e-Government and Technology Acceptance: The Case of the Implementation of Section 508 Guidelines for Websites

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Abstract: This paper examines the relevance of the Technology Acceptance Model for e-Government websites at federal government level in the United States through an exploratory research study. Various unfunded government mandates over the past several years have required agencies to create websites, put services on the sites, and make them accessible to citizens, and the federal e-Government now includes tens of thousands of sites. Section 508 of the Rehabilitation Act, for example, was passed to ensure e-Government sites would be accessible to persons with disabilities. By studying the implementation of the requirements of Section 508 through a number of data collection techniques and in terms of the Technology Acceptance Model, this paper seeks to use this particular law as an example through which to better understand the processes by which government agencies adopt e-Government requirements and the actions that government managers can take to improve the implementation of such adoption.

Keywords: e-Government, technology acceptance model, accessibility, Section 508, disability, public servants, websites

1. Introduction: e-Government technologies and guidelines

Governments internationally are showing a strong preference for delivering services via the Internet, particularly as a means of boosting cost-efficiency and reducing time spent on direct interactions with citizens (Ebbers, Pieterson, & Noordman 2008). The United States has created a larger e-Government network than any other nation. While e-Government includes a wide-range of functions such as e-voting, e-procurement, data collection, management and analysis, inter-agency collaboration, intra- and inter-agency communication, e-learning, for agency staff, human resource management, a key focus of the President's e-Government Management Agenda (http://www.whitehouse.gov/omb/egov/) is on interactions between the government and citizens and many government agencies are viewing e-Government as their primary method for interacting with citizens. As such, it is extremely important for e-Government research to focus on issues of how e-Government is meeting the needs of citizens.

Citizens still show a strong preference for phone-based or in person interactions with government representatives when they have questions or are seeking services, though individuals with higher levels of education are typically more open to using online interactions with government (Ebbers, Pieterson, & Noordman 2008; Steib & Navarro 2006). e-Government services generally are limited by difficulties in searching for and locating the desired information, as well as lack of availability of computers and Internet access for many segments of the general population (Singh, & Sahu 2008). Such problems are exacerbated by a general lack of familiarity with the structure of government and attitudes toward technology and government among many citizens (Jaeger & Thompson 2003, 2004). While the e-Government Act of 2002 and President's e-Government Management Agenda have emphasized the transformative effect of e-Government, thus far it has primarily been used as a way to make information available, provide forms and electronic filing, and distribute the viewpoints of government agencies (Jaeger 2005). As commercial sites are developing faster and provide more innovative services than e-Government sites, public satisfaction with government websites is declining (Barr 2007).

For these and other reasons, the majority of citizens, even those with a high speed Internet connection at home, seeking government information and services, prefer to speak to a person directly in their contacts with the government (Horrigan 2004). As a result of these tensions between policy, implementation, and public perception, e-Government exists as an option, but not the preferred option, of most citizens. There is a range of reasons that may deter some users—infrequent need for them, lack of interactivity, lack of availability of services or information that people really want. However, a key part of the problem is that e-Government websites are not being designed to fully implement user-oriented standards.

This paper examines this problem as a matter of technology acceptance, specifically the process by which and the extent to which agencies accept and implement standards for e-Government websites. This problem will be examined through the lens of Section 508 of the Rehabilitation Act (29 U.S.C. § 794d), which provides a set of standards to ensure e-Government website are accessible to persons with disabilities. As e-Government websites are intended to serve as the electronic face of government and provide the majority of

government services, determining how to better increase the adoption of standards for e-Government sites by government agencies is essential to improving the usage of and user experiences with e-Government websites.

2. Accessibility and e-Government

Accessibility is equal access to information and communication technologies (ICTs) for persons with disabilities. "Accessibility allows individuals with disabilities—regardless of the type of disability they have—to use ICTs, such as websites, in a manner that is equal to the use enjoyed by others" (Jaeger 2008: 24). This equal access is of utmost importance to persons with disabilities in a society where functions of government, business, and personal life are increasingly online. In the United States, 54 million people have a disability, while the number of persons with disabilities worldwide is more than 550 million, and that number will continue to grow as the baby boom generation ages (Jaeger & Bowman 2005). For ICTs to be accessible, they should: 1) provide equal or equivalent access to all users, and 2) work compatibly with assistive technologies, such as narrators, scanners, enlargement, voice-activated technologies, and many other devices that persons with disabilities may employ.

The United States federal government has created numerous laws related to accessibility of ICTs (Jaeger 2004a, 2004b). For websites, the most prominent law is Section 508 of the Rehabilitation Act, which mandates specific design requirements that reduce barriers to access for different types of disabilities and promote compatibility with assistive technologies that users may be employing. Section 508 has a detailed set of technological and accessibility requirements as well as guidance for implementation (www.section508.gov). Federal e-Government websites, in spite of the requirements of Section 508, are still often inaccessible to persons with disabilities long after the Section 508 requirements were supposed to have been implemented in 2001 (Jaeger 2004b, 2006). Some persons with disabilities have come to distrust e-Government as a result of these accessibility issues (Cullen & Hernon 2006).

Accessibility in the online environment is a relatively new development as a focus of research and is also a highly complex topic that involves policy, technical, and user issues (Jacko & Hanson 2002; Stephanidis & Savidis 2001). This combination of newness and complexity has thus kept most investigations of online accessibility at a very practical level, including most studies of the accessibility of e-Government websites. As a result, no conceptual frameworks have been established for the standards for evaluation of the accessibility of e-Government websites. Having a conceptual framework through which to evaluate the implementation of Section 508 standards on e-Government websites would be beneficial to government employees, researchers, and citizens with disabilities. This exploratory paper proposes that an extant conceptual framework is potentially useful to the study of the accessibility of e-Government websites in terms of the implementation of Section 508 requirements.

3. The Technology Acceptance Model

The Technology Acceptance Model (TAM) was originally introduced and studied as a means of understanding how users adopt and use new technology by evaluating the factors that influenced the decision to accept a new technology (Davis 1989). TAM is based on the belief "that perceived ease of use and usefulness can predict attitudes toward technology" (Lederer et al. 2000: 269). Perceived usefulness of a technology and perceived ease of use of a technology combine to create an attitude about the technology, influencing decisions of whether to adopt the technology. Figure 1 shows the most basic form of TAM. Perceived ease of use and perceived usefulness are shaped by external factors unique to the situation, while the behavioral decisions ultimately dictate whether and how a technology is used (Davis, Bagozzi, & Warshaw 1989).

Since its introduction, TAM has been tested in many studies and has been used to evaluate numerous different technologies, including email, voice mail, and many others (i.e., Dasgupta, Granger, & McGarry 2002; Gefen & Straub 1997; Straub, Keil, & Brenner 1997). Some recent studies of TAM have extended the application of the model to areas beyond a single technology, such as the study of online educational settings or the World Wide Web (i.e., Dishaw & Strong 1999; Saade & Bahli 2005; Venkatesh & Davis 2000).
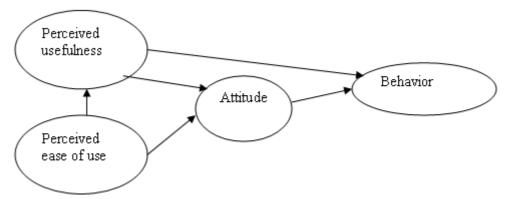
Figure 1: Basic Technology Acceptance Model.

One of the extensions of TAM has been to explore decisions by organizations comprised of groups of users, instead of individual users, to adopt new technologies. These studies have examined TAM in relation to organizational adoptions of new technologies in contexts such as e-commerce, police investigations, sales force coordination, and telemedicine (Chau & Hu 2002; Colvin & Goh 205; Grandon & Pearson 2004; Olson & Boyer 2003; Robinson, Marshall, & Stamps 2005; Yu et al. 2005). Such studies have focused on technology in numerous different forms, including software, hardware, websites, technology standards, and Internet-based activities. These types of studies of TAM within the context of organizations demonstrate the potential applicability of TAM to the acceptance of new technologies by government agencies.

Grandon and Pearson (2004), for example, explore how small and medium sized businesses accept the use of e-commerce as a part of their business activities. That study found the acceptance of e-commerce by the organizations was based on perception of the value of e-commerce in an organization, in light of certain external and internal factors, and the level of success of the adoption was influenced by a number of internal factors. The acceptance of the new technology was influenced by agency mission, actual cost, perceived cost, agency priorities, and staff interest, among others. This approach appears to have utility when applied to the process through which government agencies adopt new technologies and apply them.

4. TAM and e-Government websites

The conceptual framework tested in this study was based on the idea of a modified TAM for organizational acceptance of new technology, similar to those like the Grandon and Pearson (2004) study detailed above. The organizations studied were United States federal government agencies and the new technology at issue was accessible websites that comply with the standards of Section 508. The TAM (and its related variants) were originally developed and intended to be applied to assess the reaction and behavior of individual users of a technology. This study conceived of the federal agencies as users of the standards of Section 508 and the accessibility standards as a new technology that they were supposed to adopt. Federal agencies with e-Government websites are providers of technologies to citizens, such as websites, but they are also users of technologies, such as the elements they must use to create and provide websites. It is in this later sense that this study approached the federal agencies, with the essential problem in this research being how agencies choose to adopt or not adopt the Section 508 accessibility standards for their websites. As such, the TAM provides a unique conceptual approach to the study of the organizational acceptance of the accessibility standards by federal agencies.

Figure 2 illustrates the preliminary conceptual framework for this study. The two upper layers of the model are contextual, while the three lower layers represent the accessibility research conducted in this study. The contextual layers are derived from extant research and professional literature about the policy environment for e-Government and issues of accessibility. The three lower layers of the framework display the research focus of this study—the mandate to implement the standards of Section 508, the ways the standards could be implemented, and the actual level of compliance that is achieved.
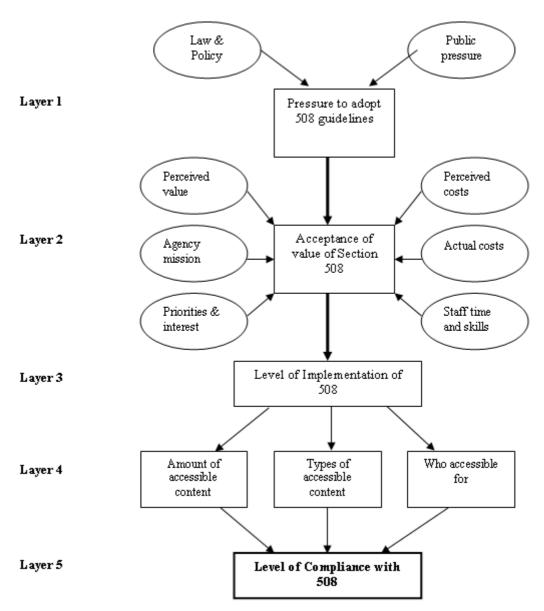
Figure 2: Conceptual framework for the study, based on modified TAM for organizations.

The top layer of the Figure 2 shows the external pressures to adopt Section 508 standards for federal e-Government websites. Various law and policy instruments, including Section 508, create legal standards for accessible websites, while various types of public pressures, such as complaints, news reports, lawsuits, and research studies may create further pressure by bringing attention to the issue (Jaeger 2004a). These pressures drive the acceptance of Section 508 standards for websites as a value to which agencies adhere.

As the second layer of the figure shows, there are many internal issues related to perceived usefulness and perceived ease of adoption of Section 508 standards for websites. Issues related to culture can have a significant impact on decisions to accept and implement a technology (Straub, Keil, & Brenner 1997). Feedback within an agency has been shown to play an important role in the development of online government services (Mahler & Regan 2002). These specific internal issues are drawn from the review of relevant research literature as key factors that can influence agency decisions regarding how to adopt Section 508 standards (see Jaeger 2004a, 2004b, 2006, 2008). On the left side of the figure are the internal factors related to perceived usefulness of adoption of Section 508 standards to websites—perceived value, agency mission, and priorities and interests of the agency. On the right hand side of the middle level of the figure are the internal factors related to perceived ease of adoption of Section 508 standards for websites—perceived costs, actual costs, and staff time and awareness.

The third layer of Figure 2 examines the influences of the varying contextual factors that will shape the ultimate level of compliance with Section 508 on an agency website. The fourth layer of Figure 2 represents

the extent to which the standards of Section 508 are implemented on an agency website. The amount of accessible content, the types of content that are accessible, and the types of disabilities that content is accessible for will all be influenced by decisions made regarding implementation of Section 508 standards on e-Government websites.

The fifth layer of Figure 2 focuses on compliance with the Section 508 standards for federal e-Government websites. Ultimately, the amount of accessible content, the types of accessible content, and the types of disabilities for which content is accessible demonstrate the extent to which an agency website complies with the standards of Section 508. If an agency considers adoption to be difficult or of limited value, the levels of compliance with Section 508 standards will likely be low. In contrast, if an agency considers adoption a high priority or of significant value, then the levels of compliance with Section 508 standards will be high.

5. The study of TAM and 508 standards

This framework was examined in a multi-method, user-centered study of e-Government websites for compliance with the Section 508 of the Rehabilitation Act standards for accessibility (Jaeger 2006, 2008). This study employed five data collection methods in the assessment of e-Government websites in terms of the implementation of Section 508 of the Rehabilitation Act. Selected federal e-Government websites were evaluated using policy analysis, expert testing, user testing, and automated testing, along with a survey administered to federal webmasters that assessed their views on accessibility. In the evaluation of e-Government sites, the use of a multi-method approach is optimal (Thompson, McClure, & Jaeger 2003).

The policy analysis was conducted through extensive review of legal and policy documents. The expert testing involved the evaluation by persons knowledgeable about the design of accessible websites to provide a technical evaluation of the accessibility. The user testing under the guidance of a researcher was used to provide detailed information from the perspective of users. Table 1 lists sample questions used in expert and user testing. Automated testing—the use of software designed to test accessibility of websites—was used, but proved to provide no additional information to the expert and user testing. Appendix A provides a detailed description of the data collection methods.

Table 1: Sample questions from expert testing and user testing

Sample Expert Testing Questions:
1. Provides an audio/video/textual equivalent for every element related to content and services?
2. Alternative formats of elements of multimedia presentations synchronize to the appropriate parts of the presentation?
3. All information conveyed through color also conveyed without color?
4. Provides clear navigation mechanisms?
5. Does not rely on moving pictures or flash to convey content?
6. Ensures user control of time-sensitive content changes?

Sample User Testing Questions:
1. Are you able to navigate the site without difficulty? If not, what accessibility problems did you face in navigating?
2. Are you able to use particular applications (i.e., download forms, view audio or video, fill out forms) on the site without difficulty? If not, what accessibility problems did you face in using these applications?
3. Do you feel that the site as a whole is working well with the assistive technology you are using? Please specify.
4. Do you notice problems that might affect people with other types of disabilities? Please specify.

The study also employed questionnaires to government webmasters about agency perceptions of accessibility. The questionnaires were sent to a diverse set of prominent government agencies that work with directly citizens. This survey received a response rate of 60%. Table 2 lists sample questions from the survey of government webmasters.

Table 2: Sample questions for government webmasters.

1. Do you feel that the accessibility of your website for persons with disabilities is a priority within your agency?
2. When working to make your website accessible for persons with disabilities, where do you turn for resources and guidelines?
3. Do you perform accessibility testing on your website to test how well it can be used by persons with disabilities? If so, at what point in the website development process is this testing done?
4. What factors (i.e., staff time, staff skills, funding, agency mission, etc.) influence the priority accorded to the accessibility of your website for persons with disabilities?
5. Have you received any feedback from users of your site regarding its accessibility? If so, were the comments generally positive or negative?
6. If you feel that the accessibility of your website could be improved, what resources would you find beneficial in working to improve it?

The primary finding from the study was that most e-Government websites do not comply with all of the requirements of Section 508 of the Rehabilitation Act, rendering most e-Government websites inaccessible to some or all persons with disabilities (Jaeger, 2006, 2008). Key accessibility barriers that were recurring problems across all of the sites tested included:

- Compatibility problems with screen enlargement;
- Compatibility problems with screen readers;
- Compatibility problems with alternate color schemes;
- Use of flash and moving images to convey content;
- Cluttered layout and organization;
- Audio content does not have a text equivalent;
- Graphics lack Alt tags;
- Difficult drop-down, mouse-over menus; and
- Problems with consistency and clarity of context, orientation, and navigation.

Further, the webmaster survey revealed that agency perceptions of the accessibility of these websites often did not match the actual levels of accessibility on the sites (Jaeger 2006, 2008).

The three lower levels of the proposed framework were studied through several methods of accessibility testing. Accessibility testing by users with a range of different disabilities, experts in accessibility testing, and automated tools evaluated the ways in which and the extent to which Section 508 standards have been implemented on the sites.

In addition to the testing, the questionnaires to government webmasters examined the context in which agencies are implementing accessibility on their websites. The law and policy analysis was used to examine the initial pressures to implement Section 508 standards, while the webmaster questionnaires explored the factors that influence agency perspectives and decision-making processes related to Section 508. As such, the webmaster questionnaires served to directly connect the findings of the accessibility testing to information about the agency perspectives and decision-making processes related to implementing accessible websites, explicitly linking the accessibility methods to the larger contextual issues.

The tentative conceptual framework presented in Figure 2 served as an initial guide for this study. Given the newness of accessibility research and the lack of established conceptual frameworks for studies of e-Government accessibility, this proposed framework of a TAM at least provided an exploratory conceptual basis from which to begin research.

6. Findings and modification of the TAM

The top layer, which posits that law and policy combine with public pressure to create the impetus for an agency to adopt the Section 508 standards on its website, seems sound in light of the findings of the study. The literature review and the policy analysis revealed an intertwined relationship between the development of the laws and policies and the support by the public and by particular stakeholder groups for such laws and policies. The passage and implementation of the primary disability rights laws were inextricably linked to public support and political protests by interested groups (Jaeger 2004a; Jaeger & Bowman 2005). Without sufficient public support and stakeholder intervention, the passage of the Rehabilitation Act, Individuals with Disabilities Education Act, or the Americans with Disabilities Act would not have been assured. As the policy analysis demonstrated, the passage of Section 508 of the Rehabilitation Act and the promulgation of

standards were greeted with significant support from an array of stakeholder groups. Further, disability rights groups and government organizations like the Access Board and the National Council on Disability have continued to lobby for better implementation of Section 508. The data from the user testing and expert testing affirm the accuracy of the top layer of the framework, as the websites that faired the best in all of the testing were primarily agencies that focus on issues related to disability. These agencies would be most likely to be interested in and affected by public pressure from stakeholder groups on issues of disability.

The bottom three layers of the conceptual framework can also be assessed in light of the data from the study. The user testing and the expert testing methods were both focused on gathering data about the level of implementation of the standards of Section 508, the success of that implementation, and the ultimate level of compliance with the Section 508 standards on a site. From the data collected, it seems that the lower three levels of the framework represent what appears to be happening on the websites. On sites where the methods of accessibility testing found poor design in terms of persons with disabilities, the problems clearly were not the result of failed efforts to provide accessibility, but were instead the result of limited attempts to provide accessibility. These sites lacked significant evidence of attempts to meet many of the Section 508 standards, demonstrating a decision to make a minimal effort to implement the standards. In these cases, the resulting sites had limited levels of accessible content, with many different types of content being inaccessible for persons with a range of different disabilities. This finding was independently reached through the user and expert methods of accessibility testing.

The opposite situations—where the design of the website evidenced meaningful attempts to provide accessibility and, thus, the intent to implement the standards of Section 508—the sites were well designed for accessibility and faired much better in the accessibility testing. In the sites that were generally better designed for accessibility, the flaws were often implementations of the standards that were not completely correct. The sites designed with a noticeable intent to comply with the standards received much better results in the expert testing and the user testing. The primary reason for these better results was that the sites provided much higher levels of accessible content, access to most or all types of content, and accessibility for users with most or all disabilities.

For both of the sites that were poorly designed for accessibility and the sites that were well designed for accessibility, the lower three layers of the conceptual framework seemed to accurately represent the situation. However, the second layer of the conceptual framework proved more difficult to assess, due to the complexity of this level of the framework and to the limitations of the responses to the webmaster questionnaire. It is also the layer that is most tied to the TAM, as it reveals the decision making process in the agency related to acceptance.

Based on the findings of the policy analysis, the second layer seems reasonable, and the findings from the user and expert accessibility testing do not call any elements of the second layer into question. However, results of the webmaster questionnaire, the data collection method most relevant to assessing this layer of the framework, are less helpful than hoped in relation to the framework. When asked about the factors that influenced decisions related to the implementation of the Section 508 standards and when asked about the prioritization of accessibility within the agency, many responses focused on the importance of providing accessibility without giving many details related to agency process or decision-making.

Even though the top layer and the lowest three layers of the framework seem accurate based on the data gathered in the study, the questions about the second layer also raise questions about the interactions of the other layers and their relationships to one another that will need to be answered in further studies. Nevertheless, the data from this study have identified four important elements not included in the initial conceptual framework:

1. User feedback – Comments from users with disabilities would influence compliance with Section 508 standards at many agencies.
2. Education and training – Many federal web developers are receiving insufficient training about designing, testing, and monitoring for accessibility.
3. Monitoring and enforcement – The current citizen-based monitoring and enforcement structure needs to be accounted for in the conceptual framework.
4. Political climate – Accessibility is not a political priority to many agencies.

Figure 3 is a revised version of the conceptual framework that incorporates these factors.

One way to address the need for information about the second layer would be a study targeted directly at web developers at government agencies. Such a study, however, would need to have a much larger sample than the one in this study. Further research will also need to account for and evaluate the suggested additions to the revised conceptual framework. One clear finding, however, is that agency management plays an enormously important role in the adoption of Section 508 requirements.

To further test the fitness of TAM as a conceptual framework for the implementation of Section 508 and other e-Government standards, future work in this area should consider the role that management plays in implementing requirements for e-Government websites. Managerial leadership and political support can be central to e-Government development (Chou, Chen & Pu 2008; Ho & Ni 2004). In specific terms of the adoption of Section 508 standards, managerial leadership and political support may offer the best means of increasing adoption of Section 508 standards among federal agencies.
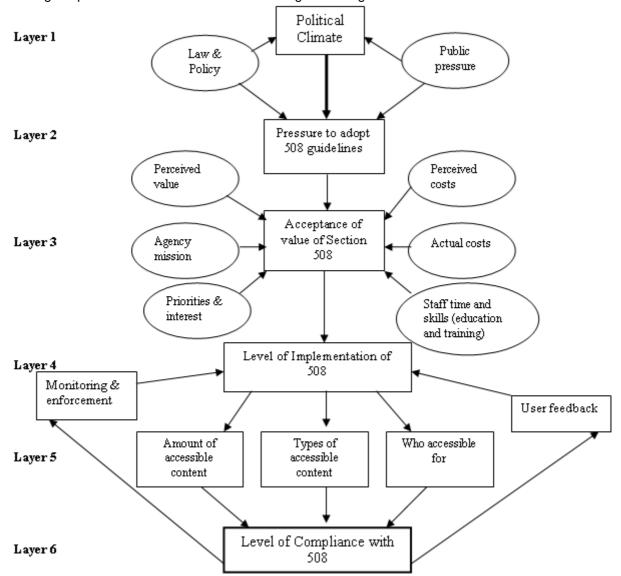

Figure 3: Revised conceptual framework of TAM for Section 508 standards on government websites.

Managerial influence can be explored as an external variable in the TAM, which influences the perceived usefulness and the perceived ease of use of the technology (Bhattacherjee & Sanford 2006). Alternatively, managerial influence might appear as a direct effect on a user's behavioral intention to accept the new technology. Although this relationship is not captured in the TAM, support for it can be found in other technology acceptance theories, such as the Theory of Reasoned Action (TRA) (Fishbein & Ajzen 1975); Theory of Planned Behavior (TPB) (Ajzen 1991); and the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2003). In the case of government agencies implementing Section 508 provisions for websites, agency managers may be perceived as "important others" by employees

responsible for implementing the changes, and thus managerial influence might affect an employee's behavioral intent to implement the provisions.

7. Conclusion: The implications of TAM and Section 508

While this paper has focused on adoption of the Section 508 standards on e-Government websites, the general ideas and approaches explored in this paper may have relevance to the adoption of e-Government standards more widely. Given the importance placed on e-Government as a means of communicating with and providing services to citizens, improving the adoption and implementation of standards is essential for e-Government to meet the stated administrative goals. This paper has identified potential areas for further research, and further research is definitely needed to ascertain the relevance of the TAM to e-Government and the process of adoption of e-Government standards to websites. The proposed model needs to be tested with other e-Government standards, and individual factors suggested in this study will need to be tested to understand the role they play in the process. These ideas need to be researched in the context of other e-Governments—international, state, and local. The particular roles of management in the adoption of e-Government standards seem to merit specific attention. Ultimately, such research could improve understanding of the ways residents and public servants use e-Government technologies (Chang et al. 2005).

Results from TAM studies might also be useful to helping to determine the best methods for addressing the issues at hand. In terms of compliance with Section 508, TAM studies might help determine the best means for raising compliance with Section 508 requirements, such as the creation of an independent division monitoring conformance of e-services to Section 508 regulations; making conformance report an essential part of e-Government project deliverables; or the adoption of technological products and frameworks known to assist accessible content and service development. However, TAM alone will not be able to explain issues of technology adoption related to e-Government. Additional factors, such as costs and technology maturity, should be considered as well.

The United States and many other local, state, federal, and supra-national governments rely on their online presence for activities ranging from information provision to complex service delivery. Given the growing importance of e-Government and the continually increasing amounts of government information and services available primarily or exclusively on the web, the process of adoption by government agencies of e-Government standards is a significant issue that merits considerable further study. Hopefully, the ideas, approaches, and models suggested in this paper will serve to foster more research in this area.

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Appendix A: Data Collection Approach

The study that inspired the discussion in this paper was conducted in 2005 and 2006 (Jaeger 2006; 2008). While the data collection techniques are not central to the concepts explored in the paper, the framework of the study provides context to this discussion. The study employed five data collection methods in the assessment of the implementation of Section 508 on e-Government websites: policy analysis, expert testing, user testing, automated testing, and a survey administered to federal webmasters that assessed their views on accessibility. The study examined major e-Government sites of the United States federal government and the sites of federal agencies with a mission related to service for persons with disabilities. These two types of sites were selected to compare the levels of attention accessibility standards received on prominent e-Government sites and on sites oriented toward persons with disabilities.

The study first engaged in the policy analysis to identify the range of federal laws, policy documents, instruments, and standards that related to the accessibility of government websites. The policy analysis was designed to provide context and serve as the basis for the development of testing protocols and questionnaires.

The expert testing was next conducted. Expert testing is the evaluation by persons knowledgeable about the design of websites based on an established protocol. The protocol was pre-tested before use, and experts were recruited from a population of web developers and researchers. The expert evaluators were persons who could identify the barriers to accessibility in design and understood the legal requirements for accessibility and how they should be properly implemented.

These questions were drawn from the specific Section 508 requirements and are necessary for achieving a broad understanding of the accessibility of the site. The testing was conducted to ensure as wide an analysis as possible. Sites were tested through multiple browsers and for compatibility with a range of technologies related to different types of disabilities, including narrators and screen readers, screen enlargement software, magnifiers, alternate color schemes, and alternate navigation devices, among others. Expert testing was conducted until no new issues were identified in subsequent tests.

Expert testing is particularly important because it is very unlikely that the evaluation of an e-Government site could be conducted so thoroughly as to include user tests that represented people who have all the different types and levels of disabilities that must be accounted for in designing for accessibility. Though the expert testing did not reach the same depth or granularity in identifying problems for any particular disability as a user with that disability would, expert testing did identify the major accessibility issues on each site.

User testing, the testing of a website by users under the guidance of a researcher, was conducted next and provided a great depth of information from the perspective of each user who is tested. The user tests were conducted with both guided and think-aloud protocols to get the broadest range of insights possible. The instruments were pre-tested before use, and subjects were recruited through disability organizations. Subjects were recruited to represent a wide range of types and levels of severities of disabilities, spanning quadriplegia to complete sight loss. Users with visual and mobility disabilities were targeted in this study because those groups among all types of disabilities face the most significant barriers to equal access to online content.

People with different levels of severity of the same kind of disability will often experience different accessibility issues on the same site. A person involved in user testing, then, can best provide information related to the experiences of people like themselves. As with the expert tests, user tests were conducted until no new information about the sites was identified in subsequent tests. The user tests took, on average, between one and two hours to complete.

The results of the automated testing were muted in comparison to the results of the expert and user testing. Not only did a range of commonly used automated testing programs reveal no additional insights beyond the expert testing and user testing, the automated programs found far fewer issues than most individual expert and user participants. While the automated programs were useful to corroborate the findings of the other forms of data collection, they did not contribute any independent data.

After the three types of testing had been completed, a questionnaire was sent to the webmasters of all of the sites being studied to gauge their perceptions of the accessibility of their websites and the emphasis given to website accessibility within their agencies. The questions for the survey were developed based on the

findings from the four previous forms of data collection. The responses to the questionnaire revealed the agencies' perceptions of the accessibility of their websites, which often did not match the findings from the user testing and the expert testing.