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Website Intelligence: Conceptual Development and Empirical Assessment

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ABSTRACT

As web sites proliferate, offering more of the same, why does a customer choose one web site over the others? Among other factors, website intelligence offers a viable answer to this question. However, past studies fall short of providing a comprehensive conceptualization or effective metric of website intelligence, limiting our ability to enhance the intelligent aspects of web sites. Integrating prior research findings, we propose website intelligence as a second order construct consisting of three sub-dimensions of content, presentation, and interaction, and develop new measures for these dimensions. Further, we theorize the website intelligence construct as a mediator of the system quality and information quality effects on user perceptions of usefulness and ease of use, and test the proposed model using PLS on data collected from an experiment. The newly developed measure exhibits strong psychometric properties. The results largely support the proposed mediating role of website intelligence.

Keywords

Website intelligence, electronic commerce, perceived usefulness, perceived ease of use, system quality, information quality, PLS

INTRODUCTION

A challenge facing firms operating through the Web is how to differentiate themselves in the eyes of the customers. As web sites proliferate, offering more of the same, why does a customer choose one web site over the others? Among other options available, developing an intelligent web site can enable firms to differentiate their offerings and enhance the value that they deliver to their customers. Past research in the electronic commerce area has focused on investigating the factors that impact a customer's behavior on the Web. The key focus has been on examining the dimensions based on which users form their usability assessments of a web site. However, past usability studies have yet to provide a comprehensive conceptualization and effective metric of website intelligence, hindering our efforts to enhance the intelligent aspects of web sites. In this study, we integrate prior research findings to develop a conceptual definition and propose a new metric for website intelligence. Furthermore, we theorize its role as a mediator between system characteristics and user perceptions and empirically validate the theoretical model.

CONCEPTUAL BACKGROUND

Research on web site design and usability argues that intelligent web sites that provide a personalized interaction experience to the users can play a significant role in driving use intentions, purchase intentions, and usability perceptions (Te'eni & Feldman, 2001). Palmer (2002) found interactivity to be an important determinant of web site success. In the context of Internet banking, personalization was found to positively impact user perceptions regarding usefulness (Chau & Lai, 2003). Agarwal and Venkatesh (2002) found personalization to be critical for repeated purchase. These studies focus on the concept of personalization, which is a function of the extent to which a web site depicts intelligence by configuring its interaction around a user's preferences. Researchers further point out that personalization can be done at varying levels. Perkowitz and Etzioni (2000a) distinguish between customization and transformation. They propose that customization takes adaptation of the web site to the individual level. However, transformation is the global adaptation of the web site to fit the preferences and task requirements of the core audience. Although, some previous studies have examined the role of customization in shaping

web site use and web revisitation, the role of transformation approach has not been explicitly examined. Transformation entails creating intelligent web sites that can provide an interaction experience, which fits with the preferences and expectations of the core audience of the web site, rather than curtailing the interface layouts and navigation patterns for each individual user.

One plausible approach in capturing the notion of website intelligence is to explore what aspects of the web site can depict intelligent behavior (Minsky, 2000). The field of artificial intelligence provides interesting insights into the notion of system intelligence. Smith and Blandford (2002) define artificial intelligence systems as systems that can learn, and based on the learning, adapt to changing circumstances. Intelligent web sites fit this profile. Artificial intelligence techniques such as rule based, content based, and collaborative filtering can be used to create intelligent web sites. Such web sites can cater to the needs of the users by providing intelligent content, intelligent presentation, and intelligent interaction. Perkowitz and Etzioni (1997) argue that transformation of a web site not only helps existing users but also new users about whom nothing is known. New web pages can be dynamically created to improve the content. Links can be added, removed, or rearranged to facilitate effective navigation, while the organization of the interface can be reconfigured to fit the preference of the core audience of the web site. Transformation of the web site, even though different from individual level personalization, is based on active analysis of user interaction histories through artificial intelligence techniques. Such analysis is then used to reconfigure the various aspects of the web site to enhance experience of the core audience (Perkowitz & Etzioni, 2000b).

Research on examining various dimensions of website quality and usability corresponds to the conceptual structure of website intelligence suggested by the work in system intelligence. Studies identify a number of factors related to website success. Among them are download speed, organization, interactivity, responsiveness, and content. Although content delivered through the web site has been presented as a consistent factor, system quality aspects show more diversity both in terms of factors used and conceptualization. Some conceptualizations propose it as ease of use, while others argue for a more disintegrative approach using navigation, responsiveness, and technical adequacy as separate variables. An in-depth review of extant literature on e-commerce and website usability has led us to conclude that a three dimensional structure constituting *content intelligence*, *presentation intelligence*, and *interaction intelligence* provides a parsimonious representation of various dimensions of the web site that are amenable to adaptation. Table 1 shows how some representative prior studies can map into the three dimensions. The conceptualization shows that website intelligence is a much broader concept than adaptive content or appearance. Building on this work, *website intelligence* is defined as "the extent to which a web site is able to provide content, presentation, and interaction that is tailored to the needs and preferences of its core audience."

Citation	Content Intelligence	Interaction Intelligence	Presentation Intelligence
McKinney et al., 2002	Information Quality (Understandability, reliability, and usefulness)	Access and Navigation	Usability
Palmer, 2002	Content	Download delay, Navigation, Interactivity, Responsiveness	Organization
Aladwani and Palvia, 2002	Content	Technical Adequacy	Appearance
Agarwal and Venkatesh, 2002	Content	Ease of Use and Feedback	
Ranganathan and Ganapathy, 2002	Content	Design	Design
Zhang and von Dran, 2002	Content	Technical support and Navigation	Visual Appearance and Organization of content
Koufaris, et al. 2002		Value Added Search Functions	
Brusilovsky and Pesin, 1998	Adaptive Content	Adaptive Navigation	Adaptive Navigation (presentation of links)

Table 1. Dimensions of Website Intelligence

Content Intelligence

Content relates to the information provided by the web site. Previous studies have examined the notion of content quality by soliciting the user's perceptions regarding the level of detail, relevance, comprehensiveness, currency, accuracy, and reliability of the content provided by the web site (Agarwal & Venkatesh, 2002; McKinney et al. 2002). Although, these are desirable properties of the content, they do not indicate whether the content meets the specific needs of the users. User needs are driven by goals and tasks. Website usage is driven by user's belief that it will assist in goal attainment or task completion. However, the diversity in the underlying goals of the users raises the challenge of intelligently presenting content to meet the expectations of the user base (Spiliopoulou, 2000). How content in the form of product lists, product descriptions, reviews, suggestions, ratings, and more should be configured is pivotal in this process. Thus, we define content intelligence as the extent to which the user perceives that the web site intelligently configures its content to meet the expectations of the user.

Interaction Intelligence

Interaction relates to structure and navigability of the web site. Although users may interact with the web site in multiple ways, browsing constitutes one of the most common approaches. Users have to navigate the web site to get what they are looking for albeit with divergent goals. The multiplicity of patterns in accessing the same web page thus increases the challenge of structuring the web site to the preferences of the user base. For example, a subject area, a particular author, or a specific ISBN number may drive a person's interaction with a web site selling books. Such divergent approaches require intelligence on the part of the web site to configure the interaction patterns to support the idiosyncratic goals and preferences of the user. Thus, we define interaction intelligence as the extent to which the user perceives that the website intelligently configures its interaction experience to meet the expectations of the user.

Presentation Intelligence

Presentation captures how content is organized in a single web page or across multiple web pages. Screen layouts involving where text and graphics are placed and how they are organized is an important element in the overall usability of the web site. Computer monitor only has so much space available. Thus, presentation of information is suggested as an important element in the overall usability of the web site (Neilson, 2000; Shneiderman, 1998). It has been found that reading information on the monitor is more difficult as compared to reading paper-based information (Neilson, 2000). Cluttering website pages with a lot of information increases the cognitive effort a user has to exert in locating and comprehending information. Effective screen layout requires that content and hyperlinks are presented in a fashion that supports the expectations of the users (Brusilovsky & Maybury, 2002). Thus, we define presentation intelligence as the extent to which the user perceives that the web site intelligently configures its presentation to meet the expectations and preferences of the user.

RESEARCH HYPOTHESES

Base Model

In addition to understanding the conceptual structure of intelligent web sites, it is also important to examine how website intelligence relates to other variables. Past studies on web usage approach the question through various theoretic perspectives. These include TAM (Davis, 1989) and information systems (IS) success model (Delone & Mclean, 1992). TAM (Technology Acceptance Model) argues that user perceptions regarding usefulness and ease of use are central variables in determining usage outcomes. DeLone and McLean's IS success model argues for system quality and information quality as antecedents to usefulness and user satisfaction.

Our approach starts with a base model, which posits that the information and system quality attributes of a web site, consistent with the IS success model, will have significant effects on user perceptions of usefulness and ease of use. This linkage is based on the logic that website quality aspects are likely to enhance individual usage outcomes by influencing user beliefs regarding the web site's usefulness and ease of use. This view is also consistent with the TAM's argument that exogenous variables such as system characteristics impact usage behavior by altering the perceptions of usefulness and ease of use (Davis, 1989). Thus, by integrating TAM and the IS success model, the base model argues for a direct linkage between each of the exogenous system variables (information quality, system quality) and each of the user belief variables (perceived usefulness, perceived easy of use). In addition, TAM theorizes perceived ease of use as an antecedent of perceived usefulness. Therefore, we hypothesize:

H1a: Information quality will have a positive effect on perceived usefulness.

H1b: Information quality will have a positive effect on perceived ease of use.

H2a: System quality will have a positive effect on perceived usefulness.

H2b: System quality will have a positive effect on perceived ease of use.

H3: Perceived ease of use will have a positive effect on perceived usefulness.

Mediating Role of Website Intelligence

Venkatesh and Davis (2000), building on work motivation theory, propose job relevance as an antecedent to usefulness. They define it as an individual's perception regarding how well the underlying system supports the various tasks he or she intends to perform as part of their job. They further elaborate on the similarities between this construct and task technology fit (Goodhue, 1995) and cognitive fit (Vessey, 1991). Website intelligence constitutes a user's perception regarding how well a web site meets their goals and preferences given a specific task they intend to perform. Usefulness constitutes the perceptions regarding use-performance contingencies. Interaction with intelligent web sites is likely to strengthen these perceptions. Research on action theory and cost benefit framework argues that users are rational decision makers in the sense that they will relate their actions or behavior to attainment of higher-level goals and benefits. To the extent that the information system is perceived to fit the expectations and preferences of the user, it will alter their belief about the effectiveness of the system.

Websites that are configured to fit with the preferences of the users are also likely to be perceived as easy to use. Dishaw and Strong (1999) found that fit between task and technology was a significant predictor of ease of use. Cognitive effort perspective argues that users have a mental representation of how a task needs to be performed. The mental representations are formed based on experience with the same task in a different environment or tasks that are similar to the one that the user intends to perform. If the task completion approach is presented in a fashion that fits with the user's mental representation, it is likely to reduce the cognitive effort in task completion. Thus, if the web site is configured to meet the preferences of the user, its use will be perceived as effort free.

Website quality that captures concepts such as relevance and accuracy of the content and ease of navigation are desirable attributes of a web site from a user's standpoint. The quality of information and interaction experience provided to support the shopping task is likely to reinforce the user's perception regarding how well the web site has been configured to meet their expectations and preferences. On the contrary, a web site that is perceived to be low quality will frustrate the users as they will struggle to accomplish their tasks. If the user perceives that the web site does not rise to the level of quality that can provide an effective usage experience, it will negatively impact their perceptions regarding how well the web site supports their expectations and task requirements. Therefore, we hypothesize that the effects of information quality and system quality on the user perceptions of usefulness and ease of use will be mediated by website intelligence as shown in Figure 1:

H4a: Website intelligence will mediate the relationship between information quality and perceived usefulness

H4b: Website intelligence will mediate the relationship between information quality and perceived ease of use

H5a: Website intelligence will mediate the relationship between system quality and perceived usefulness

H5b: Website intelligence will mediate the relationship between system quality and perceived ease of use

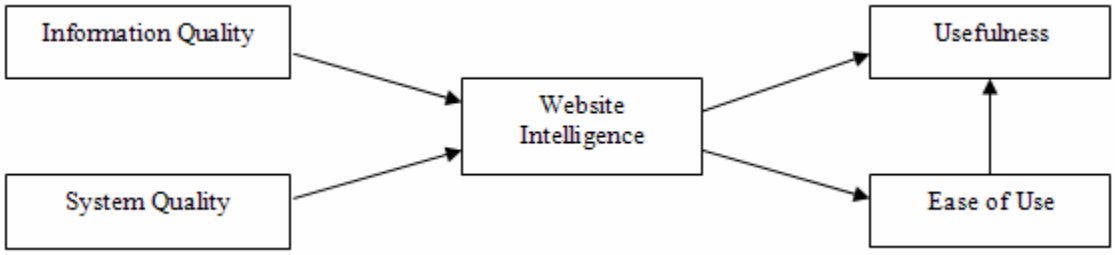

Figure 1. Mediating Role of Website Intelligence

RESEARCH METHOD

The items for system quality, information quality, usefulness, and ease of use were adapted from prior studies (Agarwal & Venkatesh, 2002; Davis et al., 1989; Han & Noh, 2000; McKinney et al. 2002; Otto et al., 2000). A new instrument was developed and validated for measuring website intelligence. Table 2 provides the list of items for the constructs. The development of the instrument for perceived website intelligence involved four stages. At the first stage, a thorough review of

literature was undertaken for comprehending the conceptual structure of the construct and subsequent item creation (Saeed et al., 2003).

Content Intelligence (CONT)

1. I find the information in this Web site highly relevant to my specific needs.*
2. The content of the Web site well supports the intended purpose of my visit.
3. The content of the Web site is well tailored to my specific needs.*
4. The Web site provides content that is useful for my intended purpose.
5. The information in this Web site is complete for my intended purpose.
6. The Web site provides highly intelligent content, which well fits my needs.

Presentation Intelligence (PRES)

1. The presentation of information in the Web site is organized and structured to fit my preferences.*
2. I find the presentation style of the Web site consistent with my preferences.
3. The screen layout of the Web site is consistent with my preferences.
4. The visual appearance of the Web site fits my style preferences.
5. The links and graphic elements are properly placed where I expect them to be found.*
6. The Web site presents its content in a highly intelligent way, consistent with my style preferences.

Interaction Intelligence (INTER)

1. When I interact with the Web site, it is clear where I am and where I can go.*
2. The website provides a navigation structure that fits my expectations.
3. The website provides access patterns that well support my spontaneous moves.
4. The website provides a secure and safe interaction experience that meets my expectations.
5. I don't feel challenged when I interact with the website.*
6. The Web site provides an intelligent interaction experience, consistent with my expectations.

Information Quality (IQ)

1. The information in this Web site is accurate
2. The information in this Web site is reliable
3. The information in this Web site is easy to comprehend*
4. The information in this Web site is comprehensive*
5. The information in this Web site is timely*
6. Overall, the quality of information in this Web site is high

System Quality (SQ)

1. This Web site has the latest security features*
2. This Web site has no dead links*
3. The Web site quickly loads all the text and graphics
4. The Web site allows a few clicks to locate information
5. The Web site provides adequate feedback*
6. Overall, the system quality of this Web site is high

Usefulness (USEFUL)

1. Using this Web site can improve my performance in searching and buying books
2. Using this Web site can improve my productivity in searching and buying books
3. Using this Web site can increase my effectiveness in searching and buying books
4. Overall, I find using the Web site useful in searching and buying books

Ease of Use (EOU)

1. Learning to use this Web site would be easy for me
2. My interaction with the Web site is clear and understandable
3. It would be easy for me to become skillful at using this Web site
4. Overall, I find this Web site easy to use

* Items dropped from the scale

Table 2. Measurement Items

In the second stage, three judges were provided with randomly ordered items and asked to sort them into separate categorizes and label them. Subsequently, the judges were provided information about the number of categories and asked to resort the items. Modifications were made to the items based on the results of the sorting exercise and the suggestions provided by the judges. After initial refinement, another sorting exercise was conducting with six IS Ph.D. students. They were provided with the definition of the constructs and a random list of items and asked to assign each item to a construct. Although, the inter-rater reliability was perfect, modification to improve the clarity of items were made based on the suggestions provide by the raters. In the third stage, a pilot test was conducted with a small sample (n=23). The subjects were presented with a shopping task. After the subjects had completed the task, they were asked to fill out the instrument. The data was analyzed to assess the initial validity and reliability of the constructs.

Finally, data was collected at a larger scale to validate the constructs and examine their nomological validity. Subjects were college students enrolled in an introductory IS class in a major university (n=114), and were presented with the same task used in the pilot test (the two samples were combined as the same items and task were used in both experiments giving the overall sample of 137). Table 3 provides the profile of the subjects. The subjects had extensive experience in using computers and the Internet, spending on average 15 hours a week on the Web (Table 3). The gender distribution was fairly equal with 52% females and 48% males.

Average Age	20 Years
Average Year of Computer Use	9.9 Years
Average Year of Internet Use	7.4 Years
Average Number Hours of Computer Use in a week	20 Hours
Average Number Hours of Web in a week	15 Hours
Gender (n=114) Male Female	 65 (48%) 71 (52%)

Table 3. Sample Profile

RESULTS

Psychometric Properties of Website Intelligence

Agarwal and Prasad (1999) suggest using both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) for assessing construct validity. They argue that EFA falls within the classical approaches for examining construct validity, while CFA is part of the contemporary approaches. Exploratory factor analysis was done by employing principal components extraction with varimax rotation on items consisting of content intelligence, presentation intelligence, interaction intelligence, system quality, information quality, ease of use, and usefulness. The analysis revealed the existence of 7 factors as predicted and explained 82% of the variance (see Table 4). The loadings ranged from 0.63 to 0.94. High loadings of the items on the latent construct provides evidence of convergent validity, while minimal evidence of cross loading supports that the latent factors are indeed distinct from each other establishing discrimnant validity. Cronbach's alpha was used to assess the reliability of the scale. The reliability for content, presentation, and interaction intelligence were 0.89, 0.94, and 0.88 respectively. These values are above the generally acceptable guideline of 0.70 for multi-item scales (Nunnally, 1978).

CALIS procedure in SAS was used for CFA. This procedure was only used to assess the measurement properties of website intelligence. Further the results of the outer model (in Partial Least Square (PLS)) were used to assess the measurement properties of constructs in the model. The indices for overall model fit from the CALIS procedure provide evidence that the data fits the model. The ratio of Chi sq. over degrees of freedom is 1.55, which is within the recommended range (Sharma, 1996). Other fit indices shown in Figure 2 also meet the recommended guidelines, providing support for the hypothesized structure of the latent constructs. Convergent validity was examined through composite reliability. Composite reliability of

0.83, 0.85, and 0.82 for content, presentation, and interaction intelligence respectively is well above the recommended guideline of 0.70 (Sharma, 1996).

	1	2	3	4	5	6	7
CONT2	0.155	0.329	0.068	**0.792**	0.092	0.062	0.131
CONT4	0.114	0.268	0.115	**0.852**	0.110	0.121	0.159
CONT5	0.189	0.229	0.170	**0.819**	0.183	0.074	0.047
CONT6	0.298	0.069	0.186	**0.644**	0.255	0.156	0.098
PRES2	**0.875**	0.142	0.168	0.179	0.149	0.028	0.124
PRES3	**0.850**	0.201	0.076	0.136	0.259	0.071	0.093
PRES4	**0.857**	0.116	0.184	0.135	0.148	0.124	0.068
PRES6	**0.838**	0.019	0.154	0.178	0.220	0.055	0.053
INTER2	0.366	0.203	0.146	0.263	**0.631**	0.123	0.172
INTER3	0.269	0.040	0.202	0.081	**0.832**	0.175	0.044
INTER4	0.157	0.263	0.170	0.162	**0.711**	0.163	0.129
INTER6	0.306	0.173	0.222	0.261	**0.694**	0.218	0.140
IQ1	0.113	0.155	0.066	0.046	0.140	**0.895**	0.091
IQ2	0.064	0.089	0.152	0.096	0.159	**0.900**	0.154
IQ6	0.068	0.338	0.096	0.264	0.237	**0.680**	0.237
SQ3	0.227	0.096	0.063	0.058	-0.045	0.139	**0.839**
SQ4	-0.032	0.259	0.109	0.166	0.285	0.080	**0.741**
SQ6	0.131	0.148	0.170	0.231	0.238	0.382	**0.653**
EOU1	0.198	**0.846**	0.066	0.193	0.043	0.104	0.123
EOU2	0.034	**0.833**	0.131	0.176	0.199	0.156	0.155
EOU3	0.162	**0.865**	0.068	0.198	0.098	0.096	0.039
EOU4	0.075	**0.812**	0.076	0.253	0.189	0.175	0.177
USEFUL1	0.200	0.037	**0.907**	0.137	0.099	0.054	0.076
USEFUL2	0.134	0.057	**0.940**	0.089	0.155	0.037	0.042
USEFUL3	0.145	0.067	**0.906**	0.059	0.204	0.067	0.061
USEFUL4	0.093	0.227	**0.690**	0.230	0.122	0.253	0.158
Variance Explained	14%	14%	13%	12%	11%	10%	8%
Total Variance Explained = 82%							

Table 4. Results of Factor Analysis

Results from the CALIS procedure along with the results of the outer model from PLS analysis were used to assess discriminant validity. Discriminant validity was assessed at two levels. First, we undertook the analysis to examine whether each first order constructs are distinct. Fornell and Lacker (1981) suggest that discriminant validity is established when average variance extracted for individual construct is greater than the squared multiple correlation of that construct with other constructs. Table 5 (diagonal elements show AVE computed based on the PLS analysis) shows that this condition is met in all cases. Second, assessment needs to be made to check whether each first order construct (i.e. content intelligence) distinctly contributes to the second order construct (i.e. website intelligence). Comparison between the average extracted

variance (AVE) for each first order construct with the shared variance between the first order constructs provides an assessment for discriminant validity. If the AVE of the first order constructs is greater than the shared variance between the first order constructs, it establishes that each first order construct provides some distinct contribution to the second order construct. Table 6 shows that this condition is met in all cases. The loadings, composite reliability, and average variance extract based on PLS analysis is shown in Table 7. Overall, the newly developed measure shows excellent psychometric properties.

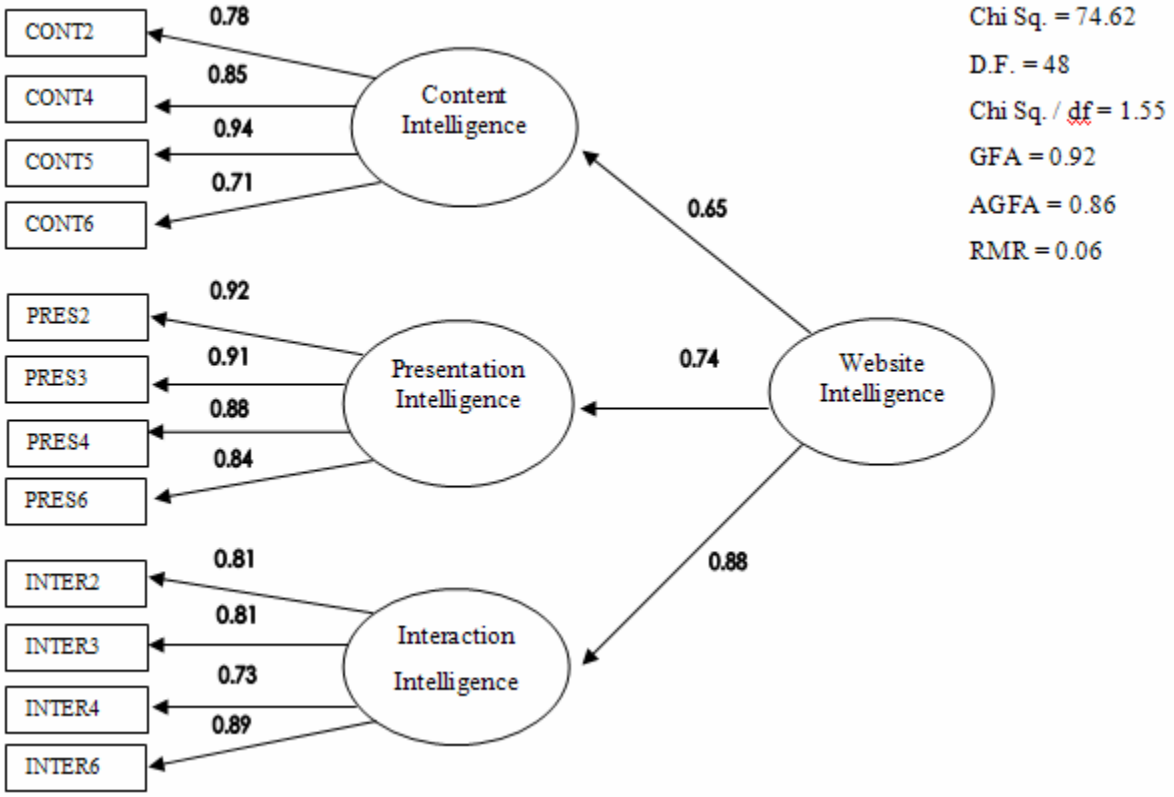

Figure 2. SAS Measurement Model

	CONT	PRES	INTER	IQ	SQ	USEFUL	EOU
CONT	{0.89} [0.75]						
PRES	0.493 (0.000)	{0.94} [0.85]					
INTER	0.551 (0.000)	0.610 (0.000)	{0.88} [0.75]				
IQ	0.376 (0.000)	0.288 (0.001)	0.477 (0.000)	{0.88} [0.82]			
SQ	0.424 (0.000)	0.346 (0.000)	0.454 (0.000)	0.485 (0.000)	{0.77} [0.69]		
USEFUL	0.405 (0.000)	.418 (0.000)	0.497 (0.000)	0.292 (0.001)	0.301 (0.001)	{0.93} [0.82]	
EOU	0.544 (0.000)	0.365 (0.000)	0.470 (0.000)	0.413 (0.000)	0.429 (0.000)	0.296 (0.001)	{0.94} [0.84]
{} Cronbach's Alpha [ ] Average variance extracted (AVE)							

Table 5. Internal Consistencies and Correlations of Constructs

Contrast Between Constructs	Loading of Construct 1 on Second Order Construct	Loading of Construct 2 on Second Order Construct	Shared Variance Between Construct 1 and Construct 2	Average Variance Extracted (AVE)	AVE for Construct 1 > Shared Variance	AVE for Construct 2 > Shared Variance
Content Intelligence Vs. Presentation Intelligence	0.65	0.74	0.23	0.55 and 0.63	YES	YES
Content Intelligence Vs. Interaction Intelligence	0.65	0.88	0.33	0.55 and 0.53	YES	YES
Presentation Intelligence Vs. Interaction Intelligence	0.74	0.88	0.42	0.63 and 0.53	YES	YES

Table 6. Discriminant Analysis

Items	**Loading**	**Composite Reliability**	**AVE**
CONT2	0.87	0.92	0.75
CONT4	0.91		
CONT5	0.80		
CONT6	0.91		
PRES2	0.94	0.96	0.85
PRES3	0.93		
PRES4	0.90		
PRES6	0.92		
INTER2	0.84	0.92	0.75
INTER3	0.88		
INTER4	0.91		
INTER6	0.83		
IQ1	0.89	0.93	0.82
IQ2	0.91		
IQ6	0.90		
SQ3	0.75	0.87	0.69
SQ4	0.88		
SQ6	0.85		
EOU1	0.89	0.95	0.82
EOU2	0.92		
EOU3	0.93		
EOU4	0.87		
USEFUL1	0.91	0.95	0.84
USEFUL2	0.94		
USEFUL3	0.93		
USEFUL4	0.87		

Table 7. PLS Measurement Analysis

Test of Models and Hypotheses

Figures 3 and 4 show the results of hypothesis testing. The approach that we used was to first run a base model (Figure 3) to test H1a, H1b, H2a, H2b, and H3. Then, the mediation model (Figure 4) was run to test hypotheses H4a, H4b, H5a, and H5b. Running these two models enabled us to examine the appropriateness of the mediating role of perceived website intelligence. Baron and Kenny (1995) propose that establishing a mediating relationship requires that: (1) a significant relationship exists

between the independent variable and the dependent variable, (2) a significant relationship exists between the presumed mediating variable and the dependent variable, and (3) in the presence of a significant relationship between the mediator and the dependent variable, the previously significant relationship between the independent variable and the dependent variable is no longer significant or the strength of the relationship is significantly decreased.

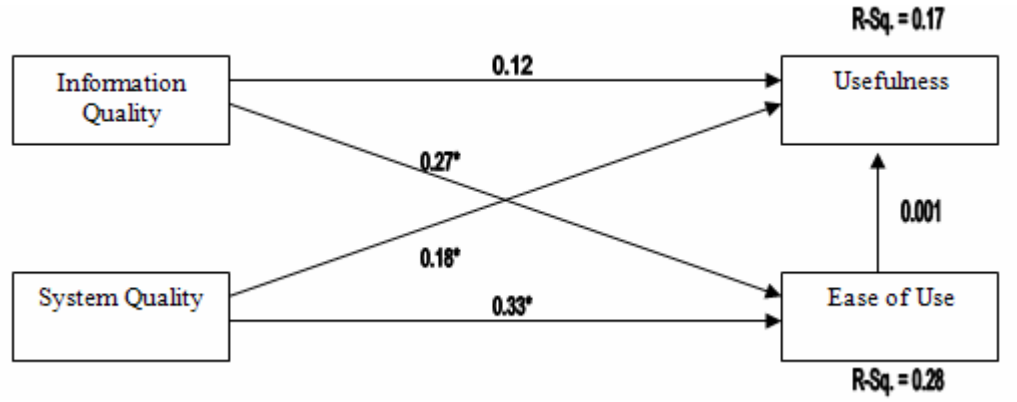

Figure 3. PLS Test of Base Model

The base model testing results provide support for H1b, H2a, and H2b (see Figure 3). Information quality had a significant effect on ease of use and system quality had a significant effect on both usefulness and ease of use. Contrary to the hypothesis, information quality did not have a significant effect on usefulness (H1a), but the effect was close to the significance level and was in the expected direction. Contrary to the hypothesis, ease of use did not have a significant effect on usefulness (H3), suggesting that, in the presence of information quality and system quality, ease of use is not a significant determinant of usefulness. Some prior studies on TAM also found that the link was not significant in some cases (Legris et al., 2003).

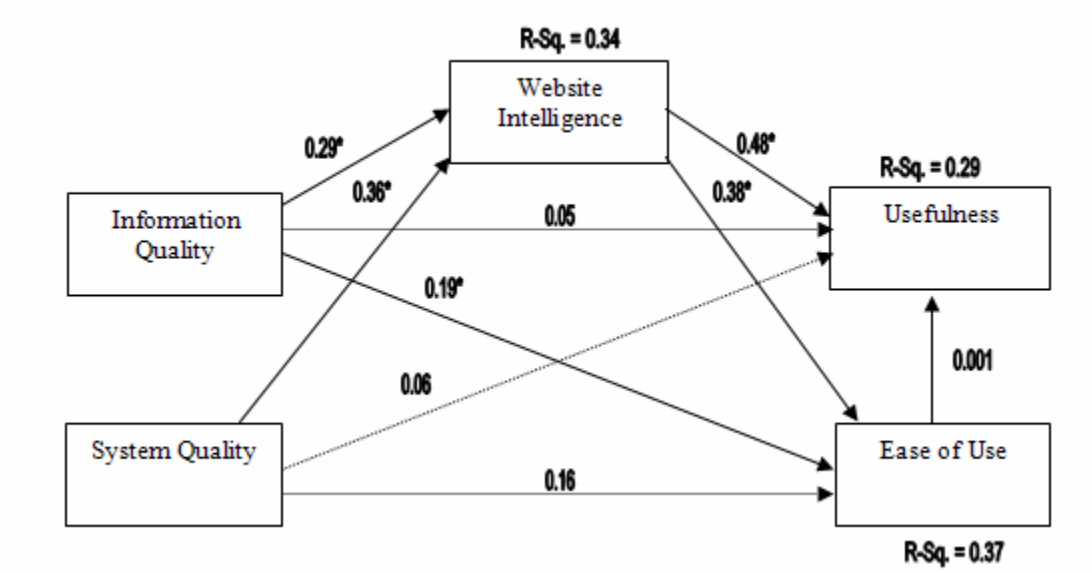

Figure 4. PLS Test of Mediation Model

The results for the mediation model provide partial support for H4 and H5. The results show that Baron and Kenny's first condition is met for all the hypothesized links except for the link between information quality and usefulness, which was found to be non-significant. The results provide support for the second condition. The path between the mediating variable (website intelligence) and the dependent variable is significant for both usefulness and ease of use. The final condition is also met. In the presence of website intelligence, the significant relationships between system quality and each of the user beliefs

becomes non-significant, indicating full mediation. In the presence of website intelligence, the relationship between information quality and ease of use is still significant, but the magnitude of relationship drops noticeably (β=.27 to β=.19), indicating partial mediation. The results show that information quality impacts ease of use both directly and indirectly via website intelligence.

An additional test proposed by Baron and Kenny (1995) is to assess the significance of the beta for the mediating path. The beta for information quality to website intelligence to usefulness is 0.14 (0.29 * 0.48) and to ease of use is 0.11 (0.29 * 0.38). System quality to website intelligence to usefulness has a beta of 0.17 (0.36 * .48), while to ease of use has a beta of 0.14 (0.36 * 0.38). Analysis conducted to assess the significance of the mediating paths shows that all four paths are statistically significant. T-values compute to 3.60, 2.97, 3.33, and 2.72 with 134 d.f. for the above stated links respectively, further strengthening support for the mediating role of website intelligence.

DISCUSSION

The objective of the present research was to advance our understanding of the concept of website intelligence and examine its importance in mediating the effects of system variables on key user beliefs. Synthesizing prior literature on electronic commerce and website usability, the current study theorizes website intelligence as a multi-dimensional second-order construct, consisting of the three sub-dimensions of content intelligence, interaction intelligence, and presentation intelligence. Consistent with our theorization, the empirical results clearly show that website intelligence is a multi-dimensional construct. The newly developed measure exhibits strong convergent and discriminant validities with high reliability scores. Hypothesis testing results support the significant mediating role of website intelligence between the exogenous system variables (information quality and system quality) and the user belief variables (usefulness and ease of use). All the direct links between system quality and usefulness, between system quality and ease of use, and between information quality and ease of use were significant. All these effects were fully mediated except for the effect of information quality on ease of use, which was partially mediated. Overall, the study findings are consistent with the proposed conceptualization of the website intelligence construct and are largely supportive of the proposed nomological network in which website intelligence is theorized as a mediator of the system effects on user beliefs.

The web has evolved as a channel that caters to various needs of users. The exponential growth in web usage continually raises the importance of investigating factors that drive website usage behavior. Given the sheer number of web sites competing for users' limited attention and time, developing intelligent web sites can be a very effective approach enabling a firm to attract and retain its customers. Our ability to design and maintain an intelligent web site has been severely hindered by our limited understanding of the website intelligence concept and lack of an effective metric. The current study makes a step toward overcoming these limitations. The proposed conceptual structure of the website intelligence construct improves our understanding of the underlying nature of the website intelligence construct. Moreover, the newly developed measure can be utilized as a useful diagnostic and guidance tool for enhancing the intelligence aspects of the existing web sites. The measure may be used in comparing alternative designs of websites at the development stage or understanding the strengths and weaknesses of the existing websites at the maintenance stage.

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