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Fostering Innovation in Electronic Government:

Benefits and Challenges of XML for Web Site Management

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Abstract

As government Web sites have grown in size, complexity, and prominence, Web site management, content management, maintenance costs, and accessibility have become growing concerns for federal, state and local governments. Government agencies are losing the ability to be responsive and flexible in providing new information and services and the costs of maintaining these Web sites have become prohibitive. Government webmasters and system administrators have come to realize that the technologies and strategies used in the past to build most Web sites are designed to produce individual Web pages. They do not provide a structure to easily maintain entire Web sites, keep them responsive to changing needs, or manage the workflow involved in Web content production and maintenance; nor do they facilitate the sharing and reuse of Web site content. This paper examines the potential of XML for Web site content management in government settings. Five state government agency teams were selected, looking for a mixture of several aspects such as technological expertise, organizational capabilities, agency size, and institutional environment. The study uses multiple research methods such as semi-structured interviews, surveys, and analysis of relevant documents to explore the benefits and challenges of using XML for Web site content management in government agencies.[1] Overall, participants identified information consistency, reduction of data and content duplication, and compatibility with new devices and formats as the main benefits. Organizational and individual resistance to change, multiple and different priorities, and unrealistic goals were identified as the most important barriers. The paper also reports some differences in perceptions between technical and program staff.

Introduction

For some, the use of information technologies has the potential to change several aspects of how government works and how it interacts with citizens, businesses, and other stakeholders. In fact, previous research has identified electronic government as a strategy for administrative reform (Heeks, 1999; Kraemer & King, 2003). Improved service quality, cost savings, productivity gains, and more effective policies and programs are some examples of potential benefits from e-government initiatives (Brown, 2001; Kim & Kim, 2003; OECD, 2003). Electronic government has been conceptualized in different ways ranging from the provision of services only through the Internet to the use of any information and communication technologies in government settings (Gil-García & Luna-Reyes, 2003; Schelin, 2003). Many of the current e-government applications involve the use of Internet and related Web technologies.

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[1] More information about the overarching study entitled "Web Site Management Using XML: A Testbed Project" can be found at www.ctg.albany.edu/projects/xmltb

Among these applications, one of the most pervasive are government Web sites. As these Web sites have grown in size, complexity, and prominence, Web site management, content management, maintenance costs, and accessibility have become growing concerns (Costello, Adhya, Gil-García, Pardo, & Werthmuller, 2004; Kerer, Kirda, Jazayeri, & Kurmanowytsch, 2001). Despite the Web's promise for ease of use and access, creativity, and efficiency, agency managers and leaders are finding their Web sites increasingly present challenges of inflexibility, inconsistency, workflow bottlenecks, and new costs. Consequently, government agencies are losing the ability to be responsive and flexible in providing new information and services. In addition, the costs of maintaining complex Web sites could become prohibitive (Costello, 2002). Government webmasters and system administrators have come to realize that the technologies and strategies used in the past to build most Web sites are designed to produce individual Web pages. However, they do not provide a structure to easily maintain entire Web sites, keep them responsive to changing needs, or manage the workflow involved in Web content production and maintenance; nor do they facilitate the sharing and reuse of Web site content.

Dealing with some of the limitations of HTML, XML offers a viable solution to these Web site management problems. However, it is not clear what benefits government agencies can expect from XML. Similarly, it is important to understand wheither XML initiatives are expected to face the same or different barriers in comparison with other government IT initiatives. This paper identifies the main benefits of and barriers to the adoption of XML for Web site content management in government settings. It also highlights some differences in perceptions between technical and program staff.

The paper is divided in five sections, including these introductory comments. Section two presents how XML has been characterized in the literature as a useful tool for Web site content management. This section highlights some of the main benefits and challenges of using XML, paying special attention to its application for Web site content management. In section three, the research design and methods are briefly described. Section four identifies the most important benefits and barriers to XML based on a survey and semi-structured interviews with program and technical staff from five state agencies. Finally, section five provides some practical lessons to help public managers to understand and, potentially, adopt XML for managing their agency Web sites.

XML for Web Site Content Management: Benefits and Barriers

XML is generally understood to be a new technology that supports effective data exchange between applications. However, XML has another value that is much less exploited or understood. It offers an innovative long-term solution to many of the shortcomings of current Web site design tools and techniques (e.g., HTML), because it structures and describes Web content in a meaningful way (Costello et al., 2004; Rockley Group, 2005). These tools and techniques may work well for individual Web pages, but present serious challenges when used for managing complex Web sites (Kerer et al., 2001). Converting and updating documents for the Web can be not only time consuming, but also produce important delays and inconsistencies across an agency Web site (Costello et al., 2004). This is, at least in part, because content authors are not able to markup documents for the Web and the task falls on a few members of agency technical staff, for whom, in many cases, the maintenance of the Web site is just a small part of their responsibilities. In addition, a very simple change to an HTML-based Web site may mean the need to change dozens of single Web pages, because the same information may be presented in multiple places in an agency Web site.

Despite clear advantages, government agencies confront many obstacles to the adoption and implementation of XML-based Web site management. These include the need for technical training and infrastructure readiness, but more important are the needs for solid business case justifications, understanding the impact of organizational change, leadership buy-in, and a firm understanding of where to begin. Based on a review of the current literature, this section identifies some of the main benefits from and most important barriers to XML adoption and implementation.

Benefits from XML

XML's properties allow for the separation of a document's content, structure, and display. The separation of these three elements of content production and distribution provide organizations with the ability to manage Web sites more effectively (Costello, 2002). The single source document concept of the XML technology is frequently cited as a major benefit of using the tool. The principle behind single source is that one document contains all the content independent of display attributes. The source document is eventually combined with an XSL (Extensible Stylesheet Language) to produce a variety of publication outputs including HTML pages, PDFs, and RTFs. This technique is frequently referred to as re-purposing content. Having the ability to create a variety of outputs from a single source can save on time and thus have a direct return on investment (Ethier, 2002).

In addition to re-purposing content, XML's single source capability decreases errors in content and ensures consistency of format throughout entire Web sites and between formats for multiple devices (Ethier, 2002). With the fast pace of information, changes to content can be frequent and since content often appears in more than one place on a Web site executing those changes can also be challenging (Kerer et al., 2001). Without a single content source, a webmaster might not be able to update all instances of the outdated content and thus risk inconsistency of presentation. The use of a single source document can also foster collaboration between staff at organizations, which would not be accomplished as easily with HTML (Rockley Group, 2005). XML requires that versions are controlled and managed in one location, the source document. This not only ensures that multiple authors do not have different versions, but also that no one individual has ownership of the content to the exclusion of all other individuals. All stakeholders involved in the publication process need to work together and design a workflow that allows the benefits of XML use to be realized.

In addition to content management, there are other general benefits that can be obtained by using XML. XML's data structure requirements provide an effective and fast method to share and exchange data (Boeri, 2002; Chen, 2003; Cingil, Dogac, & Azgin, 2000; Hibbard & Dalton, 1999; Kendall & Kendall, 1999). Data exchange is fostered by the development of a common set of tags that describe and structure the data. Unlike HTML, however, XML requires strict adherence to a formal set of standards or else Web pages will not display on browsers. Similar to other standards, using XML has a direct effect on accessibility. As the Web continues to grow in size and prominence, accessibility to data is paramount (Lawrence, 1999). Sites that contain several images may delay content from appearing on a Web page. XML's defined structure requirements make data more accessible. The tags allow search engines to pull out data based on the definition tags, without knowledge of the specific data (Silver, 2005).

Another benefit of XML is that it is device independent (Kerer et al., 2001; Lie & Saarela, 1999). As wireless devices gain popularity, this feature will be especially important to reach consumers. XML/XSL can deliver to PDAs, cell phones, and other wireless devices with the same ease as desktop computers. Furthermore, XML also allows for the potential to personalize data (Ryan, 2002). Because XML separates content from style, various stylesheets can be applied to customize data for different audiences. Finally, XML increases the speed and aggregation of content (Fichter, 2000). For instance, a related technology RSS, (Real Simple Syndication / Rich Site Summary), can locate and update content immediately.

Barriers to XML adoption and implementation

Chen, LaBrie, & Shao (2003) proposed a framework for managers when considering XML adoption. This framework includes the diffusion process, costs associated with the technology, and technology acceptance within the organization. Evaluating both benefits and barriers can help managers mitigate potential risks associated with information technologies (Andersen & Dawes, 1991; Bloniarz et al., 2000; Gil-García & Pardo, 2005). However, while XML technology is an improvement to managing data, it is still not a universal solution to all data problems (Yen, Huang, & Ku, 2002). In addition, many of the barriers organizations may face with using XML are common to other IT projects and fall under organizational and policy categories, not technical data handling.

For instance, one of the key barriers to many technology projects is the lack of understanding about workflow processes (Rockley Group, 2005). This is especially important with XML because the content management process includes several areas and multiple actors in an organization. Some of the stakeholders that must be considered in the case of XML adoption include: policy makers, who set the guidelines for document creation and the approval process; content creators, who input data; content reviewers, who ensure the data meets established criteria; and of course, technical staff, who markup and upload the Web pages.

Due to XML's structured authoring environment, an important barrier is authors' resistance to accept and adopt the new method of document creation (Ethier, 2002). XML requires strict adherence to rules guiding document structure. Since the structure of a document is predetermined, authors may lose some control over formatting. The strict environment can be a challenge, but with time and training can also be beneficial to the workflow process. XML allows organizations to define document displaying rules without impacting the author (Dunn, 2003). The organizational rules attached to XML documents can even decrease the complexity of the authoring process by reducing the need to format. Authors can spend a significant amount of time adjusting the size of headings, paragraph alignment and dealing with other formatting issues.

Another potential barrier to stakeholder acceptance may be the inability for the average user to differentiate between a system designed with XML and another type of system. XML's ability to transform data into various formats including HTML, makes XML technology difficult to detect (Fichter, 2000). Even if an individual were to view the source of a Web page they would not see the entire XML schema; they would see the HTML generated by the XSL/XML documents. The technology and its potential impact on a business should be explained to stakeholders. Providing training and demonstrations can mitigate potential resistance and other barriers.

Lastly, there is a learning curve associated with adopting XML technology. Similar to other technologies, individuals will need time to understand XML as well as its impact on the business. A key step to ensuring the success of any technology is building a business case. Analyzing the organization's information management needs along with the technology can be a great start to planning. If organizations follow steps to ensure that stakeholders understand the technology and information management process as well as the risks associated with its adoption, barriers can be mitigated and benefits can be achieved (Gil-García & Pardo, 2005).

Research Design and Methods

The study uses multiple research methods such as semi-structured interviews, surveys, and analysis of relevant documents. Five government agency teams were selected, looking for a mixture of several aspects such as technological expertise, organizational capabilities, and size, among others. Thirty individual program and technical staff members participated in the survey and were also interviewed. The items in the survey were initially developed based on existing literature about benefits and barriers to XML. However, since this literature is still in the emerging stage, the survey development was also informed by more general literature about IT adoption and success.

Interviews were transcribed and the research team looked for specific categories in the transcripts. Categories such as benefits, challenges, and barriers were analyzed looking for patterns, relationships and relevant processes. This multi-method approach helped to answer multiple interrelated research questions and practical concerns such as:
- What are the main benefits from using XML in Web site management?
- What are the main challenges that public agencies face in using XML for Web site management?
- How do perceived benefits, challenges, and problems differ from one context to another depending on project organizational and environmental characteristics?
- What are the expectations about the usefulness and capabilities of XML?
- How do these expectations differ between teams, job positions, and roles in the organization?

Results

This section presents the results from our study. They are organized in order of importance of benefits and barriers for the program and technical staff members who participated in the project. In addition to identifying the top 10 XML benefits and the top 20 barriers to XML adoption as reported by participants, this section presents some of the reasons why they were found important. It also describes the processes by which XML can help to produce the benefits and how the barriers can hinder or even neutralize some of these potential benefits.

Benefits from XML

Table 1 shows the top 10 perceived benefits from the use of XML in Web site content management. Interestingly, the first four benefits are slightly more technical in nature and do not directly involve relationships with users.

Information Consistency

Information consistency means consistency of content independent of display mechanism. Whether it is in print, Web (various browsers), wireless devices, or within a word processing format – the information displayed would be consistent. Currently, this requires different formats and multiple source documents. At any point in time the source document may change based on the edit/review process, re-writes, or updates (new information). In each of these cases, each of the various formats would require changes to their individual source documents. As the number of source documents increases, so does the percentage of error and potential for inconsistency, since the original author does not always perform the changes. As one webmaster explains "They (content developers) rely on us (technical team) because we have always done this, if the text doesn't read right, we'll have to rewrite it … so it falls on us." Information consistency is important because in typical Web sites with thousands of Web pages, it becomes an overwhelming task to constantly check and manage all pages for consistency. Nonetheless consistency is critical because you don't want to be presenting inaccurate, incomplete, or conflicting information on a Web site. At best, it's embarrassing; at worst, it could lead to litigation. XML can enhance consistency in two ways. The first is XML's single-source of content which means that regardless of where or how often the same information appears across a Web site, it always comes from the same source. So the text, spelling, etc. is consistent. The second way XML ensures consistency comes from its ability to produce multiple HTML and PDF pages from single XML/XSL files. So management of thousands of individual Web pages is achieved via dozens of XSL stylesheets that produce those pages. This turns an overwhelming task into one that is highly manageable.

Reduced Duplicate Data and Content Sources

Duplicate data and content sources mean that identical text, images, and other content that may appear in multiple locations and in multiple formats across a Web site are actually duplicate source files for those locations and formats. This duplication may even extend beyond the Web site to "original sources" such as Word documents where the content originated. Duplicate data is a problem similar in nature to information consistency. But it can also bloat your Web site by requiring multiple copies of the same files (increasing overall file size). It also creates a greater possibility that consistency among the multiple copies of the same data will not be guaranteed over time. XML can eliminate the duplication of data because the XML file serves as the single-source of the data or content. Its various manifestations throughout a Web site and beyond (HTML, Word, PDF, etc.) are produced via the XML stylesheets (called XSL) which transform and present the XML single-source content in the format and location desired, without modifying or copying that original XML data source.

Table 1. Top 10 Expected benefits from the use of XML in Web site content management

Rank	Item	Mean	Standard Deviation
1	Information will be more consistent across Web pages and non-Web deliveries (print publications, memos, etc.).	5.45	0.961
2	Duplicate data and content sources will be reduced	5.29	1.101
3	Duplicate data and content handling will be reduced	5.16	1.098
4	Web site (s) will be more compatible with new devices and formats (e.g., mobile devices, integrated call systems, etc.)	5.03	1.581
4	Internet and Intranet Web site users will have better information for their own use.	5.03	1.329
6	Participating departments or organizations will provide more responsive service to their clients through the Web site.	4.97	0.912
7	Participating departments or organizations will provide more timely, accurate, and effective information to their Web site users.	4.94	0.854
7	Elements of a shared information infrastructure (such as standards and common data definitions) will be built.	4.94	1.209
9	Participating departments or organizations will become more cost-efficient in Web site and content management.	4.84	1.036
10	Publications and information will be better coordinated among the participating departments and organizations.	4.74	1.032

Notes: Based on a seven-point rating scale: 1 = Not at all likely to be achieve, 7 = Very likely to be achieved.

Reduced Duplicate Data and Content Handling

Duplicate data implies multiple copies of a "source file" duplicated in many locations. By definition, this requires that the "same" content be handled in several locations, probably by different people, and across time. Without a single source, you create potential for "version differences" between the duplicates, manual tracking and maintenance of all the locations of the duplicated data, and different technical skills needed for handling of data in its various guises (e.g., Word, HTML, database, etc.). A technical staff member mentions "it's sometimes difficult to get content up in a timely manner, again because of the multiple formats, whether it be HTML… So there's a big emphasis on, in the formatted Web pages, its one or two paragraph summary of the publication. Then of course you have to do the full HTML document for accessibility standards. Then you have to do the PDF to actually get the full document for that. And as everybody knows, you need to make one change in one document while the other two things might not necessarily need a change. So you get multiple versions floating around there all the time." XSL "handles" the content and produces the output so XML/XSL not only eliminates the duplication of data, it also manages how that data is handled through its various manifestations.

Web Site Compatibility with New Devices and Formats

The Web is relatively young (about 15 years) and the surrounding technology advances at incredible speeds. Devises barely imagined in the early days of the Web (PDA's, cellphones, IPODS, etc.) are becoming commonplace and newer unimagined devices will be arriving. But, HTML which forms the foundation for Web pages was never intended to support these newer devices and in fact can only do it now through painstaking means. New devices and formats will continue to grow in importance as these devices become more the rule than the exception. Also, as these new technologies proliferate in the marketplace, they bring the compatibility, standards, and compliance issues that all new technologies bring. Web sites and Web pages will need to adapt to support this new environment. One respondent says "Our legal staff and PIO use BlackBerrys; other staff [members] use Palm Pilots; and laptops, and a few others use cellphones…making these types of formats available seems like it would be much easier with [XML.]" XML has one big advantage over HTML in this regard because XML is a content specification standard (a meta-language of rules for how data can and should be described). It is not tied to any output format as HTML is to producing pages on a Web browser. And because XML is an open standard, it can easily adapt and integrate with new devices and formats. In the simplest sense, it only requires an XSL stylesheet to format the output to a particular device.

Better Information for Internet and Intranet Web Site Users

This relates to timely, accurate, and effective information. Basically, since the Internet and Intranet are the primary vehicles for getting information to your user base, you want to get as much information as you can, in ways that are most useful to those users. Since XML offers a much more flexible structure for information and delivery of that information, it provides easier dissemination of information across Internet and Intranet Web sites.

More Responsive Service to Clients through the Web Site

Organizations use their Web sites as a primary vehicle for information and services. Clients of the Web site increasingly expect high levels of service from it. As Web sites continue to grow in importance, clients continue to become more savvy and demanding customers. When service does not live up to those expectations, the threat of alienating or losing those customers increases. Because an XML-based Web site offers the opportunity to shift many of the time-consuming menial maintenance tasks to activities that improve the quality and responsiveness of the Web site, it can produce more customer-oriented benefits. A technical staff member mentioned "I don't think there's a lot of, as far as people go, I don't really think there's a lot of resistance to this project because everybody sees that it just opens a new avenue, because there are so many people out there that we really aren't reaching, or we're not reaching to the full extent. So by doing this project, it's going to allow us to get those people in here."

More Timely, Accurate, and Effective Information to Web Site Users

In many, if not most, cases, Web sites are an organization's primary vehicle for delivering information. Timely, accurate and effective information means that what appears on the Web site is not out-of-date or inaccurate and that it's easy to find and understand. From a business and public service sense, it is important that the information be timely, accurate, and effective. First, it's good public relations demonstrating that you are on top of things as an organization. Secondly, it can avoid bad will or possible lawsuits. Because XML dramatically reduces the amount of time required for maintenance of Web pages (due to enhanced consistency and reduced duplication), it frees up time to ensure that the actual content on the site is timely, accurate, and effective. One technical staff member explained "I think the biggest advantage you're going to have is freeing up a really talented person to do more complicated work than she's doing right now. She's stuck doing a clerical job that's just difficult enough that no one really wants to hand it off and eliminate that." Plus, the highly automated framework that XML/XSL brings to Web management, means that updates can be made and promulgated throughout the site much quicker.

New Elements of a Shared Information Infrastructure

Data sharing, collaboration, and integration are dominant topics in today's IT world. It applies to legacy applications and the Web as well as to formats, technologies, and devices of the future, near and far. Organizations need to share data within their own organization and across organizations throughout the world. The "shelf life" of data is becoming of increasing concern, especially as technology advances and we find that formats once thought to be "universal" are now "obsolete." The costs of developing and maintaining interfaces and middleware to communicate data across different formats can be prohibitive and shortsighted. It is far more advisable to have data formats that are open, standard, easily communicable and persist over time. XML is first and foremost an open, standards-based, data formatting specification. By its very nature, it is designed to enable the sharing of information. It is not tied to any device, technology, or proprietary software. By using XML – especially by adopting industry-wide standards within XML such as DocBook, EAD, and other data definition schemas – users are building the elements of a shared information structure.

Cost-Efficiency in Web Site and Content Management

Cost efficiency in Web site and content management mean that organizations are not "paying twice or more" for the same function. Also, that staff time is not overly devoted to menial, repetitive tasks, but rather to work that will make the Web site more timely, accurate, and efficient. HTML based Web sites require a great deal of redundant and menial maintenance tasks (checking pages, making the same changes in several different places, etc.), while XML eliminates most of them through its single-source, multiple output design. A program staff member states "its pretty straight forward to make conversions in XML documents quicker (than traditional methods) and more standardized so that there's less wasted resources." With HTML cost efficiencies are inversely tied to the size of the Web site. It can be very cost-

efficient to maintain a small site in HTML, but as the site grows, those efficiencies decrease because there are more individual pages and duplicated iterations of content to manage. The more the site grows, the less efficient it becomes to manage. With XML, just the opposite occurs. Since the many pages of a Web site are generated by a very small number of XSL files, the number of files to manage stays constant as the occurrence of individual Web pages increases. For instance, an XML-based site with 20 XSL stylesheets may produce 100, 1,000, or 10,000 HTML Web pages. Regardless of the number of Web pages, the content still comes from single-source XML files and those 20 XSL files produce all the pages. It's a much easier management structure.

Publications and Information will be better Coordinated
Publications can present particular difficulties to Web sites due to their number of pages, unique formatting and layout, and navigation/paging requirements. In addition, most publications are created and maintained in a format that is "foreign" to HTML, such as word processing or desktop publishing software. Things that are taken for granted in many publications such as a table of contents, tables, graphics, and footnotes can be very difficult to recreate in HTML pages. Likewise, a single publication may have many incarnations on its way to the Web – from a word processing document (the "original") to a desktop published document (the "printer's original") to a series of individual HTML pages (the "Web original") to a PDF file (on the Web and in print). XML/XSL provides perhaps its biggest benefits in its ability to better coordinate publications. For example, take a typical 50-page publication. Since all the content for this publication can be contained in one single-source XML document, the problem with various versions and formats of the "originals" can be alleviated. Likewise, the peculiar challenges posed by publications for a Web page such as the navigation, footnotes, etc., can be "programmed" into a single XSL stylesheet and then applied to all the publications encountered on the Web site. In addition, one of the largest challenges in the publication process is from the perspective of workflow. In most publication processes, once the document leaves the content developer and is handed off for content review and edit, control of the source document can be compromised. Depending on the publication process, the original source document may change a number of times due to a variety of reasons (e.g. content edits, publication decisions, etc.) In addition to this, different actors within the process can perform the various jobs, so consistency and integrity can be compromised if attention is not paid to the process the document follows. One of the respondents mentioned "well, we think we can speed up the publication process, because right now there are a lot of people who get involved… [and] make a lot of those steps." The challenge is not only in the media used (software applications or languages), but also in the process used.

Barriers to XML Adoption and Implementation

Table 2 shows the top 20 barriers to the use of XML in Web site content management as reported by participants. An interesting finding is that in general terms benefits were rated higher than barriers, which may represent that public managers perceived more benefits and see most of the following factors as surmountable barriers.

Organizational Resistance to Change
This refers to the general characteristic of many organizations' resistance to change of any kind. It is important to recognize organizational resistance to change because any innovation requires change, so this general resistance will always have to be addressed. In regard to changes precipitated by converting to XML for Web site management, it's important to recognize that the changes required will lead to more efficient processes, better service and products, and less work down the line, so there is an incentive to change from an organizational perspective. However, it's also important to note that the changes will be felt throughout an entire organization, or at least the areas involved in developing and bringing content to the Web. So, you cannot address the factor of change only in the IT or Web unit. A program staff member explains that people need to understand "how it will affect them directly, if they can't understand this, they are less likely to help implement it."

Different Priorities among the Participating Departments
Many different departments are involved in Web content (e.g., individual business or program units, public information offices, IT, Web unit, etc.) and all these units have their own priorities and missions both in regard to the Web and outside of it. Therefore, it is important to recognize these differing priorities to

balance them among one another and with the overall organizational priorities. As one user liaison stated, "there mainly is the sort of lack of one defining focus of where we want it to go and what we want it to look like. Everybody from different parts of the agency thinks that whatever they're doing, it's the most important thing and needs to be at the top of the page and flashing red letters instead of in an appropriate and logical spot. So they (Web team) deal a lot with the personalities and the priorities." Again, an XML based Web site can help to align priorities by stressing the single-source content and demonstrating how everyone benefits from keeping the content consistent, timely, and accurate. Conversely, conflicting priorities can threaten XML initiatives by taking resources away from or focusing in different directions, so public managers should understand this barrier to manage and possibly modify the scope of an XML initiative.

Individual Resistance to Change
This refers to the general characteristic of some individuals to resist change, particularly change derived from IT initiatives. It is important to recognize and address individual resistance to change. One program staff member mentions "…and that's, I think that's a pretty common problem in any organization. People don't want change if what they're currently doing is working, especially because what they've currently been doing has been no problem for them. They do what they do and the Web staff has been picking up the slack and making it work." In regard to changes precipitated by converting to XML for Web site management, for some individuals there is an incentive to change. However, it's also important to recognize that certain individuals will resist change no matter what, so workarounds or accommodations may need to be made.

Table 2. Top 20 Perceived barriers to the use of XML in Web site content management

Rank	Item	Mean	Standard Deviation
1	Organizational resistance to change.	5.03	1.602
2	Different priorities among the participating departments and organizations.	4.94	1.340
3	Individual resistance to change.	4.68	1.514
3	Program and service staff lack knowledge of technology.	4.68	2.120
5	Turf and Conflicts.	4.61	1.783
5	Goals that are too ambitious for the people and money available.	4.61	1.564
5	Reluctance to abandon current technologies and procedures.	4.61	1.564
8	Lack of common publishing and communications standards.	4.58	1.822
9	Overlapping or conflicting missions among participating departments and organizations.	4.55	1.650
10	Lack of understanding about each department's and organization's needs and abilities.	4.35	1.603
10	Lack of agreement about the overall goals.	4.35	1.582
12	Lack of common Internet and Intranet standards.	4.23	1.668
13	Project management that is control-oriented rather than collaborative.	4.16	1.614
14	Lack of cooperation among organizations or areas.	4.10	1.826
14	A lack of successful models to follow.	4.10	1.620
16	Unrealistic time frames.	4.06	1.389
17	Technology changes too often for all parties to keep up.	4.03	1.426
18	Lack of guidelines or other tools to support XML adoption and implementation.	4.00	1.633
19	Lack of top executive support for XML.	3.97	1.991
20	Lack of adequate training.	3.94	1.879

Notes: Based on a seven-point rating scale: 1 = Not a barrier, 7 = A severe barrier.

Program and Service Staff lack Knowledge of Technology
This is a common situation in which staff simply does not know enough about a technology to evaluate or use it. This lack of knowledge can be a barrier on two levels. First, it may hamper a clear understanding of how an unfamiliar technology such as XML can provide benefits, thus making an evaluation or

acceptance of it difficult to achieve. Second, it may short-circuit implementation when staff just does not feel up to the task. Since XML is not really a technology, but rather a formatting specification, that makes other processes and technologies (such as data transfer, document management, etc.) easier, it's really not that difficult from a technological perspective. While it has a steep learning curve due to its requiring a change in mindset as to how organizations manage content, that learning curve is also short because XML/XSL itself is quite simple to use, and not highly technical. In addition, when integrating XML with existing platforms, staff needs to have knowledge not only about XML, but also about the current technological infrastructure. One program staff member said "I do think that's a big barrier for us to move forward. But I think the biggest barrier here is that we only have one person that really knows [that] system. I think they really should need and explore, I mean, our project manager or team leader, he needs to get so he knows [this platform] inside and out. And as far as [our organization] is concerned, from a business standpoint, you shouldn't only just have one person that knows it. I think that's our biggest barrier."

Turf and Conflicts
This is again a general organizational problem whereby different units or individuals have certain "turf" (programs, people, priorities) that they want to protect and which they may perceive as being threatened by other initiatives. A technical staff member recalled "…when I got here, I said, oh, my god--why are you fighting over this? It'd be better to work together but it just never was the culture to do that, and that's changing a little bit now…" Turf and conflicts can threaten any innovation because they are not based on any reasonable ground that can be evaluated and argued. Thus, stressing potential benefits may have no impact upon these turf loyalties. On the other hand, some negotiation may be necessary and useful to obviate the impact of the conflicts. XML for Web site management doesn't really in itself offer much in regard to dealing with turf and conflicts. At best, it can help to show commonalities throughout a work process and perhaps blur some of the hard and fast lines that lead to turf loyalty and conflicts. These are human relations and organizational issues that need to be addressed in order to better achieve the benefits from XML.

Goals that are too Ambitious for the People and Money Available
Redesigning part or a complete Web site (either via XML or not) can be a huge undertaking for an organization and involve far more people, areas, and resources than anticipated. One of the respondents explained "one of the reasons I said before that we're going to focus on three or four [documents] is the fact that's manageable. If we tried to do every [document], we'd be in serious trouble. But I think we're smart enough to know that. But we'd sure like this to work right out of the box and… have something we can use. But that's just not a realistic expectation. So managing the ambition, managing the resource, is going to be very important." It's important to evaluate the appropriateness of goals for two reasons. First, if they are too ambitious, public managers can be ready and scale back accordingly. Second, public managers should not confuse the ambitiousness of the goals with the "doability" of the project, and wrongly conclude that XML cannot be implemented in their agencies. XML for Web site management offers good flexibility for scaling back projects to fit an organization's capabilities, while still delivering benefits. For example, an organization may go into the project planning to convert all 10,000 pages of its Web site to XML because of potential benefits. Then, public managers may see that it is too much to tackle based on available organization's resources and expertise. So they can scale back to just convert the most popular publications and still derive the benefits of single-source and content consistency, while creating a model for future applications of XML.

Reluctance to Abandon Current Technologies and Procedures
Like resistance to change, this is a common situation for organizations and individuals – but with the added elements of technical comfort and monetary investment in technologies. A technical staff member said "we're changing the way they're doing business, so that's a potential issue. We're adding software that's not part of the standard culture so in the infrastructure group, that's going to be an issue." If people have technologies and procedures that they are used to and that work for them (regardless of how inefficient they may appear to an impartial observer), it is difficult to convince them to change their behavior on a promise. Because of its non-proprietary, open standard nature, XML does not always present an either/or situation. It can be, and is, integrated with existing technologies and procedures. On the other side, because of the efficiencies it brings to content management and the "creation to Web

workflow processes," XML can offer a strong argument for replacing cherished technologies and procedures.

Lack of Common Publishing and Communications Standards

Publications often exist and are produced in a variety of formats within an organization depending on how they will be delivered or what the creator is familiar with. This includes software such as word processors, desktop publishers, HTML editors, email, etc. as well as general standards such as how headings are defined and used in documents, and how titles, authors, dates appear, etc. The lack of standards creates a large workflow barrier as individuals continually reinvent the wheel along each step of the publication process or with each new publication. It can lead to "version control" issues whereby it becomes difficult to identify the authoritative source document. It can also create consistency problems as content is reformatted and manipulated in various steps along the way. One webmaster stated "our prior Web site was all over the place. It was different fonts, different colors. One unit put up three thousand paragraphs of text another one would put up three sentences and they didn't update it." Because XML is a specification for defining content structure, it addresses common publishing and communication standards at the root. The innate structure of XML-based documents lends itself to procedures and standards that capitalize on this structure and streamline the publishing flow. Rather than multiple source documents in various formats, XML encourages and demands single-source documents in a standard format.

Overlapping or Conflicting Missions among Participating Departments

One department's "mission" may be to have its material on the Web as soon as possible in a prominent location, while another department's mission may be to make sure that the material is in a format that is Web-accessible and positioned properly among all the elements of the Web site. A technical staff member mentioned "navigation's always a challenge. Again, the real estate issue—everybody wants to be on the home page." It's important to recognize these differing missions in order to balance them among one another and with the overall organizational priorities. It may even turn out that two missions that, at first were seen to be in conflict are on a closer look supportive. Again, an XML based Web site can help to align missions by stressing the single-source document and demonstrating how everyone benefits from keeping the content consistent, timely, and accurate. Conversely, conflicting missions can threaten XML initiatives by taking resources away or focusing in different directions.

Lack of Understanding about each Department's Needs and Abilities

Many departments across an organization are involved in the process of getting content to the Web. But often, these separate units are only aware of their function in the process and do not understand what happens in units outside of their area. This barrier is important because the lack of understanding can cause bottlenecks in the overall workflow that could be addressed if the units worked together. For example, a program unit may put together a document that will eventually appear on the Web but they format and create it in a way that is familiar to them (i.e., in a word processor). This potentially creates additional work for the Web unit in reformatting for the Web, which in turn creates additional steps in the workflow for proofreading, cross-checking versions, etc. If a transition to an XML-based Web site is implemented correctly, the teams look at the overall workflow of getting content to the Web across units and departments. This analysis can help to identify and hopefully streamline gaps or bottlenecks in the process.

Lack of Agreement about the Overall Goals

Different individuals and departments have different understandings of what's important and what results are desired as well as different levels of awareness of the workflow processes they are involved in. Thus, a Web unit may have a goal of getting out of the business of converting a 20-page MS Word document into 20 linked HTML files, while a program unit may have a goal of seeing their documents in different formats and on different devices. Because Web site management cuts across so many organizational areas and involves so many different perspectives, it's important to articulate and clarify overall goals so that everyone is not pulling in opposite directions. Because XML-based management of a Web site addresses workflow processes and standardizes how content gets from creation to the Web, it requires a certain level of agreement about goals. As a result, XML may get the Web unit out of converting

documents into HTML files by hand and also make these documents accessible in different formats and different devices.

Lack of Common Internet and Intranet Standards

Because the Web has grown rapidly and somewhat haphazardly over the past decade, many "solutions" and software approaches have evolved and been cobbled together for assembling Web sites. Even what would seem to be simple standards, such as browsers' implementation of HTML standards, were slow to evolve and messy. Current Web sites as a general rule are a mixture of different technologies – HTML, CSS, JavaScript, PDF, servlets, database connections, etc. – that are all at differing levels of compatibility with standards such as browser support, accessibility, etc. It is often hard to determine how new approaches will impact this motley environment and how they will adapt to future standards. XML, by definition, is a standard specification for describing the structure of content and data. And it is a standard that was developed specifically for the Web with application beyond the Web as well. An XML-based Web site can help to move organizations into an environment of common standards and away from proprietary or obsolete formats.

Project Management that is Control-oriented rather than Collaborative

This barrier identifies a top-down, authoritative approach to project management as opposed to an approach that involves a wider spectrum of affected participants using shared understanding and decision making. Since XML-based Web site management involves collaboration in a workflow process (getting content to the Web) that cuts across departments and units, a strictly control-oriented approach to project management could alienate many of the primary stakeholders and threaten the success of the project. While an XML-based approach to Web site management cannot in itself change or dictate a project management style, it does, by its cross-organizational look at workflow processes, lean participants toward a more collaborative approach, which in fact is required for a more successful XML implementation.

Lack of Cooperation among the Participating Departments

Departments that are involved in the process of getting content to the Web do not work well together or may choose not to cooperate with one another as part of the overall organizational process. Again, this lack of cooperation can seriously hamper or halt an initiative to convert a Web site to XML because of the crucial role of the interdepartmental workflow processes in Web management. XML makes the interrelatedness of multiple departments evident in the content management and Web site management process. Plus, since many of these departments will accrue benefits from cooperating (i.e., streamlined workflow, more accurate information, less redundancy, etc.), it may provide incentive to cooperate.

Lack of Successful Models to Follow

There is at this point a relatively small user base of individuals and organizations using XML for Web site and content management. For instance, one webmaster stated "we don't have a model to follow." This can be a problem at the start of the process of potentially adopting XML because the proponents cannot easily point to other cases that have succeeded in similar situations. It can continue to be a problem through the implementation phase because you cannot easily fall back on tried and true methods because they may not exist or not be documented or easily found. Currently, this is still a problem, although more successful models are slowly appearing as XML usage grows.

Unrealistic Time Frames

Usually, this means time frames that are much too short to achieve the desired results, although it could also mean (to a much lesser degree) proposing a time frame so long that no one cares to make the commitment or loses interest. With many projects, particularly technical ones, there is a tendency to want to jump right in to technical solutions, get things working, and solve the problem (without necessarily even understanding what the problem is). Thus, a "we need a solution now" mentality takes hold along with great pressure to show some results. Since much of the work in converting a Web site to XML involves analyzing workflow processes, collaborating with other departments, and learning a relatively new technology, time needs to be budgeted up-front to do these tasks properly. This groundwork is essential to the success of the project. The time spent at the initial stages will be reaped in the maintenance time saved later and the streamlined workflow.

Technology Changes too often for all Parties to Keep up

To paraphrase a familiar truism, technology doubles its capabilities every 18 months. In the Web world, technology advances even quicker; software and devices that didn't even exist six months ago are suddenly in common use, and then replaced themselves in another six months. Changing technology presents a two-fold problem. First, there can be a reluctance to adopt anything new or different for fear that it's just a passing trend with no long-term benefit. Secondly, it can get somewhat overwhelming from a technical knowledge perspective that it is safer just to stick with what the technical staff already know and give up on trying to constantly improve the knowledge base about new technologies. Since XML is an open standard, rather than a technology per se, it is not expected to pass away or be superseded by future software versions. Also, it's a specification that can be learned relatively easily and is not subject to a six-month software update release schedules.

Lack of Guidelines or other Tools to Support XML Adoption and Implementation

Although XML is very popular in data exchange applications, it is not in prevalent use for Web site and content management. Thus, many of the tools, training, and other infrastructure for this use is not in place. The problem, even for individuals and organizations convinced that XML is appropriate for their organization's Web site management, is that they may have no idea how to implement it on a practical level in their environment. This continues to be a problem, even though, as XML usage grows, more resources are slowly appearing. Successful organizational experiences can, to certain extent, mitigate this barrier. One of the respondents explained "we're pretty convinced that XML isn't just the flavor of the month so I don't think that's, we don't think that's an issue. And the fact that [other] system [in our organization] is built in XML and has been tremendously successful really mitigates that as an issue in the department."

Lack of Top Executive Support for XML

As with any organizational initiative, top executive support is needed since that is where all organization activity gets its direction and sanction. This can be a show-stopper because despite perceived benefits, departmental enthusiasm, and convincing prototypes, if top management does not want a project to proceed, it will not proceed. As a technical staff member explained "…now you have to propose to your management team a different alternative, saying, look, you know, we've got this system that we're using now, but it's not going to work. So in order for us to do what you want you want us to do, then we need to go this route and are you willing to allow us to do that?" In general terms, many of the reasons for lack of top executive support can be traced to the barriers itemized previously. Executive support will not be forthcoming if a project has conflicting goals or unrealistic time frames or inadequate technical skills or demands that the organization abandon existing (and apparently working) technologies or procedures. An XML for Web site and content management project, if properly executed, can obviate many of these concerns by addressing them directly to the executive level.

Lack of Adequate Training

This is closely related to the preceding barriers in that there is at this point a relatively small set of training offerings (online or classroom) that specifically address the use of XML for Web site and content management. Adequate training is always a major issue when implementing any organizational change, especially technical and cross-departmental changes. This also continues to be a problem, although more training offerings are slowly appearing (both online and in classrooms) as XML usage grows. One program staff member explained "…because as it stands right now, we have too many different areas doing different things and there's not a lot of even taking a Word document and making it a PDF and getting it as a PDF and making changes to that PDF. People have problems with that. They say, oh, I can't convert it back, but you don't have to convert it back. If you have the PDF, you can change it, but within the applications. So it's hard to train everybody on everything."

Different Perceptions between Technical and Program Staff

Identifying benefits and barriers to the adoption of XML for Web site content management is very important to plan for this type of transition. Technical and program staff may have different understandings, and therefore, different perceptions about XML, as well as its benefits and barriers. As

one member of a team stated "I think it's just a matter of our internal customers, our staff, people from the various different offices, that are not really aware of what all it takes to present this information. I think that's it in a nutshell. I think they have a lack of understanding of how it happens, how it goes from Point A to Point B to Point C —there's a vacuum there." Using t tests for difference between means, the views of program and technical staff regarding benefits and barriers of XML for Web site content management were compared. Table 3 and 4 show the benefits and barriers that were perceived significantly different by program and technical staff.

Table 3. Expected benefits from the use of XML in Web site content management (differences)

No.	Items	Mean Tech	Mean Prog	Sig. Test P-value
3	Information will be more consistent across Web pages and non-Web deliveries (print publications, memos, etc.).	5.72	5.08	.064
7	Participating departments or organizations will provide more timely, accurate, and effective information to their Web site users.	5.17	4.62	.076

Notes: Based on a seven-point rating scale: 1 = Not at all likely to be achieve, 7 = Very likely to be achieved.

The two benefits that were perceived differently are related to the consistency and quality of Web site information. In both cases, technical staff perceived that these two benefits are more likely to be achieved than program staff. The mean for technical staff was greater than the mean for program staff in both cases. This may be because technical staff members have more knowledge about the capabilities of XML, and because they are more optimistic about achieving the benefits of information technology solutions.

In general terms, program people identified six factors as more severe barriers than technical staff. For all items with significant differences, the mean for program staff was higher than the mean for technical staff. There seem to be two main topics in this group of barriers: financial resources and technology acceptance. Program staff members seem to be more concerned about the availability of adequate financial resources than technical staff. This may be because technical staff members are more knowledgeable or optimistic about the real cost of the transition from HTML to XML. As one technical staff member mentioned "…costs of transitioning from HTML into XML--I don't think those costs are terribly high to begin with. And I think we have enough commitment that that's not going to be a real big issue."

Table 4. Perceived impediments to the use of XML in Web site content management (differences)

No.	Items	Mean Tech.	Mean Prog.	Sig. Test P-Value
3	Funding that is inappropriately allocated among the participants.	3.12	4.31	.039
13	Fear that XML is just the latest "flavor of the month."	2.67	4.00	.035
19	Technology changes too often for all parties to keep up.	3.67	4.54	.093
27	Current level of investment in HTML.	2.72	3.92	.040
32	One-year-budget restrictions.	3.00	4.08	.069
33	Difficult intergovernmental relationships.	2.88	3.85	.059

Notes: Based on a seven-point rating scale: 1 = Not a barrier, 7 = A severe barrier.

Some Practical Lessons

XML is a new technology that can help to manage government Web sites better and, subsequently, improve how government serves citizens and other stakeholders. In addition, XML is a flexible technology and provides excellent opportunities for innovation in public service, as well as the capacity to improve

how government managers make use of their IT and program employees. Here are some practical lessons derived from this research.

Focus on the Business not on the Technology

As stated earlier, reviewing the workflow processes that content follows from creation to Web will help identify bottlenecks, inefficiencies, and potential areas for inconsistencies. One important factor that many times is overlooked is that process analysis identifies interorganizational hand-offs. The analysis of workflow helps organizational units see beyond their own boundaries as to what process the content follows. As one member of the agencies teams stated "I never knew exactly what happen once it left our office. I am amazed at the work they [the other unit] has to do with it once we think it is final." This acknowledgment helps organizational units see not only their part in a larger picture. It also removes the 'emotional' connection or ownership many have to the final product. Through this analysis, the various actors involved, see how their role is merely a part of a larger organization or schema. This factor alone can help eliminate or reduce the number of turf conflicts and 'ownership' issues that can and do occur.

Act Incrementally, but think Globally

Redesigning a Web site is a daunting task. At best it actually can be paralyzing not only for the technical team but also for the program and executive staff as well. What we have found in our research is that if the task is broken down into actionable components, if the project focus is refined into 'doable' subsets, the overall task becomes obtainable. Each of our five teams found that by narrowing the focus of their initial project to one publication or one static content page, they were afforded the time and energy needed to learn and explore the possibilities of XML. Once they have achieved this incremental step, they start thinking more globally. The smaller project provided them with valuable information to help guide a larger project. They were able to consider what were the changes necessary to the workflow process that needed to be accommodated to accomplish this task. How does this information become transferable or scaleable for the larger endeavor? What are the training and support issues learned in the smaller project and what are the organizational changes that need to be addressed before moving forward with the larger more complicated project. What this also afforded them was the opportunity to gain knowledge that can and will be applied to other projects. XML becomes a new "club in the bag or tool in the toolbox" as one team member stated. Thus providing them with the ability to boarden their focus to encompass a wider range of their Web site.

Involved all the Relevant Stakeholders

There are many different types of stakeholders to any process. However, not all stakeholders are created equal - they vary in power, legitimacy, and urgency. They each pull different 'weights.' Regardless of this fact, each of them needs to be considered in your analysis. If your focus is too narrow, or you only focus on the most powerful stakeholders, important stakeholders can and will be overlooked. One way to mitigate this is by considering the workflow process as a way to identify potential stakeholders. In this way involvement of those stakeholders can then take many forms – from active engagement to keeping them informed of your progress. This not only helps to ensure a well-informed design but also ensures mitigation of many of the barriers identified by our team members such as lack of understanding and cooperation among participating departments.

Secure Training for both Technical and Program Staff

Training can take many forms. Not only can it take many forms but also depending on the role and responsibilities of the various actors, and where they engage with the process, may in fact dictate the type and format of training that is required. The tendency in most organizations is to provide technical training to only the technical staff. In the case of XML for Web site content management, all actors in the process need to understand how XML works and why in fact it may change their individual processes and job functions. Without this training, many will not be able to be actively engaged in the discussion

surrounding process improvements or process changes. This universal or shared understanding by all actors helps diminish the tendency for turf conflicts and communication problems.

Balance readiness with support – whether it is internal or external support

Organizational readiness is a dimension that in many ways is overlooked by analysts when they are considering moving forward with an initiative, regardless if it is an IT initiative or organizational change initiative. We have found through this project that for those agencies that had a strong IT technical staff, their needs were more focused on organizational change support or guidance. Whereas for those agencies with limited technical staff, their needs were focused on obtaining IT support. Within the project design we were able to supplement the 'organizational readiness' of our agencies with our own staff – whether that was in IT knowledge and training, project management knowledge or support, or business analysis and organizational change support. However, in the 'real world', project sponsors need to consider what their organizational readiness is and make the necessary accommodations to obtain the necessary support – whether it is internal or external to the organization.

Understand and Address Multiple Organizational Priorities

There will always be competing priorities in any organization or unit. This is a reality we have to live with. The way to accommodate this is by understanding what those competing priorities are and communicate to the necessary actors to ensure effective decisions can be made. Ignoring this factor will lead to many of the barriers identified by the agency teams in the survey.

Obtain and Nurture Executive Support

In each of the agency teams that were part of this study, executive support shifted due to the very nature of the world in which government operates. The teams found that continual communication with their executives help ensure smooth transition when executive sponsorship changed. One vehicle that the team found helpful was the business case they developed as a part of their process. This tool provided them with a consistent and effective way to provide new leadership with the information necessary to garner their support. Each team also developed a communication plan that the project manager followed to keep their executives informed of their progress. As stated in the previous discussion, XML for Web content development many times does not provide the tangible results needed to 'show' progress. Having a more effective and efficient workflow is not as flashy as a new widget or application. Each team needed to determine for themselves what they would need to provide their management to show progress. It was through this communication plan that they were able to weather the various competing priorities and maintain executive sponsorship and support.

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