

The technology acceptance model and the World Wide Web

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Accepted 27 April 2000

Abstract

The technology acceptance model (TAM) proposes that ease of use and usefulness predict applications usage. The current research investigated TAM for work-related tasks with the World Wide Web as the application. One hundred and sixty-three subjects responded to an e-mail survey about a Web site they access often in their jobs. The results support TAM. They also demonstrate that (1) ease of understanding and ease of finding predict ease of use, and that (2) information quality predicts usefulness for revisited sites. In effect, the investigation applies TAM to help Web researchers, developers, and managers understand antecedents to users' decisions to revisit sites relevant to their jobs. © 2000 Elsevier Science B.V. All rights reserved.

Keywords: World Wide Web; Technology acceptance model; Decision support systems utilization

1. Introduction

The World Wide Web has grown phenomenally since its inception in 1990. The total value of goods and services traded over it in the US alone will reach US\$327 billion in the year 2002, an average annual growth rate of 110% [35]. Existing organizations, start-up firms, consultants, and end users are now

investing considerable resources in it. Corporations are building Intranets and Extranets to help them accomplish their objectives by assisting their employees in doing their jobs better. Thus, an understanding of the predictors of Web usage could serve a multitude of stakeholders by helping them recognize how to promote that usage.

Researchers have conducted several studies to examine the relationship between perceived ease of use, perceived usefulness, attitudes, and the usage of other information technologies in recent years [1,4,6,8–10,15–17,20,30–34]. Their research has supported the technology acceptance model (TAM) [8]. TAM posits that perceived ease of use and perceived usefulness can predict attitudes toward technology that then can predict the usage of that

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technology. Several researchers have thus validated TAM using several different applications including primarily e-mail, voice mail, word processing, and spreadsheets. Other researchers have recommended the investigation of Web user behavior [28].

The first purpose of the current research was to validate TAM with the Web as the users' application. The second purpose was to identify antecedents to Web ease of use and usefulness. Doing so could identify features of the Web that might contribute to its ease of use and usefulness. It could thus provide implications about ease of use and usefulness for Web developers and managers.

2. TAM: the theoretical background

Davis [8] has shown that TAM can explain the usage of information technology. He applied the theory of Ajzen and Fishbein [2] about reasoned action to show that beliefs influence attitudes which lead to intentions, and therefore generate behaviors. Davis thus conceived that TAM's belief–attitude–intention–behavior relationship predicts user acceptance of IT.

Davis asserted that perceived usefulness and ease of use represent the beliefs that lead to such acceptance. Perceived usefulness is the degree to which a person believes that a particular information system would enhance his or her job performance (i.e., by reducing the time to accomplish a task or providing timely information). Perceived ease of use is the degree to which a person believes that using a particular system would be free of effort [8].

Two other constructs in TAM are attitude towards use and behavioral intention to use. Attitude towards use is the user's evaluation of the desirability of

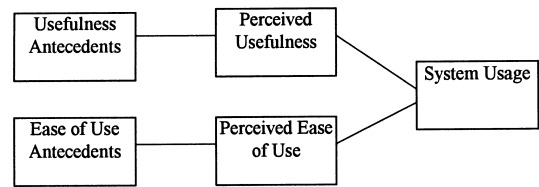


Fig. 2. The TAM and Web usage.

employing a particular information systems application. Behavioral intention to use is a measure of the likelihood a person will employ the application [2].

TAM's dependent variable is actual usage. It has typically been a self-reported measure of time or frequency of employing the application.

Fig. 1 shows the generic TAM model. Some authors have considered additional relationships. Some have ignored intention to use or attitude [1,10,17,30,33], and instead studied the effect of ease of use or usefulness directly on usage. Findings about the effects of attitude and intention have not always been significant. Hence, to maintain instrument brevity and permit the study of the antecedents of ease of use and usefulness, the current research similarly studied the direct effect of ease of use and usefulness on usage. Fig. 2 shows the model in the current study.

Such theories and models as self-efficacy theory, cost–benefit research, expectancy theory, innovation research, and channel disposition have supported TAM. Table 1 summarizes several TAM studies in IS research.

Two studies have investigated TAM using the Web as the application. One found that usefulness and ease of use predicted usage, but that usefulness had a stronger effect [33]. Another found that ease of use predicted usage [21]. By supporting TAM, both

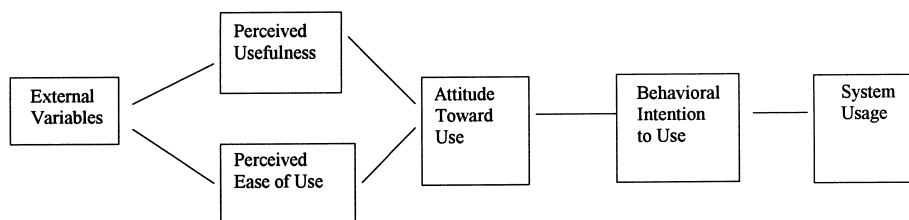


Fig. 1. The TAM.

studies suggest the importance of the antecedents to usefulness and ease of use. What makes the Web useful and easy to use? Therefore, in addition to employing previous measures of ease of use and usefulness, antecedents specific to the Web were sought.

3. Ease of use and usefulness on the Web

Researchers have investigated features potentially predictive of the perceived ease of use of the Web. The Graphic, Visualization, and Usability (GVU) Center at the Georgia Institute of Technology has conducted Web user surveys every 6 months since 1994 [23]. The results from the most recent survey identified some key ease of use problems. Most frequently cited was the slow speed of downloading or viewing Web pages. Other problems included being unable to perform such tasks as finding a page that users knew existed, organizing the pages and information they gathered, finding a page once visited, and visualizing where they had been and could go to find information.

A qualitative study raised similar problems [19]. In the qualitative approach, respondents cited slow data access as the issue that they disliked most about the Web. They also cited difficulty searching for specific information, information clutter, time delays due to images, the unreliability of sites, and incomplete category searches.

A third study identified eight usability principles: speaking the users' language (use words, phrases, concepts familiar to the user); consistency (similar concepts, terminology, graphics, layout, etc.); minimization of the user's memory load (do not force users to recall information across documents); flexibility and efficiency of use (accommodate a range of user sophistication and diverse goals); aesthetic and minimalist design (visually pleasing displays with no irrelevant or distracting information); chunking (short documents with one topic ideally on a single page); progressive levels of detail (organize information hierarchically with general information before specific detail); and navigational feedback (allow user to determine document position) [18]. A fourth study suggested similar issues [5].

Much less research has considered potential predictors of perceived usefulness of the Web. The GVV survey did, however, list the most common uses of Web users as browsing (79%), followed by entertainment (64%), work (52%), and shopping (11%) [23]. Another survey identified the amount of information on the Web as the issue most liked by respondents [19].

Usefulness measures related to the work environment were also identified as possible features of a Web site. According to Griffin [12], general information is more abstract than information related to the task environment. Griffin further asserted that managers can identify environmental factors of specific interest to organizations more easily than the abstract dimensions of general information. He identified seven task-related uses of information including information about competitors, customers, suppliers, government regulators, labor, company owners, and company relationships.

Information related to functional support within an organization might similarly provide usefulness aspects to a Web site. Such functions typically include marketing, finance, human resources, production, and research and development [12].

Four factors that differentiate between good and bad information might also provide a basis for usefulness of the Web [12]. They are accuracy, timeliness, completeness, and relevance.

Finally, Anthony [3] identified three types of managerial decision making. They were operational, managerial, and strategic decision making. Presumably, information to support those decision types could make a Web site useful.

4. Methodology

4.1. Instrument development

The authors developed an e-mail survey instrument that contained instructions asking the respondent to identify a Web site that he/she uses often for work and then to answer questions pertaining to that site. Focusing a subject on a specific site follows Churchill's recommendation to define a unit of analysis for a more precise response and greater validity [7].

Table 1
Previous TAM research^a

Authors	Constructs	Applications	Methodology	Findings
Davis [8]	U, EOU, Usage	PROFs, XEDIT, Chart-Master, Pendraw	Survey, experiment	U → usage, EOU → usage
Davis et al. [9]	U, EOU, A, BI, Usage	WriteOne	Experiment	EOU → U, U → A, EOU → A, A → BI, U → BI, BI → Usage
Haynes and Thies [15]	U, EOU, Usage	Automated teller, self-service gas	Survey	Same as Davis [8]
Mathieson [20]	EV, U, EOU, A, BI, Usage	Spreadsheet, calculator	Experiment	Same as Davis [8]
Adams et al. [1]	U, EOU, Usage	E-mail, V-mail, WordPerfect, 123, Harvard Graphics	Survey	EOU → Usage, U → Usage EOU ↔ U
Bagozzi et al. [4]	U, EOU, BI (two time intervals), Usage	WriteOne	Experiment	U → BI, EOU → BI, BI → Usage
Taylor and Todd [32]	U, EOU, A, Subjective norm, Perceived behavioral control, BI, Behavior	Computing resource center	Survey	EOU → U, U → A, EOU → A, A → BI, SN → BI, PBC → BI, BI → B, PBC → B
Straub et al. [30]	U, EOU, Usage, Social presence/information richness (SPIR)	V-Mail	Survey	U → Usage, EOU → Usage SPIR → U
Igbaria et al. [17]	EV, EOU, U, Usage	Micro-computer	Survey	EV → EOU, EV → U, EOU → U, EOU → Usage, U → Usage
Szajna [31]	U, EOU, BI, Usage	E-mail	Experiment	EOU → U, U → BI, BI → Usage
Hendrickson and Collins [16]	U, EOU, Usage	1-2-3, WordPerfect	Experiment	EOU → U, EOU → Usage, U → Usage
Chau [6]	EOU, Near-term U, Long-term U, BI	Word, Excel	Survey	EOU → Near-term U, EOU → BI, Near-term U → Long-term U, Near-term U → BI, Long-term U → BI
Morris and Dillon [21]	EOU, U, A, BI, Usage	Netscape	Survey	EOU → U, U → A, EOU → A, U → BI, A → BI, BI → Usage

Table 1 (continued)

Authors	Constructs	Applications	Methodology	Findings
Gefen and Straub [10]	Gender, U, EOU, Usage, SPIR	E-Mail	Survey	Gender → SPIR, Gender → U, Gender → EOU, SPIR → U, U → Usage
Thompson [34]	U, EOU, A, BI	Access, Web page development software	Survey	EOU → U, EOU → A, U → A, U → BI, A → BI, Motivation → BI, Social factors → A
Teo et al. [33]	U, EOU, Usage, Perceived enjoyment (PE)	Internet	Web-based survey	EOU → U, EOU → Usage, EOU → PE, U → Usage, PE → Usage

^aLegend: A, attitude; BI, behavioral intention; EOU, ease of use; U, usefulness.

The survey had the following major sections.

- Nineteen items asking the extent to which the Web site meets ease of use characteristics. Ratings on a 1–7 scale with end points of “strongly agree” and “strongly disagree” allowed the respondent to indicate the extent. Table 2A lists the three general items of Davis [8] which were used. Sixteen were Web-specific antecedents condensed from Refs. [5,18,23]. Table 2B lists 18 Web-specific measures from which these 16 were drawn.

- Twenty-two items asking the extent to which the Web site meets usefulness characteristics. These items also used the same 1–7 scale. Three were general measures from Davis [8] (see Table 2C). Sixteen were Web-specific [3,12] antecedents (see Table 2D).

- Two items measuring Web site usage. One asked the extent to which the respondent used the Web site on 1–7 scale with “frequently” and “infrequently” as anchors. The second asked the respondent how many times he/she used the site in the past 30 days.

- Demographic questions about the respondent’s age, work experience, functional area, organization size, Web experience, browser, speed of connection, and Web site location.

Six professionals who used the Web in their jobs participated in a pilot of the survey instrument. At least two of the authors observed the pilot subjects as they completed the survey. Feedback from the sub-

jects and observations by the authors resulted in minor changes to the survey instructions, changes to the order of selected items, and refinement to the wording of several items.

4.2. Subjects

The study focused on individuals who use the Web for their jobs. Potential subjects were selected from work-related Internet newsgroups. The newsgroups featured discussions of various topics, including general business, consulting, finance, law, science, and biology. The authors accessed a Web site that archived the newsgroup submissions to identify e-mail addresses of the participants. The addresses were then sorted and duplicates were removed. A computer program submitted an electronic copy of the survey to each e-mail address. Completed surveys came from 163 subjects for a 5% response rate.

This response rate may be low in comparison to conventional paper-based postal surveys. However, the novelty of unsolicited email surveys precludes a substantial basis of comparison. In any case, the total number of subjects suffices for the analysis described below.

The single method test of Harman [13] was used to test for common method variance [24]. The factor analyses produced neither a single factor nor one general factor that accounted for the majority of the variance. Each factor accounted for more than the viable cut-off of 5% [14]. This test thus failed to

Table 2

(A) TAM ease of use items [8]

- Getting the information I want from the site is easy
- Learning to use the site was easy
- Becoming skillful at using the site was easy

(B) Antecedent ease of use items

Evaluation of Web prototypes [18]

- The site uses terms familiar to me
- The site makes it easy to recognize key information
- The site displays visually pleasing design
- Each display page focuses on a single topic
- Display pages provide links to more detailed information
- The site provides more than one method of navigation
- I can determine my position within the site
- The site allows easy return to previous display pages
- The site uses consistent terms
- The site uses consistent graphics

Web user survey [23]

- The site loads quickly
- The information I need is easy to find within the site
- The site is easy to navigate

Usability testing criteria [5]

- The site uses understandable graphics
- The display pages within the site are easy to read
- The site uses understandable terms
- The information I need is easy to find within the site
- The site is easy to navigate

(C) TAM usefulness items [8]

- Using this site enhances my effectiveness at my job
- Using this site in my job increases my productivity
- Using this site improves my job performance

(D) Antecedent usefulness items

Characteristics of useful information [12]

- I use this site for accurate information for my job
- I use this site for thorough information for my job
- I use this site for timely information for my job
- I use this site for relevant information for my job

Task environment information [12]

- I use this site for information about my company's owners
- I use this site for information about my company's competitors
- I use this site for information about my company's suppliers
- I use this site for information about companies that work with my company
- I use this site for information about my company's customers
- I use this site for information about labor
- I use this site for information about government regulators of my company

Strategic areas for corporate decisions [3]

- I use this site for strategic information for my job

Table 2 (continued)

(D) Antecedent usefulness items

Strategic areas for corporate decisions [3]

- I use this site for managerial information for my job
- I use this site for operational information for my job

Functional area information [12]

- I use this site for research and development information
- I use this site for human resources information
- I use this site for marketing information
- I use this site for production information
- I use this site for financial information

identify that common method variance was a problem [11,25–27].

5. Demographics and descriptive statistics

As Table 3A indicates, survey respondents were generally well educated with over 34% holding an advanced degree and another 35% having a 4-year degree. Table 3A also identifies the respondents' functional work areas, browser used at work, and method of Internet connection.

Table 3B gives means and standard deviations for subjects' age, years of work in present position, years of work with present firm, years of Web use for job, years of Web use, and number of employees in organization. Respondents had an average age of 37.4 and had used the Web for an average of over 3 years. This indicates that the subjects were somewhat older and more experienced than Internet users in the general population [23].

Table 4A, B, C, and D show the means and standard deviations of the general ease of use and usefulness items and antecedents ordered by their mean. Table 4E shows means and standard deviations of the usage items.

6. Data analysis

The sample of 163 subjects was first split randomly into two groups. Two-factor analyses were performed on 95 subjects. One examined the Web-specific ease of use antecedent items and the other

Table 3

(A) Demographic information	
	Percent of respondents
<i>Education level</i>	
Some high school	1
High school graduate	2
Some college	14
2-year college degree	6
4-year college degree	35
Masters	23
Doctorate	13
Other	7
<i>Functional work area</i>	
Accounting/Finance	8
Human resources	4
Information systems	23
Marketing	13
Production	9
Purchasing	5
Sales	9
Other	29
<i>Browser used at work</i>	
Netscape Navigator	71
Microsoft Internet Explorer	23
America Online browser	2
Other	5
<i>Internet connection</i>	
Modem	61
ISDN connection	7
T1 connection	14
Ethernet connection	12
Other	6

(B) Demographic information		
Item	Mean	S.D.
Age	37.4	10.3
Years of work in present position	5.2	6.9
Years of work with present firm	4.5	5.7
Years of Web use for job	2.2	1.4
Years of Web use	3.0	2.1
Employees in organization	4500	24,800

analyzed the Web-specific usefulness antecedent items. The purpose of these analyses was to reduce the number of those items, and identify the dimensions of the antecedents to ease of use and usefulness. This group had 95 subjects to preserve a ratio of five subjects to each item for the usefulness items, the larger of the two sets of items [22].

Each factor analysis used principle components extraction with Varimax rotation and required eigenvalues of at least 1. Any item that failed to load on a single factor at 0.5 or greater was dropped and the factor analysis was redone. This process of dropping an item and rerunning continued until all items loaded at 0.5 or greater on one and only one factor.

Table 5A and B show the final factor structures. The authors named each factor based on their interpretation of its items.⁴

The testing of the relationships then used multiple regression on the 68 subjects in the holdback sample. The models were (see Fig. 2):

Usage = Usefulness + Ease of use;

Ease of use = Ease of understanding + Ease of finding + Information focus;

Usefulness = Information for support activities + Information quality + Information for primary activities + Information for management + Information for research and development.

The results appear in Table 6A, B and C.

Variance inflation factors did not exceed 10 for any regression [29]. In fact, they were less than 2. Hence, multicollinearity was not extensive.

7. Summary of findings

This research provided support for TAM (see Table 6A). With usage measured by the 1–7 frequency scale, the effect of usefulness and ease of use was significant ($p < 0.001$ and $R^2 = 0.15$). Usefulness ($p < 0.01$) had a stronger effect than ease of use ($p < 0.05$).

The research provided weak support for TAM where usage was measured by the number of times used in the past 30 days ($p < 0.10$ and $R^2 = 0.04$). The effect of usefulness ($p < 0.10$) was weak. The

⁴ Among the Usefulness categories was Useful Information for Research and Development. It had a single item. Although researchers sometimes drop such single-item factors, in this case, the authors chose to keep it to maintain the richness of the categories. They also conducted the statistical tests described later in this paper without this category and found very similar results.

Table 4

(A) Descriptive statistics for TAM ease of use items

TAM ease of use items	Mean	S.D.
Learning to use the site was easy	5.61	1.38
Becoming skillful at using the site was easy	5.45	1.45
Getting the information I want from the site is easy	5.40	1.39

(B) Descriptive statistics for antecedent ease of use items

Antecedent ease of use items	Mean	S.D.
The site uses terms familiar to me	5.77	1.54
The site uses consistent terms	5.72	1.28
The display pages within the site are easy to read	5.66	1.24
The site uses understandable terms	5.64	1.41
The site uses consistent graphics	5.60	1.45
Display pages provide links to more detailed information	5.54	1.59
The site uses understandable graphics	5.44	1.48
The site is easy to navigate	5.33	1.44
The site allows easy return to previous display pages	5.28	1.67
The site makes it easy to recognize key information	5.19	1.52
The information I need is easy to find within the site	5.01	1.56
I can determine my position within the site	4.71	1.84
The site loads quickly	4.71	1.73
The site displays visually pleasing design	4.70	1.48
Each display page focuses on a single topic	4.57	1.91
The site provides more than one method of navigation	4.40	1.83

(C) Descriptive statistics for usefulness items

TAM usefulness items	Mean	S. D.
Using this site improves my job performance	5.80	1.37
Using this site enhances my effectiveness at my job	5.75	1.36
Using this site in my job increases my productivity	5.71	1.32

(D) Descriptive statistics for antecedent usefulness items

Antecedent usefulness items	Mean	S.D.
I use this site for relevant information for my job	5.99	1.23
I use this site for accurate information for my job	5.89	1.39
I use this site for timely information for my job	5.81	1.35
I use this site for thorough information for my job	5.41	1.59
I use this site for strategic information for my job	5.16	1.81
I use this site for research and development information	4.90	2.12
I use this site for operational information for my job	4.44	1.99
I use this site for managerial information for my job	3.59	2.05
I use this site for marketing information	3.58	2.41
I use this site for production information	3.42	2.40
I use this site for information about my company's customers	2.95	2.22
I use this site for information about companies that work with my company	2.90	2.16
I use this site for financial information	2.78	2.17
I use this site for information about my company's competitors	2.72	2.13
I use this site for information about my company's suppliers	2.72	2.07
I use this site for information about government regulators of my company	2.49	2.06
I use this site for human resources information	2.36	2.02
I use this site for information about labor	2.13	1.71
I use this site for information about my company's owners	1.75	1.56

Table 4 (continued)

(E) Descriptive statistics for usage items

Usage items	Mean	S.D.
How frequently did you use this site in the past 30 days?	5.58	1.50
How many times did you use the site in the past 30 days?	20.80	20.75

stronger effect of usefulness than ease of use is consistent with previous Web research [33].

The research also provided some understanding of ease of use (see Table 6B). The antecedents predicted ease of use ($p < 0.01$ and $R^2 = 0.50$) with ease of understanding ($p < 0.01$) having a stronger effect than ease of finding ($p < 0.05$).

The research also provided some understanding of usefulness (see Table 6C). The antecedents predicted usefulness ($p < 0.01$ and $R^2 = 0.58$), but only information quality had a significant effect ($p < 0.01$).

8. Implications for researchers

This study supports TAM. It thus helps researchers understand the relationships between ease of use and usefulness, and the acceptance of Web technology by users. It confirms that use of Web sites depends on the usefulness and ease of use of the site. It also helps us understand the predictors of usefulness and ease of use for the Web.

The study provides two new instruments tailored to the Web. On one hand, future researchers could use these instruments for assessing the ease of use and usefulness of Web sites. On the other hand, these two instruments could stimulate future researchers to develop better instruments for assessing those characteristics of Web sites. Alternative wording of the items might be tried. With further refinement of the Web-specific items, greater variance explained might be achieved.

In this research, the highest predictive power belonged to information quality (for usefulness) and ease of understanding (for ease of use). Perhaps the former occurred because its individual items were more general to all users, whereas the others had items more specific to individual's jobs. Perhaps ease of understanding had higher predictive power than ease of finding because users more easily adjust

to difficulties navigating through frequently used Web sites. Nevertheless, future researchers might empirically investigate why these factors had the highest predictive power for their respective constructs. Future researchers might also investigate how to improve these apparently important factors in Web site design.

This research examined frequently visited sites. It thus facilitates deduction about the specific ease of use and usefulness characteristics of sites that motivate revisiting. However, future researchers might consider sites that users do not revisit. Data contrasting more often and less often visited sites might further help explain why some sites are used more frequently. Future research could also ask subjects to respond in general about their impressions of the ease of use, the usefulness, and their own usage of the Web.

One limitation of the current research is the assumption that work usage is approved and constructive rather than games or chatting. None of the subjects in the current research responded about a game or chat site. Nevertheless, future research could consider predictors of games, chatting and other potentially detrimental activities.

Although Harman's single method test did not identify common method variance as a problem, it still might have been. To ensure that it is not a problem and to prevent the consistency effect resulting from the same subject reporting both independent and dependent variables, future research might use more objective measures of the dependent variable. Software for monitoring precise usage would provide such an objective measure.

Factor analysis is a popular and useful tool for the reduction of data and the identification of key themes in the data. However, because items do not load at a given arbitrary level, they might still be relevant. Hence, future research should replicate this study. Perhaps other constructs would emerge.

Table 5

(A) Factor analysis of antecedent ease of use items

Factors and items	Factor loadings		
	F1	F2	F3
<i>Factor 1: Ease of understanding</i>			
The site uses understandable graphics.	0.89		
The site uses consistent graphics.	0.86		
The site uses consistent terms.	0.81		
The site uses understandable terms.	0.76		
Display pages provide links to more detailed information.	0.67		
The site displays visually pleasing design.	0.60		
The display pages within the site are easy to read.	0.59		
<i>Factor 2: Ease of finding</i>			
The site allows easy return to previous display pages.		0.80	
I can determine my position within the site.		0.71	
The site is easy to navigate.		0.71	
<i>Factor 3: Information focus</i>			
Each display page focuses on a single topic.			0.90
The site makes it easy to recognize key information.			0.62
Eigenvalues	5.17	1.43	1.07
Percent of variance explained	43.2	11.9	8.9
Cronbach's alpha	0.88	0.70	0.46 ^a

(B) Factor analysis of antecedent usefulness items

Factors and items	Factor loadings				
	F1	F2	F3	F4	F5
<i>Factor 1: Information for support activities</i>					
I use this site for information about my company's competitors.	0.77				
I use this site for information about labor.	0.71				
I use this site for information about my company's suppliers.	0.70				
I use this site for information about my company's customers.	0.70				
I use this site for information about companies that work with my company.	0.66				
I use this site for human resources information.	0.65				
I use this site for information about government regulators of my company.	0.58				
<i>Factor 2: Information quality</i>					
I use this site for relevant information for my job.		0.83			
I use this site for accurate information for my job.		0.82			
I use this site for timely information for my job.		0.73			
I use this site for thorough information for my job.		0.65			
<i>Factor 3: Information for primary activities</i>					
I use this site for marketing information.			0.81		
I use this site for production information.			0.77		
I use this site for financial information.			0.77		
<i>Factor 4: Information for management</i>					
I use this site for operational information for my job.				0.84	
I use this site for managerial information for my job.				0.75	
I use this site for strategic information for my job.				0.61	

Table 5 (continued)

(B) Factor analysis of antecedent usefulness items

Factor 5: Information for research and development

I use this site for research and development information.					0.85
Eigenvalues	5.18	3.52	1.43	1.13	1.05
Percent of variance explained	28.8	19.6	7.9	6.3	5.8
Cronbach's alpha	0.83	0.81	0.79	0.77	N.A.

^aCronbach's alpha in this research was 0.70 or greater for every factor except Information focus [22]. However, Information focus had only two items and hence, alpha is not so meaningful. Also, the two items correlated significantly ($p < 0.001$). Hence the factor remained in the analysis.

Table 6

(A) Two multiple regressions: Usage = Ease of use + Usefulness

	Usage ^a			
	Scale of 1–7		Number of times	
	Coefficients	$p < \text{values}$	Coefficients	$p < \text{values}$
Ease of use	0.25 **	0.02	1.19	
Usefulness	0.30 ***	0.01	2.46 *	0.08
R^2	0.15		0.04	
F	13.08 [#]	0.001	2.85 *	0.06

(B) Multiple regression: Ease of use = Ease of understanding + Ease of finding + Information focus

	Coefficients
Factor 1: Ease of understanding	0.46 [‡]
Factor 2: Ease of finding	0.20 [†]
Factor 3: Information focus	0.15
R^2	0.50
F	21.87 [‡]

(C) Multiple regression: Usefulness = Information for support activities + Information quality + Information for primary activities + Information for management + Information for research and development

	Coefficients
Factor 1: Information for support activities	−0.01
Factor 2: Information quality	0.83 [£]
Factor 3: Information for primary activities	−0.04
Factor 4: Information for management	0.06
Factor 5: Information for research and development	0.08
R^2	0.58
F	16.14 [£]

^aThe $p < \text{values}$ appear in this table because two of them are “close” to more commonly accepted cut-off values in social sciences, i.e., Ease of use for Scale of 1–7 (0.02) is “close” to 0.01 and F for Number of times (0.06) is “close” to 0.05.

* 0.10 significance level.

** 0.05 significance level.

*** 0.01 significance level.

[#] 0.001 significance level.

[†] 0.01 significance level.

[‡] 0.05 significance level.

[£] 0.01 significance level.

The response rate of 5% may be a limitation in this study. Little is known about e-mail surveys and the Internet may motivate more of them due to their low cost. In fact, the future may bring a growing popularity of even the simple posting of a Web survey where no response rate can be calculated. One recent TAM study advertised such a site and thus could not calculate a rate [33]. More needs to be understood about e-mail and Web surveys.

While the current research examined why some users access Web sites more than others do, additional research could consider why some people still do not use it at all in their jobs. TAM could not be the theoretical basis for such research because it assumes subjects can assess ease of use and usefulness. Nevertheless, such research could be useful.

Finally, most of the respondents in this study were highly educated and experienced at using the Internet. Investigating ease of use and usefulness measures with less educated and more inexperienced Web users may provide additional validation of TAM and interesting insights about ease of use and usefulness. As increasing numbers of workers use the Web in their jobs, findings about such users could prove useful to both employers and Web site developers.

9. Implications for practitioners

This research has potential for practical application in the development and use of Web sites. By confirming TAM, it suggests that Web site developers should provide ease of use and usefulness for their Web sites to encourage people to revisit their sites. It also suggests both specific factors and items that those developers might emphasize when they create new Web sites. For example, it suggests that information quality — i.e., relevance, accuracy, timeliness and thoroughness of information — may be more important than the various other more specific information uses in this study. Also, it suggests that ease of understanding may be more important than ease of finding it in the decision to revisit.

The research has also provided two instruments that could be useful to both Web site developers and Web site managers in organizations that encourage employees to use specific (especially Intranet) Web sites. Those developers and managers could have users complete the instruments about specific sites.

The responses could be used to identify strengths and weaknesses in existing sites. Developers and managers could investigate the factors and items with lower scores. The responses might thus be useful in improving those sites.

In fact, normative data about many could be accumulated using these (or future, improved versions of these) instruments. Comparisons of scores for individual sites to such data could help developers and managers assess their sites. Comparisons could also stimulate competition among Web site developers and thus foster the improvement of such sites.

10. Conclusion

This research has validated TAM in the context of the World Wide Web. It has also contributed by applying TAM to lay the groundwork for understanding antecedents to ease of use and usefulness. Such antecedents might effect Web usage. An understanding of them could guide both Web site research and development.

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