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A Theoretical Integration of User Satisfaction and Technology Acceptance

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In general, perceptions of information systems (IS) success have been investigated within two primary research streams—the user satisfaction literature and the technology acceptance literature. These two approaches have been developed in parallel and have not been reconciled or integrated. This paper develops an integrated research model that distinguishes beliefs and attitudes about the system (i.e., object-based beliefs and attitudes) from beliefs and attitudes about using the system (i.e., behavioral beliefs and attitudes) to build the theoretical logic that links the user satisfaction and technology acceptance literature. The model is then tested using a sample of 465 users from seven different organizations who completed a survey regarding their use of data warehousing software. The proposed model was supported, providing preliminary evidence that the two perspectives can and should be integrated. The integrated model helps build the bridge from design and implementation decisions to system characteristics (a core strength of the user satisfaction literature) to the prediction of usage (a core strength of the technology acceptance literature).

Key words: user satisfaction; technology acceptance model; information systems success; theory of reasoned action; system quality; information quality
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1. Introduction

Information technology (IT) researchers have developed rich streams of research that investigate the factors and processes that intervene between IT investments and the realization of their economic value. Commonly, researchers tie these factors and processes to user perceptions about IT and how it impacts their work. Although researchers have examined such perceptions in dozens of different ways (DeLone and McLean 1992), in general, there have been two dominant approaches employed—user satisfaction (e.g., Bailey and Pearson 1983, Ives et al. 1983, Melone 1990, Seddon 1997) and technology acceptance (e.g., Davis 1989, Hartwick and Barki 1994, Szajna 1996, Venkatesh et al. 2003). Both research streams offer valuable contributions to our understanding of IT, although each tells only part of the story. The purpose of this study is to integrate the two research streams so that, together, they can provide a more complete understanding of the way in which system features ultimately influence IT usage.

The user satisfaction literature explicitly enumerates system and information design attributes (e.g., information accuracy and system reliability), making it a potentially useful diagnostic for system design; however, user satisfaction is a weak predictor of system usage (Davis et al. 1989, Goodhue 1988, Hartwick and Barki 1994, Melone 1990). This is attributable to the fact that beliefs and attitudes about objects (such as an information system) are generally poor predictors of behaviors (such as system usage) (Ajzen and Fishbein, in press).

By contrast, the technology acceptance literature (i.e., the technology acceptance model, or TAM) provides sound predictions of usage by linking behaviors to attitudes and beliefs (ease of use and usefulness) that are consistent in time, target, and context with the behavior of interest (system usage). Despite its predictive ability, TAM provides only limited guidance about

how to influence usage through design and implementation (Taylor and Todd 1995, Venkatesh et al. 2003). For example, designers receive feedback regarding ease of use and usefulness in a general sense, but they do not receive actionable feedback about important aspects of the IT artifact itself (e.g., flexibility, integration, completeness of information, and information currency). Such guidance was a core objective in the development of TAM, but one that has received limited attention (Davis et al. 1989).

Although user satisfaction and technology acceptance have evolved largely as parallel research streams, the two approaches can and should be integrated (Goodhue 1988, Hartwick and Barki 1994, Melone 1990, Seddon 1997). Such integration can help build a conceptual bridge from design and implementation decisions to system characteristics to the prediction of usage. Ultimately, this would improve the predictive value of user satisfaction and augment the practical utility of technology acceptance. Furthermore, by theoretically integrating the two very important IT research streams, we can answer the call to provide a way for perception-based IT research to more fully examine the role of the IT artifact (Benbasat and Zmud 2003, Orlikowski and Iacono 2001).

To accomplish this, we apply concepts from the broader attitude literature (e.g., Ajzen 2001; Ajzen and Fishbein, in press; Eagly and Chaiken 1993; Fazio and Olson 2003; Haddock and Zanna 1999). Specifically, the paper develops a model that explicitly distinguishes the object-based beliefs and attitudes found in the user satisfaction literature from behavioral beliefs and attitudes in the technology acceptance literature. It enumerates a set of system and information characteristics that influence system and information quality, describes how they in turn influence object-based beliefs and attitudes with the system and the information it produces, and then describes how these object-based attitudes toward the system can shape the behavioral beliefs of usefulness, ease of use, and, ultimately, system usage.

The remainder of the paper proceeds as follows. Section 2 builds the theoretical arguments for the proposed research model. In §3, we present the background for a preliminary study that tested this model in the context of data warehousing. The results of an empirical test of this model are presented in §4. They are based on a sample of 465 users of data warehousing predefined reporting software from seven different organizations. Finally, in §5, we provide a discussion of the findings and an agenda for future research.

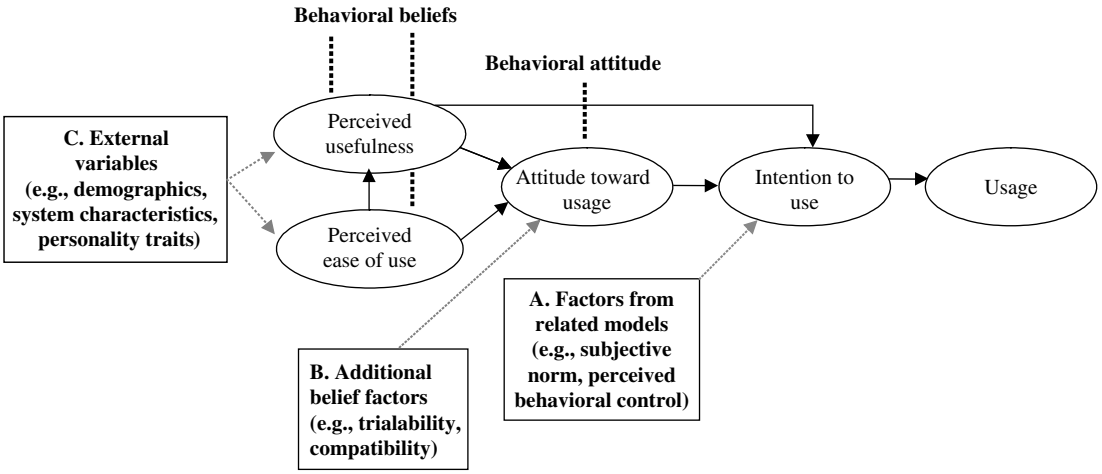
2. Theoretical Development

2.1. Understanding Behavioral Beliefs and Attitudes

According to the expectancy-value theory developed by Ajzen and Fishbein (1980), external variables influence beliefs about the outcomes associated with performing a behavior, which in turn shape attitudes toward performing a behavior. Attitude, in turn, influences intention to perform the behavior and, ultimately, influences the behavior itself. Satisfaction in a given situation is a person's feelings or attitudes toward a variety of factors affecting that situation. As articulated in the theory of reasoned action (TRA), these relationships will be predictive of behavior when the attitude and belief factors are specified in a manner consistent with the behavior to be explained in terms of time, target, and context (Ajzen and Fishbein, in press; Fazio and Olson 2003). Within the IT literature, these ideas have taken shape in the form of the TAM. TAM has been widely applied to understand the attitude one holds about the use of technology, which is used to predict the adoption and use of information technology. The attitude construct in TAM represents attitude toward the behavior of using technology.

Over the past decade, the technology acceptance literature has included a large number of empirical tests, comparisons, model variants, and model extensions. As Figure 1 illustrates, researchers have extended TAM in three primary ways to provide greater understanding and explanatory power and additional points of managerial leverage in its application. The first approach involves introducing factors from related models, such as subjective norm, perceived behavioral control, and self-efficacy (e.g., Hartwick and Barki 1994, Taylor and Todd 1995, Mathieson et al. 2001). A second approach involves introducing additional or alternative belief factors to the model. Most often, this includes adding key related factors from the diffusion of innovation literature, such as trialability, compatibility, visibility, or result demonstrability (Agarwal and Prasad 1997, Karahanna et al.

Figure 1 The TAM (Davis 1989) and Three Popular Extensions



1999, Plouffe et al. 2001). A third approach has been to examine external variables, which are antecedents to or that moderate the influence of ease of use and usefulness within the TAM, such as personality traits and demographic characteristics (e.g., Gefen and Straub 1997, Venkatesh 2000, Venkatesh and Morris 2000). Venkatesh et al. (2003) provide a comprehensive examination of eight different models and derive a unified theory of acceptance and use of technology.[1]

Despite this extensive research activity, only a handful of TAM studies have looked explicitly at the role of system characteristics as antecedents to ease of use or usefulness (e.g., Davis 1993, Igbaria et al. 1995, Lim and Benbasat 2000). For the most part, these studies have treated system characteristics at a holistic level or have looked at a limited number of features. One exception to this is the work by Hong et al. (2001–2002) that examines how dimensions of usability (information relevance, clarity of terminology, and screen design) influence ease of use and usefulness in the context of a digital library application. Their results show mixed effects with only relevance influencing both usefulness and ease of use. In their integration of the technology acceptance literature, Venkatesh et al. (2003) stress the need to extend this literature by explicitly considering system and information characteristics and the way in which they might influence the core beliefs in TAM, and might indirectly shape system usage.

[1] The Venkatesh et al. (2003) study provides an excellent review of TAM studies.

2.2. Understanding Object-Based Beliefs and Attitudes

In contrast to the technology acceptance literature, system and information characteristics have been core elements in the literature on user satisfaction (DeLone and McLean 1992). Within this literature, user satisfaction is typically viewed as the attitude that a user has toward an information system; therefore, it represents an object-based attitude. User satisfaction primarily has been measured by various subsets of beliefs about specific systems, information, and other related characteristics (e.g., IT service).

This becomes clear when one examines user satisfaction instruments, such as Bailey and Pearson (1983), Baroudi and Orlikowski (1988), Doll and Torkzadeh (1988), and Ives et al. (1983) (see Table 1). These instruments use a characteristics-based approach for measuring user satisfaction. Although these instruments have been criticized for containing an arbitrary assortment of characteristics (Galletta and Lederer 1989), the items from user satisfaction instruments appear to conceptually represent a relatively small number of higher order constructs. Thus, the existing measures of user satisfaction provide a useful base for identifying and examining the underlying structure of system and information characteristics.

A fundamental problem with user satisfaction research has been its limited ability to predict system

Table 1 Satisfaction Surveys and Constructs

External variables	Instrument characteristics	Bailey and Pearson (1983)	Ives et al. (1983)	Baroudi and Orlikowski (1988)	Doll and Torkzadeh (1988)
System quality	Accessibility	X	X		
	Timeliness	X	X		X
	Language	X	X		
	Flexibility	X	X		
	Integration	X	X		
	Efficient				X
Information quality	Accuracy	X	X	X	X
	Precision	X	X	X	X
	Reliability	X	X	X	X
	Currency	X	X		X
	Completeness	X	X	X	X
	Format	X			X
	Volume	X	X		
Service quality	Relationship with EDP staff	X	X	X	
	Communication with EDP staff	X	X	X	
	Technical competence of EDP staff	X	X		
	Attitude of EDP staff	X	X	X	
	Schedule of products or services	X	X		
	Time required for new development	X	X	X	
	Processing of change requests	X	X	X	
	Vendor support	X			
	Response time	X	X		
	Means of input with EDP center	X			
Usefulness	Usefulness	X	X		X
	Relevancy	X	X	X	X
Ease of use	User friendly				X
	Easy to use				X
Outcome expectations	Expectations	X	X		
	Understanding of systems	X	X	X	
	Confidence in the system	X	X		
	Feelings of participation	X	X	X	
	Feelings of control	X	X		
	Degree of training	X	X	X	
	Job effects	X	X		
Organizational factors	Top management involvement	X	X		
	Organizational competition with EDP	X			
	Priorities determination	X	X		
	Charge-back method	X			
	Error recovery	X	X		
	Security of data	X			
	Documentation	X	X		
	Organizational position of EDP	X	X		

Note. EDP = electronic data processing.

usage (Davis et al. 1989, DeLone and McLean 1992, Goodhue 1988, Hartwick and Barki 1994, Melone 1990, Seddon 1997). However, when one considers the general attitude literature, the equivocal relationship between user satisfaction and usage can be understood. For a belief or attitude to be directly predictive of behavior, it needs to be consistent in time, target, and context with the behavior. Therefore, satisfaction with the system and its information output is unlikely to be directly predictive of the use of that system.

Instead, user satisfaction needs to be recognized as an object-based attitude (Ajzen and Fishbein 1980, p. 84) whereby it serves as an external variable with influences on intention and behavior that are fully mediated by behavioral beliefs and attitudes (Ajzen and Fishbein 1980; Eagly and Chaiken 1993, p. 205). For example, one's satisfaction with the reliability of a system does not directly impact whether one will use the system. However, beliefs about reliability certainly will affect one's attitude toward the system, which will shape behavioral beliefs about using the system (e.g., ease of use). It is the system behavioral belief (ease of use) that directly influences attitude toward use and, ultimately, usage. In the user satisfaction literature, the mediating behavioral beliefs and attitudes are absent, and inattention to this conceptual gap explains the equivocal relationship between system satisfaction and system usage (see Figure 2).

Empirical evidence shows that object-based attitude is generally a weak predictor of behavior (Ajzen and Fishbein, in press). For example, one meta-analysis found that the correlation between object-based attitude and behavior averaged only 0.13, whereas the correlation between behavioral attitude and the behavior itself averaged 0.54 (Kraus 1995). Thus, better understanding the theoretical relationships within the user satisfaction literature can help bridge such equivocal findings while offering system designers a way to influence usage through design based on system and information characteristics.

2.3. An Integrated Model of User Satisfaction and Technology Acceptance

The investigation of relationships among object-based beliefs, attitudes, and behaviors has been an ongoing challenge in the attitude-behavior literature:

> If there is one clear conclusion to be derived from the work on the attitude-behavior relation it is that general attitudes will usually not provide a good basis for predicting and explaining single behaviors with respect to the attitude object; correlations of single behaviors with general attitudes tend to be modest at best (Ajzen and Fishbein, in press, p. 28).

For accurate prediction, beliefs and attitudes must be specified in a manner that is consistent in time, target, and context with the behavior of interest (Fishbein and Ajzen 1975). This is often referred to as the *correspondence principle* (Fishbein and Ajzen 1975) and is at the core of the power of models such as TAM where beliefs and attitudes about a specific behavior (e.g., the use of an e-mail system), in a particular context (e.g., work), at a particular point in time (e.g., over the next month) are found to be predictive of intention and behavior. Given this, we begin to construct our research model with the right half of Figure 3. Fully

Figure 2 The User Satisfaction Research Stream Approach

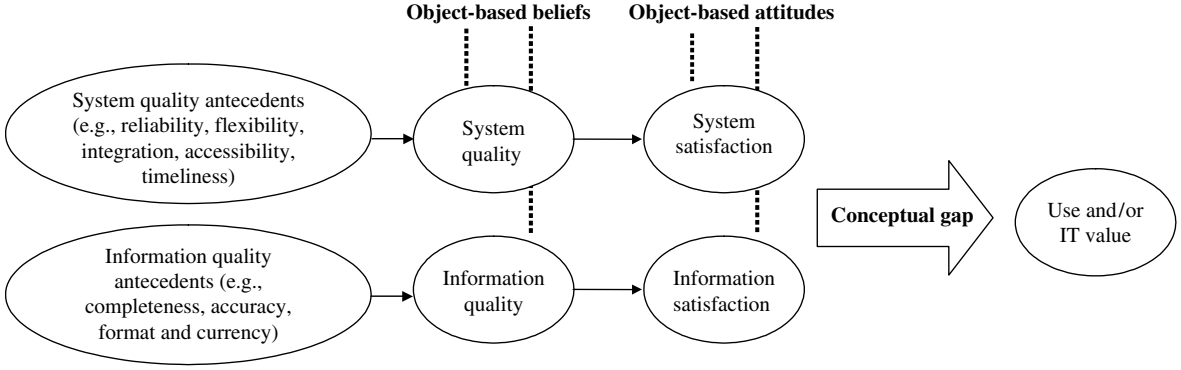
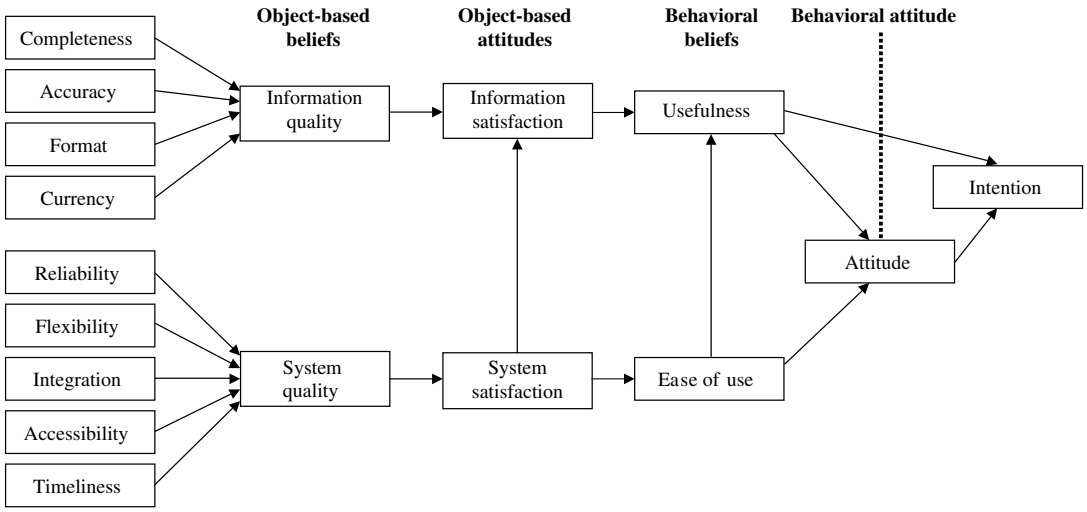


Figure 3 The Proposed Integrated Research Model



consistent with TRA, TAM, and more recent derivations, such as the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003), the model proposes that IT usage (the target behavior of interest) is driven by behavioral intention, intention is determined by attitude toward use and usefulness, and usefulness is a function of ease of use. Usefulness and ease of use are both assessments of the consequences of using a system to accomplish some task.

More general object-based attitudes (e.g., attitudes about a system) also can be predictive of behavioral dispositions by influencing the way in which information about the behavior is perceived and judged (Fazio and Olson 2003, Eagly and Chaiken 1993). Theoretically, these serve as external variables that may determine satisfaction with an object, and that level of satisfaction subsequently may influence beliefs about the consequences of using the object (Ajzen and Fishbein, in press). More specifically, Ajzen and Fishbein (1980, p. 9) note that "external variables may influence the beliefs a person holds or the relative importance he attaches to attitudinal and normative considerations."

Ajzen and Fishbein (1980) illustrate the use of object attitudes as external variables using the consumer context. A consumer often forms an attitude toward a particular brand. That attitude is shaped by beliefs about the brand. The consumer may also develop an attitude toward purchase of the brand, which will be influenced by beliefs about the consequences of purchasing the brand. Those beliefs are shaped, at least in part, by the attitude toward the brand itself. In the context of IT, beliefs about using the system to accomplish a particular task will be shaped, in part, by the attitude toward the system itself; indirectly these beliefs will shape attitude toward use and the eventual usage behavior.

Given this, we introduce the left side of Figure 3, which represents the user satisfaction literature. The far-left side of the model specifies key antecedents to information and system quality. These specific factors are derived from a decomposition and integration of factors identified in the user satisfaction literature (see Table 1). Although we believe these dimensions have general applicability, it may be that the relative importance of each is contingent on a specific system and setting. For system quality, *reliability* refers to the dependability of system operation, *flexibility* refers to the way the system adapts to changing demands of the user, *integration* refers to the way the system allows data to be integrated from various sources, *accessibility* refers to the ease with which information can be accessed or extracted from the system, and *timeliness* refers to the degree to which the system offers timely responses to requests for information or action.[2] It is important to note that each of these

[2] These five antecedents to system quality were selected based on their widespread use, representativeness, and relevance to the IT

factors reflects perceptions of the system itself and the way it delivers information.

Information quality is shaped by four dimensions: *completeness* represents the degree to which the system provides all necessary information; *accuracy* represents the user's perception that the information is correct; *format* represents the user's perception of how well the information is presented; and *currency* represents the user's perception of the degree to which the information is up to date.[3] These dimensions determine the user's perception of the quality of the information included in the system.

Next, we assert that information and system quality beliefs shape attitudes about information and system satisfaction, respectively.[4] This is supported by the concept from the attitude behavior literature that beliefs about objects (in this case, system and information quality) are linked to attitude toward an object (in this case, system and information satisfaction) (Ajzen and Fishbein 1980).

At this point, information and system satisfaction represent object-based attitudes that serve as external variables shaping behavioral beliefs. Satisfaction with the information produced by the system will influence perceptions of usefulness. That is, the higher the overall satisfaction with the information, the more likely one will find the application of that information useful in enhancing work performance. A similar effect is anticipated in terms of system satisfaction. System satisfaction represents a degree of favorableness with respect to the system and the mechanics of interaction. The more satisfied one is with the system itself, the more likely one is to find the system to be easy to use.

Consistent with the notion that ease of use will influence perceptions of usefulness, our model hypothesizes that system satisfaction will influence information satisfaction. Being able to effectively interact with the system is a necessary condition to obtaining useful information from it. Thus, an individual's level of satisfaction with the system is likely to influence his or her sense of satisfaction with the information it produces.

To summarize, our models suggest that the technology acceptance literature and the parallel user satisfaction stream are not competing approaches to understanding IT usage and value. Rather, they represent complementary steps in a causal chain from key characteristics of system design, to beliefs and expectations about outcomes that ultimately determine usage. Next, we present a preliminary empirical test of the proposed model to assess the aptness of the proposed relationships. The test is based on a sample of 465 users of data warehousing predefined reporting software from 7 different organizations.

3. Method

3.1. Instrument Development

The development of the survey instrument was patterned after the process proposed by Moore and Benbasat (1991). First, groups of questions were compiled from validated instruments to represent each construct, and wording was modified to fit the data warehousing context to be studied. Next, 10 professors and graduate students sorted the 88 initial items into 17 separate categories, identifying ambiguous or poorly worded items. Items were removed, and minor wording changes were made prior to a second round of sorting, which did not uncover further problems. The three items that were categorized most accurately were selected for each construct and included in a random order on the survey instrument.[5] Each question was measured on a 7-point, Likert-type scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

context that will be explored in this study. This list is not necessarily exhaustive.

[3] These four antecedents to information quality were selected based on their widespread use, representativeness, and relevance to the IT context that will be explored in this study. This list is not necessarily exhaustive.

[4] User satisfaction instruments also refer to other categories of object beliefs, such as service quality that could be included in this model. However, consistent with Seddon (1997), when the focus of the model is on the use of an application, we treat only the system and information characteristics, rather than the broader set of factors that might be used to evaluate satisfaction with overall IT services. This is not to say that such factors are not important, but rather that they are focused on the broader target of the IS function rather than on the individual application.

[5] Only two questions were included for information satisfaction and system satisfaction to reduce redundancy.

The context of the survey instrument was the success of data warehousing predefined reporting software. Predefined reporting software was installed and managed by the data warehousing project team and run by users on a regular basis to provide predetermined information. This context was chosen because of its importance and widespread use in practice. It was hoped that widespread interest in the topic of data warehousing would encourage individual and corporate participation in the study.

Before implementing the survey, the instrument was reviewed by academics and practitioners with knowledge of survey design, IS success, and data warehousing. Minor changes were made based on their suggestions. The resulting survey was then pilot tested using respondents from a large public university to identify problems with the instruments' wording, content, format, and procedures. For this pilot test, surveys were distributed to 250 active users of the university's data warehouse; 73 responded, resulting in a 29% response rate. Pilot participants completed the instruments and provided written comments about length, wording, and instructions. Two of the participants were interviewed to gain a richer understanding of the feedback. Each construct in the pilot test showed internal consistency levels exceeding 0.70, as measured by Cronbach's alpha (Nunnally 1978).

Based on the results of the pilot sample, minor modifications were made to the survey design. The final survey included 76 items representing the 17 constructs identified in Figure 3, as well as a series of demographic and self-reported usage items. The specified items, organized by construct, are shown in Table 2.

3.2. Sample

To obtain study participants, an e-mail announcement was sent to members of The Data Warehousing Institute, offering a free study to assess the success of their organization's data warehousing data access software. Seven organizations from a variety of industries (e.g., health care, consumer goods, financial services, and government) agreed to participate. Each organization was asked to distribute paper-based surveys to all of the active users of its data warehouse. All surveys were confidential; no identifying personal information was required. At each organization, the study contact collected the completed surveys and returned them to the researchers. Response rates varied across organizations (see Table 3), with an overall study response rate of 21%, yielding 465 completed surveys.

The average age of the respondents was 42 years, and 40% were male. The respondents had an average of 12 years tenure with their organization and 18 years average total work experience. Their positions in the organizations varied from clerical to senior management—58% were analysts; they represented different functional areas across the organization. The demographic profile of the sample is shown in Table 4.

The respondents were direct, voluntary users of data warehousing predefined reporting software. On the survey, they identified their absolute usage of the system and their use relative to opportunity. Both absolute and relative usage were measured using a 1 to 7 Likert-type scale, with 1 representing low use and 7 representing high use. The averages for absolute usage and relative usage were 3.6 and 4, respectively, suggesting that the respondents, on average, had a reasonable level of experience using the data warehouse software. The standard deviations for absolute (1.95) and relative usage (1.46) also suggest that there was reasonable variance across the sample in usage experience. All users accessed warehouses that had been in place for at least six months.

4. Results

The research model was tested using partial least squares (PLS), a structural modeling technique that is well suited for highly complex predictive models (Barclay et al. 1995, Chin 1998, Lohmoller 1989, Wold and Joreskog 1982). PLS was most appropriate given the large number of constructs that resulted when the satisfaction and usage models were combined. PLS Graph version 2.91 (Chin and Frye 1996) was used for the analysis, and the bootstrap resampling method (100 resamples) was used to determine the significance of the paths within the structural model.

4.1. Measurement Model

The test of the measurement model includes the estimation of internal consistency and the convergent and discriminant validity of the instrument

Table 2 Survey Items and Measurement Properties

Construct and item	Mean	St. dev.
Completeness		
$\alpha = 0.90$		
Fornell = 0.94		
—— provides me with a complete set of information.	4.58	1.77
—— produces comprehensive information.	4.88	1.70
—— provides me with all the information I need.	4.15	1.87
Format		
$\alpha = 0.89$		
Fornell = 0.92		
The information provided by —— is well formatted.	4.93	1.68
The information provided by —— is well laid out.	5.10	1.57
The information provided by —— is clearly presented on the screen.	5.23	1.55
Accuracy		
$\alpha = 0.87$		
Fornell = 0.90		
—— produces correct information.	5.14	1.60
There are few errors in the information I obtain from ——.	4.75	1.78
The information provided by —— is accurate.	5.04	1.66
Currency		
$\alpha = 0.93$		
Fornell = 0.94		
—— provides me with the most recent information.	5.05	1.87
—— produces the most current information.	4.96	1.79
The information from —— is always up to date.	4.71	1.77
Information quality		
$\alpha = 0.94$		
Fornell = 0.94		
Overall, I would give the information from —— high marks.	5.09	1.68
Overall, I would give the information provided by —— a high rating in terms of quality.	5.10	1.63
In general, —— provides me with high-quality information.	5.11	1.61
Reliability		
$\alpha = 0.90$		
Fornell = 0.93		
—— operates reliably.	5.10	1.73
—— performs reliably.	5.15	1.66
The operation of —— is dependable.	5.10	1.56
Accessibility		
$\alpha = 0.90$		
Fornell = 0.92		
—— allows information to be readily accessible to me.	5.27	1.70
—— makes information very accessible.	5.16	1.69
—— makes information easy to access.	5.14	1.70
Flexibility		
$\alpha = 0.86$		
Fornell = 0.90		
—— can be adapted to meet a variety of needs.	4.28	1.99
—— can flexibly adjust to new demands or conditions.	3.73	1.86
—— is versatile in addressing needs as they arise.	4.00	1.83
Integration		
$\alpha = 0.89$		
Fornell = 0.91		
—— effectively integrates data from different areas of the company.	4.78	1.89

Table 2 (cont'd.)

Construct and item	Mean	St. dev.
—— pulls together information that used to come from different places in the company.	5.14	1.77
—— effectively combines data from different areas of the company.	4.93	1.77
Timeliness		
$\alpha = 0.80$		
Fornell = 0.87		
It takes too long for —— to respond to my requests. (RC)	4.26	1.90
—— provides information in a timely fashion.	5.07	1.67
—— returns answers to my requests quickly.	4.90	1.72
System quality		
$\alpha = 0.91$		
Fornell = 0.94		
In terms of system quality, I would rate —— highly.	4.91	1.69
Overall, —— is of high quality.	5.12	1.55
Overall, I would give the quality of —— a high rating.	4.97	1.62
Information satisfaction		
$\alpha = 0.93$		
Fornell = 0.96		
Overall, the information I get from —— is very satisfying.	4.89	1.80
I am very satisfied with the information I receive from ——.	4.84	1.78
System satisfaction		
$\alpha = 0.92$		
Fornell = 0.95		
All things considered, I am very satisfied with ——.	4.61	1.94
Overall, my interaction with —— is very satisfying.	4.65	1.82
Attitude		
$\alpha = 0.89$		
Fornell = 0.91		
Using —— is (not enjoyable/ very enjoyable).	4.13	1.86
Overall, using —— is a (unpleasant/pleasant) experience.	4.89	1.79
My attitude toward using —— is (very unfavorable/very favorable).	4.98	1.77
Intention		
$\alpha = 0.87$		
Fornell = 0.92		
I intend to use —— as a routine part of my job over the next year.	5.13	1.94
I intend to use —— at every opportunity over the next year.	4.80	1.93
I plan to increase my use of —— over the next year.	4.64	1.88
Ease of use		
$\alpha = 0.85$		
Fornell = 0.89		
—— is easy to use.	5.31	1.82
It is easy to get —— to do what I want it to do.	4.39	1.98
—— is easy to operate.	5.20	1.84
Usefulness		
$\alpha = 0.82$		
Fornell = 0.88		
Using —— improves my ability to make good decisions.	5.04	1.65
—— allows me to get my work done more quickly.	4.84	1.80
Using —— enhances my effectiveness on the job.	5.04	1.76

Note. RC = reverse coded.

Table 3 Survey Response Rates

Company	Surveys sent*	Surveys returned	Response rate (percent)
A-Health care	129	40	31
B-Packaged goods	300	92	31
C-Financial services	179	23	13
D-Health care	108	42	39
E-Public sector	1,200	172	14
F-Public sector	231	61	26
G-Public sector	66	35	53
Overall	2,213	465	21

*Note that this represents the number of surveys sent to each company. We cannot be certain that all surveys sent were distributed to data warehouse users. Thus, our effective response rate is likely somewhat higher that reported here.

Table 4 Demographic Profile of Respondents

	Number	Percent
Organizational level:		
Senior management	13	3
Middle management	95	22
First-level supervisor	48	11
Analyst	257	58
Clerical	27	6
Functional area:		
Accounting	22	5
Finance	79	17
Human resources	22	5
Information systems	37	8
Marketing and sales	82	18
Research and development	96	21
Other	116	25
Gender:		
Male	180	40
Female	270	60
Average age:		42 years
Average years at company:		12 years
Average years in workforce:		18 years

items. Table 2 lists the survey scales and their internal consistency reliabilities. All reliability measures were 0.8 or higher, well above the recommended level of 0.70, indicating adequate internal consistency (Nunnally 1978).

Although some of the variable intercorrelations were quite high (ranging from 0.36 to 0.85), the items demonstrated satisfactory convergent and discriminant validity. Convergent validity is adequate when constructs have an average variance extracted (AVE) of at least 0.5 (Fornell and Larcker 1981). For satisfactory discriminant validity, the AVE from the construct should be greater than the variance shared between the construct and other constructs in the model (Chin 1998). Table 5 lists the correlation matrix, with correlations among constructs and the square root of AVE on the diagonal. In all cases, the AVE for each construct is larger than the correlation of that construct with all other constructs in the model.

Table 5 Correlations of Latent Variables†

	COMP	ACCU	FORM	CURR	RELI	FLEX	INTE	TIME	ACCE	INFQ	SYSQ	INTN	ATTI	EASE	USEF	SYSS	INFS
Completeness	**0.91**																
Accuracy	0.55*	**0.87**															
Format	0.66	0.49	**0.89**														
Currency	0.57	0.61	0.48	**0.92**													
Reliability	0.62	0.68	0.57	0.59	**0.90**												
Flexibility	0.68	0.33	0.47	0.39	0.41	**0.86**											
Integration	0.69	0.46	0.50	0.50	0.50	0.48	**0.88**										
Timeliness	0.55	0.54	0.52	0.54	0.74	0.46	0.47	**0.83**									
Accessibility	0.70	0.54	0.63	0.55	0.70	0.54	0.61	0.70	**0.89**								
Info. quality	0.74	0.76	0.64	0.64	0.73	0.54	0.63	0.60	0.71	**0.91**							
System quality	0.77	0.71	0.71	0.56	0.77	0.57	0.57	0.67	0.77	0.85	**0.91**						
Intention	0.53	0.36	0.40	0.39	0.41	0.51	0.42	0.43	0.58	0.53	0.57	**0.89**					
Attitude	0.59	0.49	0.63	0.44	0.61	0.56	0.47	0.62	0.70	0.67	0.75	0.71	**0.87**				
Ease of use	0.52	0.42	0.57	0.38	0.58	0.44	0.45	0.56	0.68	0.58	0.69	0.55	0.77	**0.85**			
Usefulness	0.60	0.47	0.49	0.47	0.54	0.54	0.53	0.52	0.66	0.69	0.67	0.76	0.75	0.65	**0.85**		
System sat.	0.66	0.41	0.60	0.39	0.60	0.58	0.51	0.57	0.71	0.67	0.75	0.67	0.84	0.81	0.77	**0.95**	
Information sat.	0.67	0.52	0.55	0.51	0.61	0.58	0.54	0.54	0.63	0.77	0.72	0.66	0.73	0.61	0.80	0.79	**0.96**

*All correlations are significant at the 0.001 level.
†Diagonal elements are the square root of AVE. These values should exceed the interconstruct correlations for adequate discriminant validity. This condition is satisfied for each construct.

Discriminant and convergent validity are further confirmed when individual items load above 0.50 on their associated factors and when the loadings within construct are higher than those across constructs. The appendix contains the loadings and cross-loadings for items used in this study; all items loaded on their constructs as expected. Furthermore, all items loaded more highly on their construct than they loaded on any other construct, and in all but one case among the 784 cross loadings the differences were greater than 0.10.

Finally, the data were tested for multicollinearity. We tested for all potential collinearity problems that had more than one predictor construct. In all cases, the variance inflation factor was below the 5.0 level.

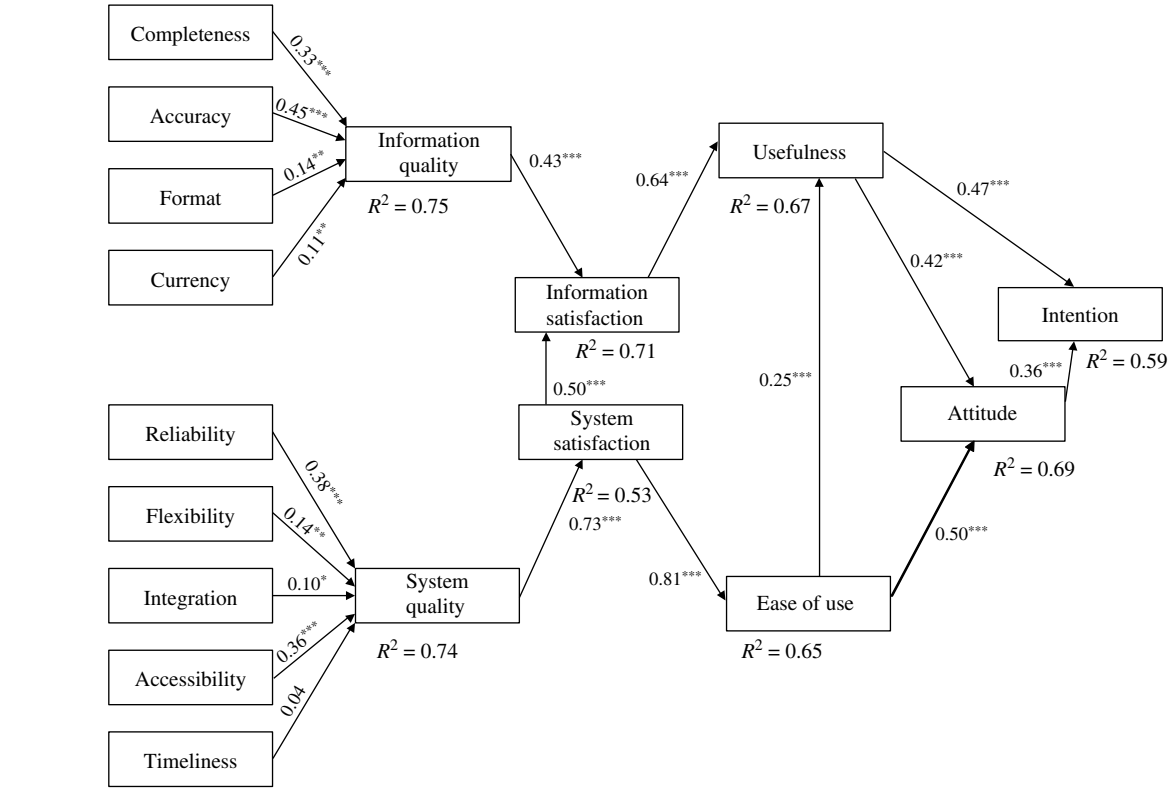
4.2. Structural Model

The test of the structural model includes estimates of the path coefficients, which indicate the strengths of the relationships between the dependent and independent variables, and the R^2 values, which represent the amount of variance explained by the independent variables. Together, the R^2 and the path coefficients (loadings and significance) indicate how well the data support the hypothesized model.

Figure 4 shows the results of the test of the hypothesized structural model. The paths specified in TAM are all significant with the direct and indirect effects of usefulness, ease of use, and attitude toward use accounting for 59% of the variance in intention. As predicted, information satisfaction (0.64) had a significant influence on perceived usefulness and accounted for 67% of the variance in perceived usefulness. System satisfaction (0.81) had a significant influence on perceived ease of use and accounted for 65% of the variance in perceived ease of use.

As expected, information quality (0.43) and system satisfaction (0.50) had significant influences on information satisfaction, accounting for 71% of the variance in that measure. System quality also was a significant determinant of system satisfaction (0.73), accounting for 53% of its variance. Completeness

Figure 4 Research Model Results



$^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

(0.33), accuracy (0.45), format (0.14), and currency (0.11) were all significantly related to information quality and collectively account for 75% of the variance in information quality. Reliability (0.38), flexibility (0.14), integration (0.10), and accessibility (0.36) were all significant determinants of system quality, whereas timeliness was not. The first three factors together accounted for 74% of the variance in system quality.

4.3. Alternative Models

The proposed research model is clearly a single construction and ordering of the factors that we have presented. The core logic for the proposed model is based on the correspondence principle (Fishbein and Ajzen 1975), which maintains that the beliefs and attitudes that most closely correspond to the behavior of interest should be the most important proximal predictors of those behaviors. Factors that are progressively more distant (e.g., attitude toward the system, system quality, assessment of specific system factors) should provide weaker direct effects in terms of predicting intention and, ultimately, the target behavior.

It certainly is possible to imagine and argue for alternative models that organize the factors under investigation in a different fashion. Our data is a cross-sectional sample of current users; therefore, we cannot claim that our results demonstrate causal relationships. Thus, to more fully assess the aptness of the proposed research model, we examined alternative models to determine the degree to which each predicts and explains intention.

First, we examined whether system and information satisfaction and quality could serve as direct antecedents to intention in the same fashion as usefulness and attitude. The proposed model suggests that the influence of these factors should be fully mediated through usefulness and ease of use, and the analysis bears this out (see Table 6). The additional paths to intention are weak (0.12 or less) and provide a trivial 0.01 increase in explanatory power for intention.

Second, we examined a pragmatic model that posits the system characteristics (e.g., completeness, flexibility) as additional direct antecedents to intention (see Table 6). The theory suggests that they will be weak predictors of intention. Indeed, when these nine factors are added as direct antecedents to intention in addition to usefulness and attitude, only two are significant. Collectively, the nine additional direct factors only increase explanatory power for intention from 0.59 to 0.62.

Table 6 Alternative Models to Predict Intentions

	TAM	Plus quality and satisfaction to intention	Plus system characteristics to intention	All factors to intention
Intention R^2	0.59	0.60	0.62	0.63
Attitude	0.36***	0.35***	0.41***	0.41***
Usefulness	0.47***	0.44***	0.42***	0.42***
Information satisfaction		0.11		0.11
System satisfaction		0.01		0.03
Information quality		0.12		0.13
System quality		0.05		0.14
Completeness			0.10	0.07
Accuracy			0.01	0.02
Format			0.12*	0.13*
Currency			0.07	0.08
Reliability			0.20**	0.22**
Flexibility			0.06	0.06
Integration			0.03	0.01
Accessibility			0.09	0.08
Timeliness			0.01	0.02

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

Next, we tested a model where all factors were included simultaneously as direct antecedents to intention (see Table 6). Usefulness and attitude again dominate in the prediction of intention, and the remaining path coefficients are generally small (8 of 13 are below 0.1). The explanatory power for intention increases marginally from 0.59 to 0.63.

Finally, we examined whether the mediating influences of information and system satisfaction are important to the model. To do this, information and system quality were analyzed as direct determinants of usefulness and ease of use, respectively. Without the satisfaction constructs, information quality (path = 0.45) and systems quality (path = 0.66) are indeed significant determinants of usefulness and ease of use. Consistent with our notion that they are more distal predictors than satisfaction, however, the path coefficients are significantly lower than in the proposed research model (down from 0.64 and 0.81). Furthermore, the R^2 values for ease of use and use-

fulness decrease from 0.65 to 0.43, and from 0.67 to 0.55, respectively.

Overall, the alternative models provide less explanatory power than the proposed research model and, more importantly, limit our understanding of the role of each class of variable in shaping intention and usage. Consistent with the underlying theory, our empirical evidence suggests that the further removed a factor is from the actual usage behavior, the less predictive it will be.

5. Discussion

The findings of this study provide a preliminary test of the viability of the research model within the context of data warehousing predefined reporting software. The findings are consistent with the proposed theoretical foundation, and they support the need to differentiate between object-based beliefs and attitudes (system and information quality, system and information satisfaction), and behavior-based beliefs and attitudes (ease of use and usefulness, attitude) when trying to predict usage behavior.

Findings show, for example, that system and information characteristics explain 75% of the variance for system and information quality. Completeness, accuracy, format, and currency serve as antecedents to information quality, with accuracy and completeness serving particularly important roles. Similarly, reliability, flexibility, integration, and accessibility serve as antecedent beliefs to system quality, with reliability and accessibility having the strongest effects.

Timeliness was not found to be an important antecedent belief in this context. Typically, decisions based on data warehouse data are strategic in nature; a fast response time is not as important as other factors. Timeliness may have a different relative effect with other kinds of systems, especially those that support business operations (e.g., inventory management, order-entry). As warehouses evolve to serve more operational needs, as in the cases of real-time warehousing and business activity monitoring, timeliness may become more important in data warehousing.

Perhaps most important, the proposed influences of object-based attitudes on behavioral beliefs are demonstrated by the strong significant relationships between information satisfaction and usefulness, and between system satisfaction and ease of use. The results support the applicability of information and system satisfaction as external variables to the traditional TAM beliefs about usage behavior. These specific findings form the integrative mechanisms that tie concepts from the user satisfaction and technology acceptance literature into a single research model. In this study, it is clear that the mediating roles of quality and satisfaction are critical. When alternatives are examined (Table 6), each shows deficiencies relative to the proposed research model. The performance of information satisfaction and system satisfaction is consistent with the original conceptualization of external variables as a "bridge between the internal beliefs, attitudes and intentions represented in TAM and the various individual differences, situational constraints and managerially controllable interventions impinging on behavior" (Davis et al. 1989, p. 988).

There are several limitations to this study that should be noted. First, the study respondents were direct users of data warehousing predefined reporting software within seven large organizations. Findings cannot be generalized to other settings and technologies without further research. Also, the respondents were existing users of the technology, so the results do not further our understanding of preadoption situations.

The exclusive use of surveys for data collection suggests that common-method bias may be present in the study's measurements. We believe that our careful attention to survey design and the application of reliability and validity checks instill confidence in the study's results. Additional research that employs a triangulation of data collection methods would best alleviate common-method bias concerns, however.

One also should note the potential for nonresponse bias in the study. A few of the organizations' response rates were quite low (e.g., 13%), and there is a chance that individuals who chose to complete a survey have different perceptions from those who did not choose to respond. Unfortunately, the authors had no direct interaction with the study respondents. The surveys were distributed by a company contact who conducted the publicity and follow-up efforts. The varied response rates (i.e., 13% to 53%) resulted from the differing knowledge and control that the contact person had with his or her user base. With the larger implementations, the contact person had much less personal

contact and influence. With the smaller implementations, the contact person typically had more time and a greater understanding of the users, which led to higher response rates. At the same time, we note that across the sample there was significant variance in user experience with the data warehouse software and varying organizational levels and positions represented among the respondents across a variety of businesses and industries. Collectively, this heterogeneity should suggest that our results are relatively robust.

5.1. Implications for Practice

A key benefit of this study is that managers now have a way to assess system and information characteristics and then reliably investigate their impacts on ultimate usage through the proposed causal chain. This can help with management activities such as task prioritization and resource allocation. For example, a manager who participated in this study discovered that the data currency in his data warehouse was too old to be useful to the users. The "intention to use" scores were so low that the manager decided to take immediate steps to improve the system's data currency. The manager had a long list of ways to improve the data warehouse, but the information from this study helped him focus on which tasks would be most likely to improve system usage.

The proposed research model also provides a mechanism for understanding and assessing the relative influence of detailed system and information characteristics; this provides important guidance to system designers. For example, the model first can help designers understand which characteristics (e.g., completeness, accuracy, and reliability) have the most relative importance within the context of interest (e.g., data warehousing, enterprise resource planning systems (ERP), and mobile computing). Based on this understanding, designers can look at the scores for these characteristics and determine what kinds of changes can have the most meaningful impacts. For example, if users perceive significant problems with the accuracy of information (a very important information characteristic in this study), then designers can focus efforts accordingly. More specifically in the data warehousing context, designers can address accuracy through such efforts as meta data, data sourcing, quality assessment tools, and business semantic layers. Ideally, as knowledge about the relative influences of factors across different contexts (e.g., technologies, applications, tasks, and settings) is accumulated, it might provide a basis for important design guidelines and standards for building effective systems.

Furthermore, we believe that the research model has diagnostic value at any stage of a system's implementation or usage process. In current times, systems are less likely to be built from scratch; rather, they evolve over time. Data warehousing, for example, is typically described as a journey rather than a destination—with companies adding new applications, meeting unique business needs, and creating architectural changes over time. Therefore, it is important to understand design and implementation issues and their ultimate effects on usage at any point within the system life cycle. In fact, many of the companies that participated in our study did so because they wanted to assess the effectiveness of their existing data warehouse and make changes accordingly.

5.2. Implications for Research

This study yields three implications for research. First, this study illustrates the importance that researchers understand and preserve essential theoretical relationships when performing empirical research in this area. We encourage researchers to consider the principle of correspondence when designing research models that involve object-based and behavioral beliefs and attitudes. If one is interested in understanding how system and related design and implementation attributes might influence system and information satisfaction, per se, then these should be measured as a consistent set of beliefs and attitudes about system characteristics. Furthermore, the aptness of such models should not be based on the relationship of these factors directly to usage or measures of business value. Such relationships can only be understood by examining appropriate mediating factors related to behavioral beliefs and attitudes, such as ease of use, usefulness, attitude toward use, and behavioral intention as specified in TAM. Comparisons across studies also need to take into account the nature of the constructs as conceptualized and operationalized to avoid mixing studies that examine factors at differing levels of abstraction. Attempts to integrate such studies would only contribute to conflicting and contradictory results.

This study also identifies considerable opportunity for researchers to develop the portions of our model

that feed into TAM. We acknowledge that researchers have worked diligently to extend TAM (see Figure 1); however, we encourage researchers to investigate the effects of the IT artifact itself as an antecedent to ease of use, usefulness, and related factors. We believe our research model suggests ways in which this can be accomplished.

Additionally, it would be useful for researchers to investigate whether there is a core set of system characteristics that apply broadly across a wide range of systems. Studies should systematically investigate various technologies that differ on important dimensions. For example, systems with strong analytical capabilities can be compared with those that have stronger information richness components. We may find that features that make one system useful or easy to use are less relevant for another kind. Whether information accuracy is important overall, only relevant in a data warehousing context, or less salient when the users create information themselves leads to further research questions. The research model provides a platform for more detailed thinking, theorizing, and testing of such ideas. Continued research along this vein should further confirm the absolute importance of other components of the integrated model.

A challenge to researchers is not to identify and test alternative factors in an indiscriminate fashion, but to develop a way to theorize about the characteristics of a system and the information it produces to arrive at ways to predict and understand them across contexts. In other words, researchers need to develop theories about information and system characteristics to overcome the legitimate complaint that existing sets of system and information characteristics are arbitrary (Galletta and Lederer 1989).

Finally, other research designs would strengthen our understanding of the integrated model. This study examined a cross-section of individuals with a variety of usage patterns. Other studies may want to look at more-controlled subsets of users and contexts to identify constraints and exceptions to the model. It would also be beneficial to perform longitudinal studies that test the proposed relationships as they unfold over time.

6. Conclusion

This study integrated the theoretical perspectives and empirical findings of the user satisfaction and technology acceptance research streams by applying Ajzen and Fishbein's (1980, in press) conceptualizations of object-based and behavioral beliefs and attitudes. It developed a research model, conducted a preliminary test using survey data from 465 data warehouse users, and analyzed the data using structural equation modeling. Overall, the results are largely consistent with the hypothesized model and demonstrate the potential to integrate concepts related to user satisfaction and technology acceptance into a single unified model. This provides an opportunity to integrate two streams of research that, until now, have been treated largely as distinct, and to build on the unique strengths of each.

Orlikowski and Iacono (2001) criticize past TAM studies because they "lack the means to account for temporal and contextual variations in the patterns discerned. To do so will require more careful theorizing about differences in IT artifacts and their role and use in different contexts and over time" (p. 129). We believe that this study helps to leverage the rich stream of research found within the technology acceptance literature by offering a theoretical way to integrate it with a research stream, user satisfaction, which offers a way to theorize about and account for differences in the IT artifact.

The important extension that the integrated model provides is the conceptual understanding of the difference between object-based beliefs and attitudes and behavioral beliefs and attitudes toward use, which primarily have been investigated separately in the user satisfaction and TAM literatures, respectively. We believe our model provides an important step on the path to providing conceptual clarity to two critically important streams of IT research. Nonetheless, it is simply a step. Additional research is needed to develop a refined understanding of the relationships proposed in the integrated model.

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Appendix. Matrix of Loadings and Cross Loadings

	COMP	ACCU	FORM	CURR	RELI	FLEX	INTE	TIME	ACCE	INFQ	SYSQ	INTN	ATTI	EASE	USEF	SYSS	INFS	
COMP1	**0.915**	0.495	0.589	0.558	0.565	0.601	0.600	0.481	0.569	0.666	0.687	0.407	0.478	0.404	0.470	0.528	0.570	COMP1
COMP2	**0.913**	0.523	0.640	0.474	0.584	0.602	0.700	0.528	0.677	0.692	0.735	0.454	0.535	0.482	0.560	0.601	0.624	COMP2
COMP3	**0.913**	0.497	0.594	0.503	0.551	0.684	0.574	0.528	0.647	0.668	0.702	0.531	0.581	0.523	0.576	0.645	0.619	COMP3
ACCU1	0.541	**0.926**	0.495	0.579	0.652	0.354	0.444	0.540	0.519	0.764	0.720	0.375	0.483	0.439	0.461	0.432	0.533	ACCU1
ACCU2	0.421	**0.804**	0.399	0.460	0.561	0.276	0.392	0.447	0.427	0.555	0.530	0.233	0.330	0.309	0.330	0.275	0.379	ACCU2
ACCU3	0.516	**0.930**	0.506	0.622	0.643	0.317	0.387	0.520	0.485	0.738	0.690	0.310	0.421	0.367	0.414	0.345	0.470	ACCU3
FORM1	0.607	0.465	**0.907**	0.427	0.523	0.421	0.429	0.507	0.565	0.566	0.649	0.348	0.559	0.521	0.444	0.535	0.498	FORM1
FORM2	0.651	0.536	**0.932**	0.473	0.562	0.455	0.493	0.578	0.631	0.650	0.695	0.440	0.620	0.587	0.519	0.597	0.556	FORM2
FORM3	0.560	0.410	**0.870**	0.405	0.524	0.416	0.430	0.475	0.545	0.547	0.606	0.325	0.541	0.492	0.427	0.519	0.480	FORM3
CURR1	0.491	0.530	0.438	**0.921**	0.520	0.349	0.450	0.524	0.461	0.598	0.497	0.378	0.384	0.374	0.438	0.354	0.516	CURR1
CURR2	0.491	0.593	0.435	**0.944**	0.516	0.343	0.461	0.519	0.479	0.574	0.483	0.331	0.366	0.333	0.399	0.314	0.436	CURR2
CURR3	0.572	0.608	0.472	**0.928**	0.553	0.372	0.477	0.540	0.505	0.623	0.545	0.316	0.416	0.317	0.372	0.350	0.436	CURR3
RELI1	0.518	0.634	0.508	0.459	**0.913**	0.348	0.390	0.651	0.574	0.630	0.686	0.356	0.553	0.540	0.494	0.561	0.551	RELI1
RELI2	0.600	0.658	0.554	0.585	**0.937**	0.435	0.491	0.734	0.670	0.748	0.747	0.387	0.568	0.523	0.540	0.555	0.629	RELI2
RELI3	0.583	0.601	0.567	0.523	**0.888**	0.386	0.435	0.690	0.677	0.612	0.677	0.292	0.497	0.485	0.420	0.485	0.457	RELI3
FLEX1	0.601	0.228	0.429	0.295	0.358	**0.844**	0.448	0.414	0.507	0.493	0.480	0.496	0.535	0.382	0.512	0.519	0.501	FLEX1
FLEX2	0.580	0.353	0.403	0.357	0.424	**0.890**	0.450	0.450	0.455	0.474	0.506	0.427	0.470	0.414	0.511	0.539	0.525	FLEX2
FLEX3	0.650	0.357	0.434	0.372	0.367	**0.909**	0.475	0.441	0.514	0.528	0.538	0.474	0.476	0.390	0.499	0.523	0.554	FLEX3
INTE1	0.649	0.471	0.468	0.475	0.514	0.479	**0.892**	0.478	0.557	0.625	0.564	0.415	0.457	0.416	0.510	0.503	0.530	INTE1
INTE2]	0.611	0.314	0.440	0.426	0.352	0.462	**0.896**	0.408	0.498	0.485	0.480	0.363	0.382	0.367	0.423	0.418	0.417	INTE2]
INTE3	0.617	0.440	0.450	0.461	0.446	0.470	**0.922**	0.426	0.487	0.582	0.535	0.326	0.396	0.392	0.455	0.409	0.487	INTE3
TIME1	0.330	0.310	0.369	0.288	0.515	0.311	0.274	**0.791**	0.430	0.352	0.436	0.216	0.423	0.355	0.300	0.389	0.317	TIME1
TIME2	0.539	0.531	0.484	0.673	0.676	0.426	0.463	**0.838**	0.623	0.603	0.575	0.407	0.529	0.492	0.434	0.465	0.501	TIME2
TIME3	0.532	0.539	0.574	0.452	0.698	0.481	0.455	**0.908**	0.676	0.600	0.700	0.430	0.609	0.563	0.550	0.574	0.539	TIME3
ACCE1	0.635	0.524	0.573	0.534	0.649	0.483	0.545	0.653	**0.891**	0.672	0.699	0.528	0.616	0.553	0.607	0.609	0.575	ACCE1
ACCE2	0.664	0.497	0.586	0.504	0.679	0.538	0.533	0.636	**0.933**	0.657	0.723	0.519	0.636	0.592	0.605	0.642	0.577	ACCE2
ACCE3	0.596	0.456	0.622	0.390	0.592	0.498	0.482	0.625	**0.900**	0.618	0.733	0.509	0.675	0.726	0.601	0.719	0.578	ACCE3
INFQ1	0.715	0.656	0.555	0.647	0.702	0.550	0.624	0.584	0.647	**0.916**	0.760	0.484	0.606	0.521	0.665	0.629	0.768	INFQ1
INFQ2	0.710	0.751	0.642	0.601	0.703	0.528	0.564	0.608	0.675	**0.946**	0.858	0.503	0.625	0.550	0.607	0.639	0.704	INFQ2
INFQ3	0.669	0.773	0.630	0.578	0.656	0.505	0.553	0.587	0.656	**0.942**	0.806	0.503	0.607	0.510	0.626	0.587	0.689	INFQ3
SYSQ1	0.653	0.638	0.679	0.443	0.756	0.486	0.486	0.675	0.663	0.732	**0.898**	0.509	0.697	0.650	0.602	0.706	0.661	SYSQ1
SYSQ2	0.734	0.719	0.675	0.533	0.669	0.535	0.558	0.623	0.747	0.828	**0.931**	0.522	0.649	0.609	0.601	0.663	0.653	SYSQ2
SYSQ3	0.772	0.690	0.669	0.554	0.709	0.573	0.571	0.641	0.776	0.837	**0.946**	0.559	0.681	0.603	0.632	0.701	0.696	SYSQ3
INTN1	0.444	0.287	0.335	0.335	0.368	0.413	0.347	0.398	0.512	0.479	0.502	**0.895**	0.612	0.522	0.685	0.611	0.597	INTN1
INTN2	0.456	0.372	0.417	0.344	0.393	0.460	0.388	0.424	0.539	0.487	0.539	**0.917**	0.674	0.521	0.670	0.631	0.590	INTN2
INTN3	0.453	0.244	0.337	0.287	0.222	0.507	0.323	0.304	0.434	0.410	0.447	**0.874**	0.592	0.389	0.589	0.525	0.536	INTN3
ATTI1	0.509	0.429	0.561	0.369	0.500	0.487	0.423	0.566	0.599	0.574	0.631	0.618	**0.885**	0.671	0.621	0.712	0.620	ATTI1
ATTI2	0.541	0.437	0.634	0.374	0.581	0.508	0.400	0.618	0.665	0.621	0.697	0.636	**0.926**	0.754	0.707	0.844	0.693	ATTI2
ATTI3	0.565	0.419	0.568	0.415	0.539	0.530	0.425	0.549	0.657	0.601	0.672	0.704	**0.890**	0.684	0.701	0.770	0.673	ATTI3
EASE1	0.435	0.402	0.541	0.319	0.496	0.333	0.379	0.527	0.623	0.482	0.590	0.446	0.660	**0.896**	0.511	0.669	0.443	EASE1
EASE2	0.539	0.348	0.488	0.355	0.490	0.532	0.426	0.498	0.586	0.544	0.602	0.555	0.709	**0.847**	0.666	0.787	0.703	EASE2
EASE3	0.375	0.366	0.549	0.293	0.490	0.278	0.317	0.467	0.582	0.441	0.548	0.436	0.659	**0.880**	0.507	0.671	0.453	EASE3
USEF1	0.443	0.291	0.367	0.350	0.337	0.431	0.444	0.330	0.449	0.490	0.438	0.566	0.521	0.454	**0.813**	0.598	0.601	USEF1
USEF2	0.520	0.412	0.470	0.285	0.499	0.502	0.387	0.484	0.632	0.591	0.635	0.653	0.728	0.614	**0.862**	0.709	0.681	USEF2
USEF3	0.548	0.450	0.476	0.484	0.509	0.524	0.482	0.513	0.601	0.637	0.607	0.706	0.642	0.575	**0.898**	0.651	0.774	USEF3
SYSS1	0.641	0.388	0.585	0.359	0.559	0.568	0.494	0.547	0.672	0.640	0.711	0.652	0.806	0.765	0.722	**0.955**	0.752	SYSS1
SYSS2	0.600	0.374	0.574	0.334	0.551	0.552	0.432	0.548	0.690	0.609	0.694	0.629	0.823	0.780	0.726	**0.961**	0.749	SYSS2
INFS1	0.628	0.503	0.534	0.463	0.559	0.576	0.480	0.517	0.605	0.729	0.688	0.621	0.674	0.575	0.780	0.738	**0.965**	INFS1
INFS2	0.645	0.492	0.547	0.489	0.588	0.556	0.520	0.533	0.604	0.732	0.695	0.631	0.701	0.605	0.753	0.767	**0.965**	INFS2

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