

User Involvement in the Web Development Process: Methods and Cost-Justification

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ABSTRACT

Increasingly, companies and organizations are involving users in their web development projects to help get a better understanding of the content and usability needs of the users. This paper reviews the methods for user involvement, and describes how population definition and task pre-definition influence the methods used for user involvement through the Task-Time-Population (TTP) Model of User Involvement. Survey data was collected, relating to the methods for user involvement in 149 web development projects. The challenge of cost-justifying user involvement in web development projects is discussed, and suggestions are made for quantifying the value of user involvement.

INTRODUCTION

It is well-accepted that it is important to include end users in the development process when building information systems [6]. User involvement ensures that the information system being built will actually meet the needs of the end users. However, frequently, users are not involved in the development of web-based systems. This can lead to numerous problems, such as web sites that do not offer content that the users are interested in, or a web site that is difficult to use.

There are many approaches to user involvement in the development process. In addition, no two web sites are the same. Rather, web sites have different missions, user populations, task goals, and levels of complexity. Choosing an appropriate strategy for user involvement can be a challenge. Another challenge can be to cost-justify the involvement of users in the development process. The free-wheeling dot-com market of the late 1990s is no more; rather, budgets are tight and carefully monitored. Those in charge of web development projects (with titles such as project managers, user interaction managers, and information architects) must frequently justify the cost of getting users involved in web development. The purpose of this paper is to introduce the various methods of user involvement, and how they can be implemented in different types of web sites. A survey was developed to determine which methods for user involvement are most popular and the results of that survey are presented in this paper. Cost-justification models will also be presented.

GETTING USERS INVOLVED IN WEB SITE DEVELOPMENT

There are many different lifecycles for developing informational systems. For instance, the Systems Development Lifecycle (SDLC) is the most traditional model [6,22]. In this model, users are involved at various stages of the systems development. This model usually refers to information systems that are being developed for a well-defined set of users within an organization. Other informational systems being built are designed for larger market appeal, and the goal is to make a software product that large quantities of consumers will purchase. For instance, Microsoft™ regularly involves users in developing products such as Windows XP™ and the new XBOX™ game system. Web sites come in various forms, with different audiences and target user populations. Only a portion of web sites are built for traditional, internal organizational user populations. In addition, web sites are rarely “sold” as products, and only a very small percentage of web sites (such as the Wall Street Journal) collect fees for simply accessing the site. Population definition can be an important factor in determining user involvement.

User Population Not Well-Defined

The approach to involving users in web site development may differ based on what type of web site is being built or redesigned. It is important to determine the targeted user population of a web site. Some web sites, such as news sites (Washingtonpost.com, cnn.com), search engines (altavista.com, google.com) and e-commerce sites (amazon.com, ebay.com) are targeted towards the entire population of web users. The users of these sites do not fit a single profile, rather these users are as diverse as all the users of the WWW.

The level of user involvement needed in the development process corresponds to the pre-definition of user tasks. For instance, the user tasks for an e-commerce site or a search engine are relatively clear. In an e-commerce site, the users want to find out information about products, and then possibly purchase those products. For news web sites, such as the Washington Post, the majority of tasks are related to news stories, which in many cases are based on the paper version in the newspaper. The goal and task of a newspaper has a well-defined tradition, although some additional tools, such as chat rooms, might be added. Web search tools are designed to search large information spaces, however, the methods of searching are generally well-known from years of research in library science [12]. In these types of web sites, the tasks tend to be well-defined, and the user population tends to be broad.

User Population Somewhat Well-Defined

Outside of very popular websites that are geared towards the entire population of web users, for many other web sites, the targeted population of users narrows. As the target population narrows, the required tasks are more specific, but it may not be totally clear without user involvement what those tasks are. For instance, it's relatively clear (based on 20 years of research on user searching behavior) what users want from a search engine. It becomes less clear what users want from a web site for, say, undergraduate students who are Mathematics majors. These types of web sites, with a more narrowly defined user population, tend to be informational or community-based. In these types of sites, it becomes not only important to build a site that is easy to use, but also, you first must do requirements gathering, to determine what tasks users would want in a site [8]. The site might be easy to use, but the tasks that the users want to perform (e.g. retrieving certain types of information) might not be clear beforehand. On the other hand, requirements gathering tends to be a bit easier, since the user population is more well-defined. The targeted users are usually people within a certain profession, or people that have a specific interest, membership, or affiliation. Therefore, it is usually easier to access users for requirements gathering. An example follows, of where the user population is somewhat well-defined, but the tasks requested by the users are not pre-defined.

Example:

The College of Science and Mathematics (CSM) is one of six colleges at Towson University. A re-design for the CSM web site was planned for Fall 2001. Surveys were created and distributed among the faculty, staff, and students in the college, to help determine the task needs of the users. What are the user tasks of a college-wide web site? The tasks are not well-defined, before user involvement. A representative sample of surveys were collected (>70), with most respondents indicating that they did not visit the CSM web site on a regular basis. When asked what content they were interested in, most of the responses were asking for content that was not currently on the web site. For instance, survey respondents were most interested in lists of college-wide committees, and minutes of previous college council meetings. Neither of these resources had been previously available on the CSM web site. Redesigning for improved usability would not have drawn more people to the web site, because even if it was 100% usable, the information that was there was not what people wanted. It was critical to consult the users to determine their task needs.

User Population Very Well-Defined

There are some circumstances where the user population is very well-defined. For most internal, organizational informational systems, the user population is well-defined, because only certain users (or user groups) can have access to organizational data. In addition, software is also built for workgroups that must access shared data across different organizations (extranets). Some of these corporate applications are actually delivered through web browsers. For instance, corporate intranets or workgroup software can be accessed via a web browser [7]. To access the information, users must have a valid password. This is a well-defined population, where the borders are clear between users and non-users. Identifying users to be involved in the development process is not hard, since all users will need to be assigned usernames and

passwords. While this is a well-defined population, this can be anything from a population of 10 users to a million authorized users. Even if we know who the users are, there can be multiple user groups, and a diverse set of needs.

The challenge in this case is not defining who the users are, but rather, what tasks need to be performed by the users. For real-time work, there are a multitude of tasks that the users may need: searching databases, chat rooms, shared whiteboards, schedules, shared data stores, etc. For an intranet/extranet to be successful, these user tasks must be determined. Therefore, an organizational information system delivered via a web browser has a very well-defined user population, but the tasks are not well-defined in advance of site development. This is the exact opposite of a web site such as a search engine.

USER TIME INVOLVEMENT

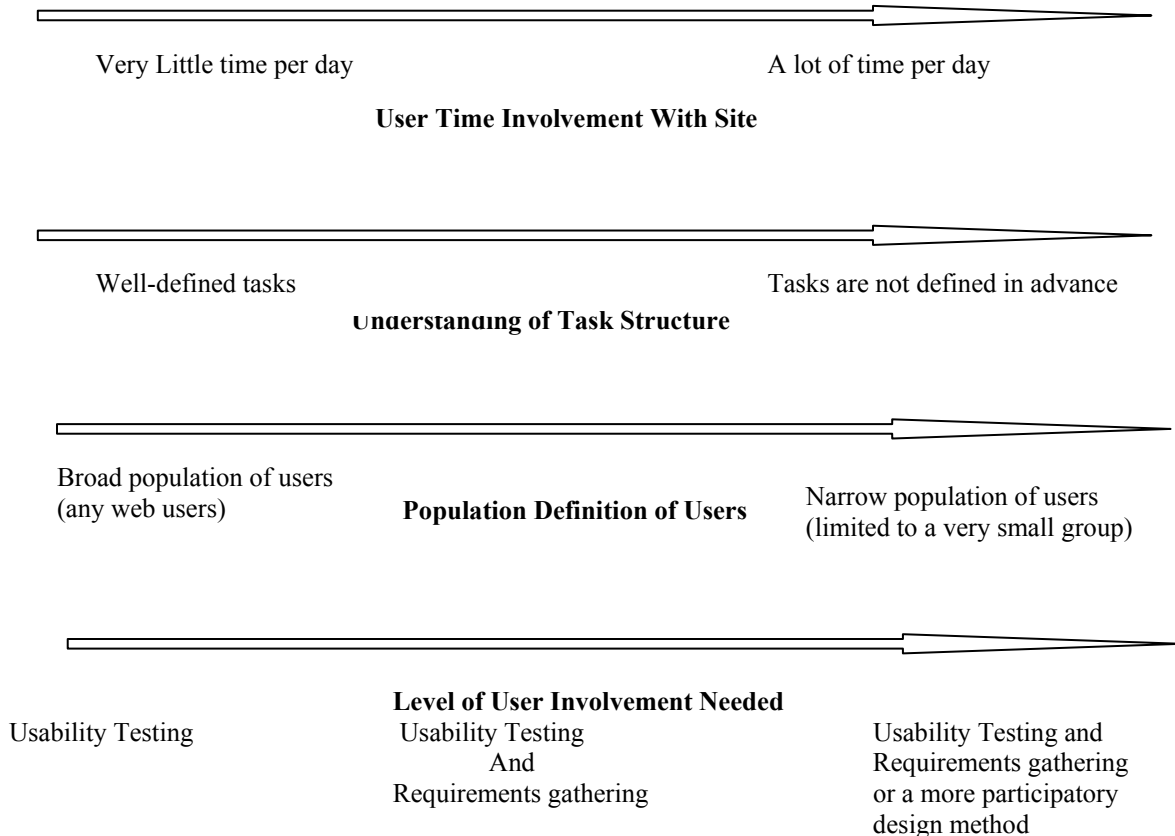
Theoretically, it would be ideal to have users involved with every moment of systems development. In this model of user participation, called participatory design, users are involved, as members of the design team [17]. Realistically, users are busy people, who don't have much time to give, and the costs of user involvement can be prohibitive. Therefore, users may be most willing to give their time for systems development when they feel that it will benefit them the most. Users will receive the most benefit of being involved with development when they are using a web site/system frequently, either for long periods of time, or for many short periods of time. The types of web sites where users tend to spend the longest amounts of time include web-based applications, organizational intranets, and extranets. These are the web development projects in which users will be likely to receive the most benefit from being involved in the development process.

TASK DEFINITION

Task analysis is an important first step in determining what level of user involvement is appropriate for a web site. It should be analyzed to determine what is known about the tasks that users want to complete before development (or re-development) of web sites. The tasks that users engage in, tend to be predefined for web sites that appeal to large audiences. For instance, it is well-defined, in advance, what tasks users want out of a search engine, news site, or e-commerce site. In contrast, understanding the tasks users will engage in requires greater analysis when web sites target a more focused audience. It is not predetermined what tasks the users want for, say, a web site for anesthesiologists or a distributed work team.

Web sites that appeal to the largest user groups (such as e-commerce sites, search engines) tend to have the most pre-defined tasks. The goal of a user, when interacting with a search engine, is to find information on a specific topic. The goal of a user when interacting with an e-commerce site is to browse for, and possibly purchase a product (assuming that the e-commerce site has a product that the user wants, at a price that the user is willing to pay) [10,20]. On the other hand, the web-based sites that have a very narrowly-defined user population also tend to have the least pre-defined task definition. What tasks on a corporate intranet are the users in need of performing? There could be tens, or hundreds, of tasks that the users want to successfully complete on an intranet. This illustrates the need for even more user involvement.

Figure 1. Task-Time-Population (TTP) Model of User Involvement



SPECTRUM OF USER INVOLVEMENT

There are many different ways to get users involved in a development process. Users can be involved in requirements gathering, using techniques such as surveys (paper, electronic, or phone), focus groups, interviews, or card sorting. Users can be involved with testing, through some sort of usability testing, based on completed interfaces, prototypes, or even paper prototypes. At the other end is participatory design, where users become members of the design team, being involved with every stage of development.

The amount of user involvement that is appropriate, is presented in the task-time-population model of user involvement. Figure 1 presents the task-time-population model of user involvement. The idea of the model is that there is a relationship between the pre-determined task structure, the population definition, the user involvement needed, and the amount of time that the users will give to the development project. The more clearly defined the user population, the more time that the users spend on the site per day, and the less pre-defined the task structure, the more user involvement is needed for successful web development. Users will likely be willing to spend more time on web development projects that benefit them more (such as Intranets), and these are the projects with the least pre-defined task structure, where user input is needed the most. Web development projects where the user population is broad and not well-defined (such as search engines and newspaper web sites) also tend to be the sites where the task structure is well-defined and clear, and user involvement is not needed as much. This model can help those involved in managing web development projects with determining what level of user involvement is appropriate.

RESEARCH METHODOLOGY

To learn more about which user involvement methods are most popular, a survey was developed, asking people who have led recent web development projects about which user involvement methods were utilized. The survey was developed by the researchers to be used for both new web site development and sites that were re-designed. The survey asked about all known methods for user involvement in project development, both direct and indirect methods. The survey was first distributed at the ACM Conference on Human Factors in Computing Systems (CHI) conference in April 2002. At the CHI conference, 22 surveys were collected. The same survey was then placed on the web ,and surveys were collected over the next few months. Utilizing both paper and web-based versions of a survey is a proven method for increasing survey responses while improving the overall validity of the response [11]. Responses from those responsible for web site development were requested via listservers representing a number of different communities: human-computer interaction, computer science, information systems, library science, and software engineering. A total of 149 surveys were collected.

RESULTS

Due to page limitations, a copy of the survey could not be included in this paper. Please e-mail jlazar@towson.edu for a copy of the survey instrument. The first survey question related to the job responsibility (or responsibilities) of those responding to the survey. The survey responses came from: Information Architect (84), Usability Consultant (78), Interaction Designer (61), Project Manager (58), Researcher (52), Web Programmer (36), Educator (27), User Services (12). Other respondents indicated that their job responsibilities included librarians, user-centered design specialists, and technical writers. In addition to the nature of the job responsibilities, respondents were also asked about the nature of the web development project. The web development projects represent all types of possible projects: Informational sites (84), educational-related sites (41), E-commerce sites (37), Organizational intranets (34), community-based sites (34), organizational extranets (16), and entertainment-related sites (12). Based on the data from these two questions, it is certain that the survey responses represent the many possible job responsibilities and many possible types of web development projects. Please note that all questions were listed as “check as many that apply,” so numbers of responses per question may add up to more than 149.

Question 2 asked about the specific methods used for user involvement in web development projects. The results are in table 1. The most frequently cited methods of user involvement were usability testing (94), interviews (72), surveys (electronic, paper, and phone, 65), and informal feedback via e-mail (56). Participatory design is also starting to be used frequently for designing web sites (42).

Table 1. Methods of User Involvement

Number of Projects	User Involvement Method	Stage of Development
94	Usability Testing: Usability testing is a method by which users of a product are asked to perform tasks in an effort to measure and improve the product's ease-of-use.	Late-stage
72	Interviews: Interviews are formal events where users are asked a structured series of questions.	Early-stage
56	Feedback via E-Mail	Late-stage
65	Surveys (total of electronic surveys, paper surveys, and phone surveys)	Early-stage
42	Participatory Design: Participatory design is when users actually become a part of the design team, and take part in all decisions relating to the design process.	All-stage

37	Focus Groups: During a focus group session, the facilitator may ask questions about how users do things, what they have done in the past, and what they think they would do in certain situations.	Early-stage
34	Card Sorting: Card sorting is a categorization method where users organize index cards, depicting various web content, into categories. This helps guide the organization of content on a web site.	Late-stage
33	Electronic Surveys: Surveys distributed via web pages or e-mail	Early-stage
21	Ethnography: Ethnography is when users are observed in their work settings, to help determine their usability requirements.	Early-stage
21	Paper Surveys: Surveys are a list of questions, where users record their responses. The questions can be closed-ended or open-ended.	Early-stage
15	Naturalistic Inquiry/ Contextual Inquiry: Contextual inquiry is a structured field interviewing method, with the goal of understanding the context in which users will use an informational system.	Early-stage
11	Phone Surveys: Phone surveys are ad hoc interviews with users over the phone, where a set list of questions is asked and the users' responses recorded.	Early-stage
3	Phone Usability: Phone usability is a remote data collection method in a 30-minute phone interview while looking at a prototype on the Internet.	Late-stage

The next survey question deals with methods for indirectly incorporating the user into the development process. Table 2 reports the results of other indirect methods of user involvement in web development projects. Heuristic review, where an expert reviews an interface using a short set of usability heuristics [15], was the most frequently cited indirect method of incorporating user needs (78 respondents reported using it in projects). In addition, 73 respondents reported using user profiles. The heuristic review was cited more often than other types of expert reviews, including the consistency review (51) and the guidelines review (44), most likely because a heuristic review consists of only a short set of rules or guidelines, and therefore is relatively quick and inexpensive to perform. Automated usability software tools (such as Lift, PageScreamer, and InFocus), which examine a user interface looking for usability problems, were only cited as being used in 21 projects. This might be due to the fact that many tools are expensive, flawed, and report incorrect findings [9].

Table 2. Indirect methods for incorporating user needs into the development process

Number of Projects	Indirect Involvement Method	Stage of Development
78	Heuristic Review: A heuristic review is when a group of experts examine an interface and evaluate each element of the interface against a list of commonly accepted principles--heuristics.	Late-stage
73	User profiles: A user profile is a collection of data about the users and their demographics, used to help understand the needs of the users, and build interfaces based on those needs.	Late-stage

51	Consistency Review: Consistency reviews are when usability experts examine a series of interfaces to check that they all have common layouts, colors, and terminology.	Late-stage
44	Guidelines Review: A guidelines review is similar to a heuristic review, except that a heuristic review uses a short set of heuristics, whereas a guidelines review uses a much larger set of guidelines (e.g. 20-200 guidelines).	Late-stage
21	Automated Usability Testing: An automated usability test is when interfaces are checked against a set of usability guidelines by a software application (such as LIFT, WebSAT, Bobby, or InFocus).	Late-stage

Based on the data collected, the instances of user involvement were organized into the stage of development that it took place. The results are in figure 2, which shows the instances of user involvement, organized by the stage of development. Based on the figure, it is clear that there is much more involvement in late-stages of web development (454 instances of user involvement) than in earlier stages (210 instances of user involvement). The task-time-population model of user involvement predicts higher levels of user involvement in later phases of development. These results therefore provide some preliminary support for the model.

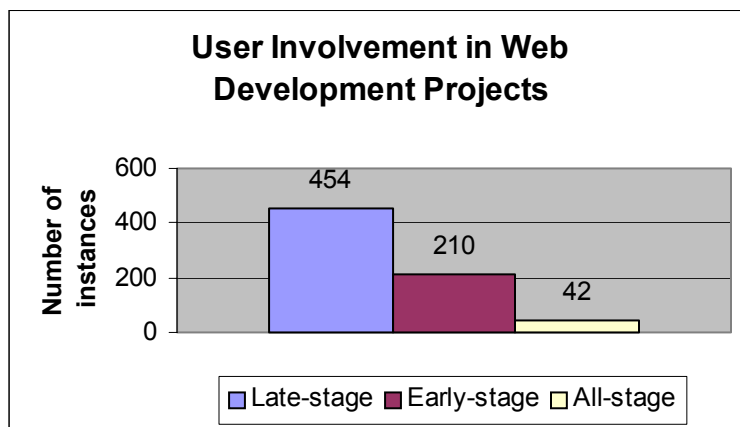


Figure 2. Instances of user involvement organized by stage of web development

COST-JUSTIFICATION OF USER INVOLVEMENT

Relating to the last question on the survey, only 14/149 respondents reported that they incorporate return on investment metrics related to user involvement in their web development projects (the terms cost-justification and return on investment are used by different populations, but convey the same concept). In an ideal world, money would be available to complete any project that seems interesting. In the real world, it is frequently necessary to provide justification for funding specific projects. However, only approximately 10% of respondents reported cost-justifying the user involvement. This is an interesting paradox, because most types of projects, including information systems projects, require a cost-benefit analysis. An information system will not be built unless there is some expected benefit for the company. At the end of an information systems project, there is a completed product—a piece of software, a local area network, or a web site. When additional funds are spent on user involvement, there is no additional product built. The costs of the user involvement instead are reflected in a better system. This can be hard to quantify, and therefore, it can frequently be hard to convince people of the benefit of user involvement [3,21]. Those who want to see more user involvement must be prepared to explain to others why user

involvement is important, to quantify how user involvement can help, and to prepare a cost-benefit analysis of the user involvement.

The costs for focusing on user involvement and usability are relatively easy to measure. For instance, for requirements gathering, there is the cost of preparing and copying surveys, postage costs for mailing the paper surveys, paying users to take part in interviews or focus groups, and the time of employees who will manage all of these activities. These activities might be carried out by internal employees, or by an external consulting firm that specializes in user-centered activities. The same holds true for usability testing activities, in which the costs are to purchase, rent, or use usability equipment, to pay the users to take part in the usability testing, and the cost of employee time to manage these activities [15].

The benefits of user involvement in a project are much harder to measure. User involvement usually ensures a better interface, which allows users to complete more tasks in a shorter amount of time, with a higher level of satisfaction [2,3]. These can be hard to measure. In addition, there can be other benefits, such as word of mouth advertising, higher numbers of page visits, and repeat visits by the same users. All of these are hard to measure, and especially hard to link to the increased user involvement. Furthermore, it may be possible to measure these benefits after a system has been implemented, however, the challenge to the interaction designer is to estimate the benefit of user involvement before it ever takes place. Estimating is used in a classic cost-justification model for usability [3]. In this model, the justification for usability testing is made on the fact that, say, a certain screen was viewed over 2,000 times a day by various employees in the organization. An estimate is made that, say, usability testing would improve the user task processing time of each screen by 1 second. The 1 second savings is then multiplied by the number of screen that a user views per day, multiplied by the number of users, multiplied by the number of business days in a year. It is possible that a 1 second savings in one screen would actually save over 300 hours a year. The actual formula follows:

The number of seconds saved per screen * number of screens per day * number of users * number of days per year

COST-JUSTIFICATION OF USER INVOLVEMENT IN WEB SITES

In this usability cost-justification model, the assumption is that an application is being built for a well-defined set of users within an organization. This type of cost-justification model can still apply to the organizational information systems that happen to be deployed through a web browser, such as an intranet. However, it becomes harder to measure the benefits of usability when the information system is a public web site and therefore fits a number of characteristics [14]:

- The web site is being built for a distributed population
- The web site is not an application that is used the entire day
- The web site is not being built for the internal users of an organization, but rather users outside the organization

In responses to this survey, affirmative answers to the question “Did you incorporate usability return on investment (ROI) metrics in the analysis of this project?” were few. Only approximately 10 % answered yes, and the reasons given for not using cost-justification metrics confirmed that tracking and measuring success is both time-consuming and costly. Some of these reasons reported by respondents, for not using cost-justification metrics, follow:

- Formula not watertight.
- These are tough to identify.
- Wasn't tracked.
- In progress.
- Tried to, but concrete ROI data for IT projects, particularly web and IA related projects, is virtually non-existent
- Not authorized by client (management) to spend much time on this effort, which is on hold now for "political" and budgetary reasons.
- In all future sites internally we will include the numbers for ROI

When respondents were asked to “describe the type of metric tracked for this project,” the easiest metrics to track were listed:

- User Log (7) Traffic, time spent on site, page views per session, number of new users, system usage (number of files shared, number of files created, etc.)
- Cost and Time (4) Revenues
- Task completion. (7)
- None (6)
- User-acceptance (3)
- Number of successful search requests. (2)
- Dollars forgone - cost of poor design
- All work to date has been entirely qualitative for this project with focus on ease of use
- Lots of quantitative & qualitative data

The most common sentiment is that the development team intends to track the ROI, but runs out of time or funds and the priority moves lower in the project plan. Although proving the ROI of involving users is important to development teams, it is rarely budgeted. Even for discount usability efforts like phone usability testing with results in 16 hours [16], there is often an inability to add time to compare data from a previous round of user testing. There are extra steps to cost-justify a usability engineering plan to show ROI and it is crucial that both staff time and budget is allocated sufficiently:

- create a usability engineering plan
- specify particular techniques to employ for each lifecycle task
- break the techniques down into steps
- add the personnel hours and equipment costs for each step
- total the cost for each task by multiplying the number of hours for each type of personnel by their hourly wage (loaded)
- add any equipment and other costs to figure the total cost for the plan
- identify the benefits and calculate expected benefits by plugging project-specific parameters and assumptions in to benefit formulas, and summing benefits across categories. [14].

Some web development organizations measure both qualitative and quantitative ROI metrics. Buchanan and Lukaszewski (1997) separate data into three types of measurements: raw, composite, and impact [4]. Raw measures are the easiest to collect since they exist in server and log files. Consolidated measures rely on summative analysis of raw data for average purchase cost, for example. Impact measures are based on formulaic analysis of consolidated and raw measures in order to show cost and benefit. More specific information on quantitative measures is outlined in Buchanan and Lukaszewski [4]. This may help to reframe for some development teams the level of effort necessary and the amount of data required to track, analyze and prove ROI of involving users.

SUMMARY

The survey results confirm that the majority of organizations are involving users in their web development projects and there are many benefits associated with these actions. While it can still be a challenge to measure the return on investment (ROI) of user involvement, it is clear that user involvement does improve the user experience in measurable ways. The up front cost and diligent advanced planning and strategic analysis of composite measures of user experience are essential for dispelling these myths and for proving that usability is, indeed, cost justified.

In addition, there are two trends that are increasing the importance of user involvement in web development: accessibility for people with disabilities, and hand-held devices. In terms of web accessibility, much of the heightened awareness in this area is due to the formation of the Web Accessibility Initiative (WAI), which was founded to lead the Web to its full potential with respect to promoting a high degree of usability for people with disabilities. The WAI recognizes that the Web presents barriers to people with different kinds of disabilities. More specifically, people with visual disabilities encounter problems with unlabeled graphics, and video, poorly marked-up tables or frames, and lack of keyboard support or screen reader compatibility. People with hearing disabilities encounter, for example, a lack of captioning for audio, and a proliferation of text without visual signposts. People with

physical disabilities encounter a lack of keyboard or single-switch support for menu commands, and people with cognitive disabilities encounter a lack of consistent navigation structure, overly complex presentation or language, a lack of illustrative non-text materials, and flickering or strobe designs on pages. Examples of solutions to these problems constitute accessible web design and include, but are not limited to, multi-modalities, redundant text/audio/video, and captioning. Research and development in the area of accessible web design is ongoing, and is fertile ground for advancement and innovation. Current guidelines for web accessibility are available at <http://www.w3.org/wai>. Most recently, the U.S. Government has required their government-sponsored web sites to be accessible for people with disabilities. More information about the Government requirements is available at <http://www.section508.gov>. Unfortunately, despite these efforts, recent studies point out that large percentages (70-98%, depending on the category of site) of web sites are not accessible. For instance, in recent studies, private and non-profit web sites [9], for-profit commerce web sites [19], U.S. state web sites [5], and even U.S. Federal web sites [18] were found to have major accessibility problems.

Another future direction is web connectivity in portable devices such as cellular phones and personal digital assistants. There are many challenges related to usability and content in these devices, which only increases the need for user involvement [13]. When designing for smaller screens, much smaller connections, and smaller input methods (such as a numeric keypad instead of a full keyboard), usability is even more of a concern. In addition, the interaction styles, and the user tasks, for portable devices simply cannot be transferred from the desktop [1]. Users do not want to perform the same tasks on a desktop computer as they do on a portable device. Therefore, it is very important to determine what tasks users would want to perform on a portable device, and how they would expect to perform such tasks. More user involvement, and more testing, is especially important since many portable devices are sized differently, offer different interaction styles, and different types of input devices. Users may come to a new portable device with no experience, unsure of how to properly operate the device and access web content via the device.

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