offers some useful advice in his conclusion (2007):

> "Without vainly aspiring toward a general field theory of information technology, it is still possible to focus on these theoretically important dimensions and thereby advance the state of the art of research on information technology in the public sector and even in general. To achieve the next step, the level of mid-range theory, researchers must avoid the temptation to be mere publicists of technological novelty and possibility or social engineers studying how to co-opt actors into acceptance of technological change. Researchers must instead return to their roots as social scientists, selecting the targets of study based on theoretical importance, operationally defining indicators of concepts, indexing these into latent variables, and modeling the relationship of these variables to one another."

Toward this end, the specific research questions we intend to ask are:

(1) How are public agencies using Web 2.0 technologies and for what purposes?

(2) How do government agencies decide to use Web 2.0 tools? What has led government managers and analysts to undertake such initiatives? How are these tools integrated into the existing media and information distribution strategy?

(3) To what degree have government agencies begun to embrace Web 2.0 technologies? What kinds of technologies are being used and for what purposes? Are these more often proprietary or open source technologies? For what type of informational purposes are what kind of tools used? How might these applications be categorized? (2) What technologies seem to be most promising and for what purposes?

(4) How are these tools being implemented in traditionally bureaucratic and stove-piped government environments?

(5) What institutional changes were necessary? Are there examples of cross-agency, intergovernmental, or public-private partnerships supported by these tools?

(6) Are these technologies enhancing or disrupting information and work flow?

(7) Are these tools transforming traditional government environments?

(8) What generalizable findings can be developed to inform transformation of government?

Based on previous IT and government research, the overall expectation is that these tools will be embraced in situations that align themselves with the four general findings by Kraemer and King above. In other words, the null hypothesis is that Web 2.0 does not result in administrative reform. But, as we have tried to emphasize, the environment now, with the ease in which people can deploy these technologies that can harness and reach others both internally and externally to the organization, one could easily hypothesize that this time it might be different.

To get at these questions and this overarching hypothesis, we intend to undertake a thorough literature review related to theory relevant to Web 2.0 adoption in the public sector, and develop a framework for Web 2.0 technology adoption in the public sector.

The research program we are proposing needs to develop a theory of *Web 2.0 adoption in the public sector*, and build on prior theories of ICT adoption and management in the public sector. There is significant past work, over multiple decades to build upon. For example, in the opening article in a special issue of Public Administration Review on Public Management Information Systems, Bozeman and Bretschneider (1986) introduced "A Framework for Public Management Information Systems Research" that included three levels of analysis: individual, organizational, and societal, as well as six sets of independent variables (individual attributes, decision-making context, organizational context, MIS structural context, external environment, and societal context) that then lead to macro or micro influences on MIS performance. In the Web 2.0 era, one could think of macro external environment and societal factors putting pressure on government organizations to potentially innovate using these technologies. Moreover, changes in organizational context, and the need in particular sectors for more immediate communication across organizational lines, coupled with budget issues, could lead to Web 2.0 implementations. Other theoretical frameworks developed in public sector information technology literature in other eras, also could be informative (see for example Fountain, 2001, 2008; Garson, 2000) to understand the human side of Web 2.0 adoption.

This effort will provide the ingredients for a theory of Web 2.0 adoption in the public sector in order to understand challenges, transformational affects on traditional standard operating procedure and the cultural changes necessary to follow the new information paradigm in the public sector.

Appendix

Table 1. Examples of Task Granularity in Peer Production Applications	
Extremely Coarse Grained	- Lead author in a Wikibook - Core developer in an open source software project
Coarse Grained	- Writing a chapter in a Wikibook - Leading a team of open content collaborators
Medium Grained	- Writing the first draft of a Wikipedia entry - Contributing a relatively small programming fix in an open source project - Making and posting a video to YouTube.com
Fine Grained	- Sign up to receive information of interest - Subscribing to an email list or RSS feed - Answering a question to someone else via an email distribution list or forum - Reporting a bug in some software - Posting an entry (e.g., a Digg story) - Submitting a story in SlashDot - Adding a sentence or reference to a Wikipedia page - Voting that you liked a posting in Digg - Save a URL via del.icio.us
Transparently Grained	- Google – Pagerank algorithm - Amazon.com – recommendations on what others have read - ReCapcha – typing in scanned words such that it contributes to digital books - Digg's recommendation system

Web 2.0 category	Functionality	Degree of citizen involvement	Example in the public sector

Collaborative content creation	• Harnessing Collective Intelligence: Cooperation
	• Breaking up knowledge silos in government
		User-generated content: Everyone can add, edit, share, etc.	• Wikis
			  o FluWikie (http://www.fluwikie.com)
			  o Intellipedia (DNI)
			  o Diplopedia (DS)
			  o Techpedia (DoD)
			• TheyWorkForYou

	• Distribution of digital content	Photo, video sharing	• Library of Congress Flickr page: http://www.flickr.com/photos/Library_of_Congress • MyBikeLane
	• Blogs • Microblogging	Information creation, dissemination, comment collection, Self-presentation	• David Fletcher, CIO of Utah: http://davidfletcher.blogspot.com/
	Cloud computing: Sharing data centers with the "cloud"	None	• Google Apps, Google Site (calendar, email, documents & spreadsheet ,wikis, IM) • Gmail
Crowdsourcing	Providing attention		• Nasa Clickworkers
Information sharing	Podcasts		• USA.gov podcasts: http://www.usa.gov/Topics/Reference_Shelf/Libraries/Podcasts.shtml
	RSS feeds		• USA government RSS collection (http://www.usa.gov/rss/index.shtml)

Web 2.0 category	Functionality	Degree of citizen involvement	Example in the public sector
	Widgets		• http://www.cdc.gov/Widgets/#available (includes CDC emergency text messages, seasonal flu updates, etc.
	Geospatial interface		• Virtual Alabama: http://www.dhs.alabama.gov/virtual_alabama/home.aspx
Social bookmarking		Sharing	• Technorati • Delicious
Social networking		Sharing and production Chat Messaging Profile Collaboration Staffing Finding volunteers Philanthropy	• GovLoop • Facebook pages of Obama and McCain • A-Space (Intelligence community) • Netmus.com
Participation in policy making		Access to information otherwise inaccessible	• OpenCongress on Facebook
Prediction markets vs. forecasting and expert opinions	Decision markets: "online bazaars of information/ opinions"	Allows people to update their beliefs and develop a better forecast	• Intrade.com
Political campaigning	Active involvement of citizens, recruiting of volunteers	Information access Involvement Activism	• Iphone applications of the Obama and McCain campaigns

Table 1: Categorization of Web 2.0 functionalities, degree of participation and examples

References

Anderson, C. (2008). *The Long Tail: The, Revised and Updated Edition: Why the Future of Business is Selling Less of More* New York: Hyperion.

Behn, R. D. (1995). The Big Questions of Public Management. *Public Administration Review, 55*(July/August), 313-324.

Benkler, Y. (2006). *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. New Haven: Yale University Press.

Bingham, L. B., & O'Leary, R. (2008). *The Collaborative Public Manager: New Ideas for the Twenty-first Century (Public Management and Change)*. Washington, D.C.: Georgetown University Press.

boyd, d. (2007). Case Commentary on "We Googled You: Should Fred hire Mimi despite her online history?" by Diane Coutu. *Harvard Business Review, June*.

boyd, d. (2008). Digital Handshakes in Networked Publics: Why Politicians Must Interact, Not Broadcast. In B. Rigby (Ed.), *Mobilizing Generation 2.0*. San Francisco: Jossey-Bass.

Bozeman, B., & Bretschneider, S. (1986). Public Management Information Systems. *Public Administration Review, 46*(6), 473-473.

Brabham, D. (2008a). Crowdsourcing as a Model for Problem Solving: An Introduction and Cases. *Convergence, 14*(1), 75-90.

Brabham, D. (2008b). Moving the Crowd at iStockphoto: The Composition of the crowd and Motivations for Participation in a Crowdsourcing Application. *FirstMonday - Peer Reviewed Journal of the Internet, 13*(6). Retrieved from http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/2159/1969

Brewin, B. (2008). FDA panel cites shortfalls in technology, staffing. *Government Executive, January 29, 2008*. Retrieved from http://www.govexec.com/story_page.cfm?articleid=39153&printerfriendlyvers=1

Carr, D. (2008). Mourning Old Media's Decline. *The New York Times, October 29, 2008*,

Cormode, G., & Krishanmurthy, B. (2008). Key differences between Web 1.0 and Web 2.0. *FirstMonday - Peer Reviewed Journal of the Internet, 13*(6), 1-19.

Creative Commons (2008). Creative Commons, from http://creativecommons.org/

Deek, F., P. , & McHugh, J. A. M. (2008). *Open Source Technology and Policy*. New York: Cambridge University Pres.

Digital Proofreaders (2008). Digital Proofreaders Retrieved July 17, 2008, 2008, from http://www.pgdp.net/c/

Director of National Intelligence (2008). United States Intelligence Community: Information Sharing Strategy.

Fountain, J. E. (2001). *Building the Virtual State: Information Technology and Institutional Change*. Washington, D. C.: Brookings Institution Press.

Fountain, J. E. (2008). Challenges to Organizational Change: Multi-Level Integrated Information Structures. In V. M.-S. a. D. Lazer (Ed.), *Government Information Technology: From Electronic Government to Information Government* (pp. 63-

93). Cambridge, MA: MIT Press.

Friess, S. (2007). Online Fossett Searchers Ask, Was It Worth It? *Wired*. Retrieved July 17, 2008 from.

Garson, D. (2000). Information Systems, Politics, and Government: Leading Theoretical Perspectives. In D. Garson (Ed.), *Handbook of Public Information Systems* (pp. 591-610): Marcel Dekker.

Garson, D. (2007). An Information Technology Research Agenda for Public Administration. In D. Garson (Ed.), *Modern Public Information Technology Systems: Issues and Challenges*: IGI Publishing.

Gasser, U., & Palfrey, J. (2008). *Born Digital: Understanding the First Generation of Digital Natives*. New York: Basic Books.

Ghosh, R. A. (2005). Understanding Free Software Developers: Findings from the FLOSS study. In B. F. J. Feller, S. Hissam & K. R. Lakhani (Ed.), *Perspectives on Free and Open Source Software* (pp. 23-46). Cambridge, MA: MIT Press.

Gross (2006). US intelligence community's wiki aids info sharing. *InfoWorld, October 31, 2006*. Retrieved from http://www.infoworld.com/article/06/10/31/HNusintelligencewiki_1.html

Hardy, M. (2008). Congress warms up to Web 2.0. *GCN Government Computer News, 108/27/2008*. Retrieved from http://www.gcn.com/online/vol1_no1/47454-1.html?topic=&CMP=OTC-RSS

Howe, J. (2006). Crowdsourcing Retrieved October 22, 2008, 2008, from http://crowdsourcing.typepad.com

Howe, J. A. (2006). The Rise of Crowdsourcing. *Wired, June*. Retrieved from http://www.wired.com/wired/archive/14.06/crowds_pr.html

Journalism.org (2008). 2007 State of the News Media Report - Newspapers. Retrieved from http://www.journalism.org/node/7218

Kirlin, J. J. (1996). The Big Questions of Public Administration in a Democracy. *Public Administration Review, 56*(5), 416-423.

Koontz, T. M., Steelman, T. A., Carmin, J., Korfmacher, K. S., Moseley, C., & Thomas, C. W. (2004). *Collaborative Environmental Management: What Roles for Government?* Washington D.C.: Resources for the Future Press.

Kraemer, K., & King, J. L. (2003). *Information Technology and Administrative Reform: Will the Time After E-Government Be Different?* Paper presented at the Heinrich Reinemann Schrift Fest, Post Graduate School of Administration. from http://www.crito.uci.edu/publications/pdf/egovernment.pdf

Krishnamurthy, S. (2002). Cave or Community?: An Empirical Examination of 100 Mature Open Source Projects. *First Monday, 7(6)*. Retrieved from http://firstmonday.org/issues/issue7_6/krishnamurthy/

Lakhani, K. R., & Wolf, R. G. (2005). Why Hackers Do What They Do: Understanding Motivation and Effort in Free/Open Source Software Projects. In B. F. J. Feller, S. Hissam & K. R. Lakhani (Ed.), *Perspectives on free and open source software* (pp. 3-22). Cambridge, MA: MIT Press.

Lerner, J., & Tirole, J. (2005). Economic Perspectives of Open Source. In J. Feller, B. Fitzgerald, S. A. Hissam & K. R. Lakhani (Eds.), *Perspectives on Free and Open*

Source Software. Cambridge, MA: MIT Press.

Lukensmeyer, C. J., & Torres, L. H. (2008). *Citizensourcing: Citizen Participation in a Networked Nation*. Charlotte, North Carolina.

Lynch, V. G. (2008). Fighting Government Waste One Google App at a Time. *CIO online*. Retrieved from http://www.cio.com/article/450636/Fighting_Government_Waste_One_Google_App_At_a_Time_

McCarthy, C. (2007, 10/24/2007). Microsoft acquires equity stake in Facebook, expands ad partnership. *cnet news*, from http://news.cnet.com/8301-13577_3-9803872-36.html

Mergel, I., Lazer, D., & Binz-Scharf, M. (2008). Lending a helping hand: Voluntary engagement in a network of professionals. *International Journal of Learning and Change (IJLC), 3*(1), 5-22.

NASA (2001). Clickworkers (original site) Retrieved July 17, 2008, 2008, from http://clickworkers.arc.nasa.gov/top

NASA (2008). Clickworkers HiRise Retrieved July 17, 2008, 2008, from http://clickworkers.arc.nasa.gov/hirise

O'Leary, R., Gerard, C., & Bingham, L. B. (2006). Introduction to the Symposium on Collaborative Public Management. *Public Administration Review, 66*(s1), 6-9.

O'Reilly, T. (2004). The Architecure of participation. *June*. Retrieved from http://www.oreillynet.com/pub/a/oreilly/tim/articles/architecture_of_participation.html

O'Reilly, T. (2005). What Is Web 2.0: Design Patterns and Business Models for the Next Generation of Software. *09/30/2005*. Retrieved from http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html

PEW Internet & American Life Project (2007). A Typology of Information and Communication Technology Users (pp. http://www.pewinternet.org/pdfs/PIP_ICT_Typology.pdf).

ReCaptcha (2008). What is reCAPTCHA? Retrieved July 17, 2008, 2008, from http://recaptcha.net/learnmore.html

Rid, T. (2007). *War and Media Operations: The US Military and the Press from Vietnam to Iraq*: Routledge.

Riehle, D. (2007). The Economic Motivation of Open Source Software: Stakeholder Perspectives. *IEEE Computer Society, April 2007*.

Schweik, C. M., & English, R. (2007). Conceptualizing the Institutional Designs of Free/Libre and Open Source Software Projects. *First Monday 12*(2). Retrieved from http://www.firstmonday.org/issues/issue12_2/schweik/index.html

Stebbins, R. A. (2001). Serious Leisure. *Society, 38*(4), 53-57.

Sternstein, A. (2006). Web 2.0 for feds. Retrieved from http://www.fcw.com/print/12_43/news/96857-1.html

Stevens, H. (2008). Gartner Says Citizen Social Networks Will Complement, and May Replace, Some Government Functions. Retrieved from http://www.gartner.com/it/page.jsp?id=784212

Surowiecki, J. (2004). *The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations*: Random House, Inc.

Surowiecki, J. (2005). *The Wisdom of Crowds*.

The United States Army (2008). Army Knowledge Management Principles from http://www.army.mil/ciog6/docs/AKMPrinciples.pdf

Thottam, G. (1999). The future of newspapers: Survival or extinction. *Media Asia, 26*(4), 216-221.

U.S. Department of State Freedom of Information Act (FOIA) (2007).

von Hippel, E. (2005a). *Democratizing Innovation*. Cambridge, MA: The MIT Press.

von Hippel, E. (2005b). Open Source Software Projects as User Innovation Networks. In B. F. Joseph Feller, Scott A. Hissam, and Karim R. Lakhani (Ed.), *Perspectives on Free and Open Source Software* (pp. 267-278). London, England: MIT Press.

von Hippel, E., & von Krogh, G. (2003). Open Source Software and the 'Private-Collective' Innovation Model: Issues for Organization Science. *Organization Science, 14*(2), 209-223.

Weber, S. (2004). *The Success of Open Source*. Cambridge, MA: Harvard University Press.

Wylie, S. (2007). The 2.0 Agenda: Transparency, Sharing, Access--Are You Ready For Enterprise 2.0? . *May 26, 2007*. Retrieved from http://www.informationweek.com/news/infrastructure/management/showArticle.jhtml?articleID=199702156