# AN INSTRUMENT FOR MEASURING CUSTOMER SATISFACTION TOWARD WEB SITES THAT MARKET DIGITAL PRODUCTS AND SERVICES

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## ABSTRACT

MIS literature has not addressed the measurement of customer information satisfaction in electronic commerce. Current models for measuring user information satisfaction (UIS) and end-user computing satisfaction (EUCS) are perceived as inapplicable as they are targeted primarily towards either conventional data processing or the end-user computing environment. This study develops a comprehensive model and instrument for measuring customer information satisfaction (CIS) for web sites that market digital products and services. This paper first discusses the concepts and definitions of customer information satisfaction from the literature. We summarize our findings in a theoretical framework. Based on this framework, we develop a measurement instrument to measure customer information satisfaction. The procedures used in generating items, collecting data, and purifying a multiple-item scale are described. We have carefully examined evidences of reliability, content validity, criterion-related validity, convergent validity, discriminant validity, and nomological validity by analyzing data from a quota sample of 520 adult respondents. The norms of the instrument are then developed, and the potential applications for practitioners and researchers are explored. Finally, we conclude this study by discussing limitations and potential future research. We hope that our CIS instrument can be used by other researchers to develop and test Internet marketing and EC theories in the future.

**Keywords：** Internet marketing, Digital products and services, Customer information satisfaction, User information satisfaction, End-user computing satisfaction.

## 1. Introduction

Internet marketing for digital products and services is one of the most significant developments in the information systems industry in the last five years. The growth of digital marketing[1] has presented a unique challenge for both marketing and information system managers. Since digital products and services, such as graphics and on-line banking, can be delivered via the Internet, they are naturally considered information-oriented products or services. Individual customers that purchase and receive digital products[2] thoroughly via the Internet emphasize numerous aspects of information satisfaction. Therefore, understanding customer information satisfaction (CIS) is a critical factor in digital marketing.

The effectiveness of digital marketing cannot be evaluated using simple financial measures such as return on investment. The effectiveness measure of digital marketing must incorporate different aspects of customer satisfaction to become a diagnostic instrument for practical and theoretical use. Such purposes cannot be achieved when effectiveness is captured using only a single aggregated scale. Traditionally, both UIS and EUCS scale have been used as a surrogate measure of system effectiveness to evaluate user satisfaction toward information systems (e.g., Bailey and Pearson 1983; Ives, et al. 1983; Doll and Torkzadeh 1988). However, measures of user information satisfaction developed for the conventional data processing environment or end-user computing environment may no longer be appropriate for the digital marketing context, where the role

[1] Digital marketing refers herein to Internet marketing for digital products and services.
[2] Since there seems to be some overlap between digital products and services, the researchers use digital products to represent both in the later sections.

of an individual customer is in some ways different to that of an organizational end user. UIS and EUCS instruments focus primarily on general or specific user information satisfaction within an organization rather than on customer satisfaction with regard to web site. Neither instrument has been developed or validated for measuring web customer information satisfaction, and both omit facets important to CIS and include aspects inappropriate to CIS.

To assess the extent and specific nature of web customer satisfaction rendered by digital marketing activities, different dimensions of CIS must be theoretically and operationally defined. The development of such multidimensional instrument can (1) capture multiple aspects of customer information satisfaction that may be subsumed within general (single scale) measures, (2) provide insight into the nature of interrelationships among CIS dimensions, and (3) provide a more accurate diagnostic tool to assess digital marketing activities within organizations. Until such instrument is developed, the varying criteria of digital marketing effectiveness among studies will inhibit the generalizability and accumulation of research findings. In addition, using a well-validated instrument, EC managers can better justify their Internet marketing activities when they devote significant portion of their organizational resources to such activities.

The purpose of this research is to develop a theoretical and operational construct space for latent factors that may be indicative of CIS. We incorporate both classical frameworks for developing measures (e.g., Churchill 1979) and contemporary statistical technique (e.g., EFA) for assessing dimensionality. This paper is divided into seven sections, which provide an overview of the steps followed herein. The first section defines the concept of customer information satisfaction. The second section then explains the process of item generation. The third section describes the exploratory factor analysis and scale-purification procedures used to identify the factor structure of the scale. Next, the fourth section validates the proposed instrument's reliability and validity using adequate statistic techniques. The fifth section compares the underlying dimensions between UIS, EUCS, and CIS constructs. The sixth section discusses the development of norms for the instrument and explores its potential applications for practitioners and researchers. Finally, the seventh section discusses some limitations of the present work and some possible directions for future investigation.

## 2. Domain of Customer Information Satisfaction

### 2.1 The Conceptual Definition of Customer Information Satisfaction (CIS)

Digital products, which can be transmitted via the Internet, are essentially "information product." Digitized books, pictures and online newspaper are good examples in this category. Meanwhile, digital services, which can be processed over the Internet, are generally "information processing service." Online banking and security transactions are example of such service. During the process of delivering digital product and service, digital marketing using web-based information systems[3] makes customers system end users. Consequently, the content and user interface of information systems (websites) are important for measuring customer satisfaction in the context of digital marketing. Traditional methods of measuring customer satisfaction seem conceptually and operationally inappropriate for researches involved in digital marketing. To emphasize the nature of "information" and "information processing" for digital products and services, and the nature of "information systems" for digital marketing, this study proposes the construct of customer information satisfaction (CIS) for digital marketing, to distinguish from the construct of customer satisfaction for traditional marketing.

Defining a construct's theoretical meaning and conceptual domain are necessary steps in developing appropriate measures and obtaining valid results (Churchill 1979; Gerbing and Anderson 1988). Unfortunately, other than the extensive research efforts by Cardozo's (1965), researchers have yet developed a standard definition of consumer satisfaction. Most studies focus on testing models or psychological determinants of consumer satisfaction that explore the relationships among expectation, perceived performance, disconfirmation, satisfaction, and post-purchase behavior (e.g., Oliver 1980; Churchill and Surprenant 1982; Oliver and DeSarbo 1988; Oliver 1993; Spreng et al. 1996), while definitional considerations have received little attention (Giese and Cote 2000). As noted by Peterson and Wilson (1992), "Studies of customer satisfaction are perhaps best characterized by their lack of definitional and methodological standardization" (p.62).

The lack of consensus on a definition of satisfaction has created serious problems for customer satisfaction research. First, developing context-specific items becomes difficult given the fact that the conceptual definition of customer satisfaction is not clear. Therefore, most researches use a single-item rating scale to measure customer satisfaction. Single-item scales do not provide sufficient content domain sampling of complex constructs and are generally believed to be unreliable, since they do not allow internal consistency to be calculated (Nunnally 1978). Furthermore, Single-item measures provide no guidance to respondents or researchers in interpreting the exact meaning of satisfaction. Consequently, developing multiple-item measures to resolve the measurement difficulties caused by single-item measures is highly recommended (Churchill 1979). Second, the lack of definitional and measurement standards of customer satisfaction limits theory development in this field, weakens the explanation power of any new theories, and confines the generalization of any

[3] The end users of information systems in traditional marketing are intraorganizational personnel.

empirical findings. As Yi (1990) suggests, "for the field of consumer satisfaction to develop further, a clear definition of consumer satisfaction is needed" (p.74).

Recently, Giese and Cote (2000) proposed a definitional framework for consumer satisfaction to resolve inconsistencies in the literature. They have identified the commonalities from 20 different definitions used in past 30 years of consumer satisfaction research. As concluded by their literature reviews and validated by group and personal interview data, consumer satisfaction appears to comprise three essential components: (1) summary affective response which varies in intensity; (2) time of determination which varies by situation, but is generally limited in duration; and (3) satisfaction focus around product choice, purchase and consumption.

Based on Giese and Gote's (2000) findings, customer information satisfaction (CIS) for digital marketing can be conceptualized as "a summary affective response of varying intensity that follows consumption, and is stimulated by focal aspects of sales activities, information systems (websites), digital products/services, customer support, after-sales service, and company culture." Operationally, CIS can be considered as a summation of satisfactions with various attributes or items, similar to attitude. On the one hand, CIS, like traditional customer satisfaction, represents a transaction-specific affective response (Halstead et al. 1994; Oliver 1989), much like an attitude-like post-consumption evaluative judgment (Hunt 1977) varying along the hedonic continuum (Oliver 1989; Westbrook and Oliver 1991). On the other hand, as described earlier, the CIS construct conceptually emphasizes specific aspects of digital marketing contexts, such as "information products," "information processing," "IS contents," and "IS interface". Furthermore, the conceptualization of CIS emphasizes the construct itself rather than the evaluative process (model) through which the response is determined. Consequently, the focus herein is on the response (construct) rather than the process (model), to facilitate the operationalization of customer information satisfaction as a single construct, unencumbered by various antecedents or consequences.

2.2 The Theoretical Framework for Assessing CIS

Measurement issues are receiving increased attention among the MIS and EC research community. The primary purpose for developing CIS measures is to predict certain behaviors, and thus the measurement of web customer information satisfaction should be somehow more closely tied to the attitude-behavior theory. CIS is an important theoretical construct because of its potential for helping us discover both forward and backward links in a causal chain (i.e., a network of cause and effect relationships that describe a large portion of the domain of EC research) that are important to the EC research community (see Figure 1). Thus, customer information satisfaction is potentially both a dependent variable (when the domain of one's research interest is upstream activities or factors that cause customer information satisfaction) and an independent variable (when the domain of one's research interest is downstream behaviors affected by customer information satisfaction). Past research in information systems relating user attitudes (e.g. satisfaction) to success (e.g., intention to use the system) bears some resemblance to downstream research domain in the assumed direction of influence (attitudes → behavior) (Melone 1990). Likewise, consumer satisfaction is believed to mediate consumer learning from prior experience and to explain key postpurchase behaviors, such as complaining, word of mouth, repurchase intention, and product usage (Westbrook and Oliver 1991).

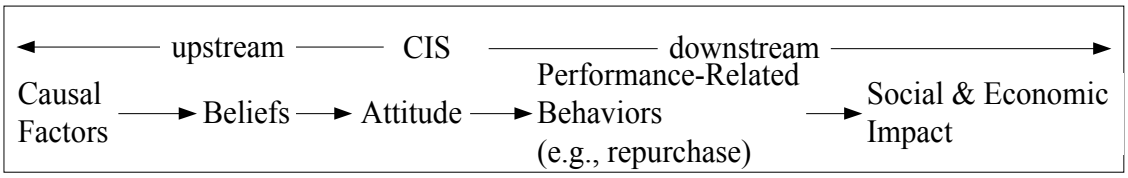


Figure 1. The Theoretical Framework for Assessing CIS
(Adapted from Doll and Torkzadeh 1991)

Based on the theoretical framework described in Figure 1, satisfaction appraisal is generally considered the central mediator of postpurchase behavior, which links prechoice product beliefs to postchoice cognitive structure, consumer communications, and repurchase behavior (Bearden and Teel 1983; Oliver 1980). Most consumer behaviorists would agree that satisfaction influences future purchase intention and complaining behavior. Consumers with high levels of satisfaction are expected to have higher levels of repurchase intention and less complaining behavior. An instrument has nomological validity if it "behaves as expected with respect to some other construct to which it is theoretically related" (Churchill 1995, p.538). Therefore, the following two hypotheses were tested to validate the nomological validity of the proposed CIS instrument:

**H1:** A positive relationship exists between CIS score and the repurchase intention.
**H2:** A negative relationship exists between CIS score and the extent of postpurchase complaint behavior.

## 3.Generation of Scale Items

3.1 Generation of Initial Item List

In MIS research, the development of instruments for measuring both user information satisfaction (e.g. Bailey and Pearson 1983; Ives, et al. 1983; Doll et al. 1995) and end-user computing satisfaction (e.g., Doll and Torkzadeh 1988; Doll et al. 1994) has been heavily emphasized.

Focusing on indirect or intermediate users, Bailey and Pearson (1983) interviewed 32 middle managers and developed a semantic differential instrument measuring overall computer user satisfaction. Ives, et al. (1983) later surveyed production managers and employed factor analysis to present a condensed form of the Bailey and Pearson instrument. Doll and Torkzadeh (1988) suggest that Ives, et al.'s instrument was designed for traditional data processing environments and measures general user satisfaction with EDP staff and service, information products, and user involvement/knowledge rather than satisfaction with specific applications. Doll and Torkzadeh (1988) also found that Ives et al.'s instrument ignores important "ease of use" aspects of the man-machine interface in end-user computing (EUC) environments, and that both its EDP staff and service items and user involvement/knowledge items seem inappropriate for EUC environments. Hence, Doll and Torkzadeh (1988) developed a 12-item and 5-factor instrument for measuring end-user computing satisfaction (EUCS) through conscientious approaches, such as reliability analysis, factor analysis, and the multitrait-multimethod matrix (MTMM) approach, to overcome Ives, et al. instrument's problems and make it to fit an EUC environment.

Doll and Torkzadeh EUCS and Ives et al. UIS instruments are frequently applied and discussed (e.g., Galletta and Lederer 1989; Klenke 1992; Doll et al. 1994; McHaney et al. 1999), but neither has been used for digital marketing contexts. As mentioned earlier, customers in digital marketing contexts become end users of information systems (web sites). Therefore, such customers are more similar to end users in EUC contexts than "indirect" users in traditional data processing contexts. Accordingly, Doll and Torkzadeh's EUCS instrument should be considered when the researchers generate initial items to develop CIS instruments. However, regardless of how an instrument may have been carefully validated in its original form, excising selected items does not result in a valid derivative instrument (Straub 1989). Consequently, it seems highly inappropriate for researchers to directly use Ives et al.'s UIS instrument, developed for DP contexts, or Doll and Torkzadeh EUCS instrument, developed for EUC contexts, to measure the CIS construct in digital marketing contexts. In sum, the conceptualization and operationalization of traditional UIS and EUCS may have to depend on adding, eliminating, or modifying some of their items and dimensions to provide a new instrument for measuring the CIS construct, given the changed role of information systems and customers in digital marketing contexts.

As mentioned earlier, the conceptualization of the CIS construct emphasizes the "information systems" dimension, such as information content, IS function, and IS interface. Meanwhile, the traditional customer satisfaction construct seems to ignore the important IS dimension underlying the CIS construct. However, conventional UIS and EUCS instruments appear to omit several important marketing aspects underlying the CIS construct, such as digital products, sales activities, customer support, after-sales service, and company culture. These factors have been discussed in the marketing literature (e.g. Lele 1987).

Various potential measures of the CIS construct exist. Reviewing the literature on user information satisfaction, end user computing satisfaction, and traditional customer satisfaction (e.g., Bailey and Pearson 1983; Ives, et al. 1983; Doll and Torkzadeh 1988; Palvia 1996; Lele 1987; Oliver 1980, 1981, 1989, 1993; Churchill and Surprenant 1982; Spreng et al. 1996; Giese and Gote 2000) obtained 36 items representing various dimensions underlying CIS construct, and used these to form the initial item pool for the CIS scale. To ensure important aspects of satisfaction were not omitted, researchers conducted experience surveys and personal interviews concerning digital markets with 5 managers, 2 professionals, 5 college teachers, and 12 consumers. The interviewees were asked to review the initial item list of the CIS scale, and recommended adding eight items and deleting three. This expanded 41-item list was then compared with another 38-item list generated from the discussions of a focus group composed of 8 doctoral students majoring in MIS or marketing. This comparison revealed that the entire contents of the 38-item list are included in the expanded 41-item list. Consequently, the researchers conclude that the expanded 41-item list constitutes a complete domain for CIS measurement.

An exploratory CIS instrument involving 43 items (see Appendix), including two global measures in perceived overall satisfaction and in success of the website as a criterion, was developed using a five point Likert-type scale, where 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; and 5 = strongly agree. The global measures can be used to analyze the construct validity[4] of the instrument and to rapidly measure overall satisfaction prior to detailed analysis (Palvia 1996). Besides the performance items, the questionnaire contains demographic and job-related questions. The measure of the degree of importance for each item was not adopted

[4] Construct validity Palvia (1996) mentioned refers to criterion-related validity, including concurrent and predictive validity (Cronbach and Meehl 1955).

herein because (1) adding an independent measure of degree of importance merely provides redundant information (Fishbein and Ajzen, 1975), and (2) "the weighted and unweighted scores are highly correlated, making the additional information provided by the importance rating unnecessary" (Ives, et al. 1983, p.787). After careful examination of the result of experience surveys and interviews, the statements were further adjusted to make their wording as precise as possible.

3.2 Pilot Study

The initial measurement model was pilot tested in a survey of 100 customers who had purchased and used the digital products or services in question during the past three weeks. To increase the generalizability of the results, the respondents were spread across 13 different digital product categories, including paper-based information products, product information, graphics, audio, video, tickets and reservations, financial instruments, government services, electronic messaging, business value creation processes, auctions and electronic markets, remote education, and interactive entertainment. These categories were selected to represent a broad range of digital products and services as proposed by Choi et al. (1997). The data was gathered from several organizations, including two universities, one manufacturing firm, and one insurance company. This test is primarily intended to establish the basic soundness of the model before scale purification. Meanwhile, the secondary purpose of the test was to eliminate logically duplicative items; i.e., those with aspects sharing the same underlying concept (Palvia, 1996).

Correlation coefficients were examined for all pairs of items within the 41-item instrument (2 global items excluded). In each pair where the correlation coefficient exceeded .5 and was significant at $p < .001$, one item within the pair was considered to be eliminated to enhance instrument readability and parsimony. However, not all related items have to be eliminated. Namely, only the duplicated items were eliminated because the pilot study was meant to determine duplicates and not just related items. Related items that represent a common or distinct factor must be retained. For example, the correlation coefficient between P3 and P4 ($r = 0.57$) is significant at $p< .001$. However, P3 represents the readability of a web site; P4 represents the "ease of use" of a web site. Obviously, the two items are related but not duplicated. The researcher therefore kept the pair in the item pool.

Based on the above criterion, three item pairs, i.e., (P22, P23), (P36, P38), and (P35, P39), have similar wordings and are significantly correlated at $p < .001$ and $r> .5$ (correlation coefficients = 0.72, 0.54, 0.64 respectively). In each pair, the wording with the lowest corrected item-to-total correlation[5] was eliminated. The corrected item-to-total correlations for these six items are: P22: 0.51; P23: 0.49; P36: 0.57; P38: 0.43; P35: 0.57; P39: 0.54. These measured results enabled the researchers to eliminate three items, i.e., P23, P38, and P39. In this pilot study, the remaining 38 items had a reliability (Cronbach's alpha) of .93 and a correlation of .85 with the two-item criterion scale. Additionally, all items correlate positively, both with the total item score and with the composite of the two global items. Therefore, the remaining 38 items were considered adequate for further investigation.

## 4.Data Collection and Scale Purification

4.1 Sample and Procedure

The data gathering method at the scale purification stage is similar to those used in the pilot study. The respondents were also spread across 13 different digital product categories. However, data for the initial refinement of the 40-item instruments (including 2 global items) were gathered from a quota sample of 520 adult respondents (aged 20 years or older) attending an e-business exposition and symposium held in Taiwan, with an equal quota of 40 responses from each category of digital products. The ratio of sample size to number of items (approximately 12:1) significantly exceeded the minimum 10:1 ratio for factor analysis recommended by Kerlinger (1978). To be consistent with the transaction-specific nature of CIS conceptualization, respondents must have purchased and used at least one of the digital product categories listed in the questionnaire during the three weeks prior to the survey. The screened and qualified respondents self-administered a 40-item questionnaire. The first part of the questionnaire focused on demographic data, while the second part required respondents to name the web sites where they had purchased digital products in the previous three weeks. For each question, respondents were asked to circle the response which best described their level of agreement with the statements.

According to the demographic data, the respondents represent a broad cross-section in terms of industry and management levels; the sample was also about equally divided between males and females.

4.2 Item Analysis and Reliability Estimates

The 38-item instrument (2 global items excluded) was refined through analyzing the pooled data; that is, data from all 13 categories of digital products was considered together. Because the primary purpose herein was to develop a general instrument capable of reliably and accurately measuring CIS in various digital product

[5] Corrected item-to-total correlation refers to correlation between the score on the item and the sum of scores on all other items making up the initial CIS instrument (sum for 40 items).

sectors, the pooling of sample data was appropriate.

Churchill (1979) describes the need to purify the instrument before going beyond the pilot stage in research. Some analysts like to gather data and perform a factor analysis on the data before doing anything to purify the instrument in the hope of determining the number of dimensions underlying the construct. Churchill contends that when factor analysis is done before purification, there seems to be a tendency to produce many more dimensions than can be conceptually identified. This effect is partly due to the "garbage items" which do not have the common core but which do produce additional dimensions in the factor analysis. Accordingly, the first step in purifying the instrument is to calculate the coefficient alpha and item-to-total correlations, which will be used to delete garbage items (Cronbach 1951; Churchill 1979). In addition, it seems appropriate and justified to assume that CIS is a simple construct prior to identifying its underlying dimensions using exploratory factor analysis. Thus, based on the assumption that all items in CIS instrument share a common core, the researchers only calculated the coefficient alpha and item-to-total correlations for the 38-item CIS instrument during initial scale purification.

The 38-item CIS instrument had a reliability (Cronbach's alpha) of .92. To avoid spurious part-whole correlation, the criterion used by the researchers to determine whether to delete an item was the item's corrected item-to-total correlation. The corrected item-to-total correlations were plotted in descending order, and items with item-to-total correlations below .4 or whose correlations produced a substantial or sudden drop in the plotted pattern were eliminated. The correlations with the corrected item total ($r \geq .4$) were significant at $p < .001$. Thus, the cutoff values were considered high enough to ensure that the items retained were adequate measures of the CIS construct. The sequence of computing alpha values and item-to-total correlations, followed by item deletion, resulted in the elimination of nine confounding items (i.e., P1, P2, P6, P9, P13, P22, P25, P30, and P41). In reliability analysis with a large sample, the remaining 29 items retained a reliability of .92 and a correlation of .88 with the two-item criterion scale.

Table 1. Rotated Factor Loadings for the 21-Item Instrument

| Item Code | Customer Support | Security | Ease of Use | Digital Products/ Services | Transaction and Payment | Information Content | Innovation |
|---|---|---|---|---|---|---|---|
| CS1 | .893 | | | | | | |
| CS2 | .879 | | | | | | |
| CS3 | .824 | | | | | | |
| CS4 | .639 | | | | | | |
| SE1 | | .930 | | | | | |
| SE2 | | .856 | | | | | |
| SE3 | | .844 | | | | | |
| EU1 | | | .920 | | | | |
| EU2 | | | .889 | | | | |
| EU3 | | | .851 | | | | |
| DP1 | | | | .867 | | | |
| DP2 | | | | .845 | | | |
| DP3 | | | | .740 | | | |
| TP1 | | | | | .860 | | |
| TP2 | | | | | .857 | | |
| TP3 | | | | | .740 | | |
| IC1 | | | | | | .860 | |
| IC2 | | | | | | .778 | |
| IC3 | | | | | | .777 | |
| IV1 | | | | | | | .901 |
| IV2 | | | | | | | .852 |

Note: Table 2 provides quick mapping between item code and item description.

4.3 Identifying the Factor Structure of the CIS construct

The researchers conducted an exploratory factor analysis to further examine the factor structure of the 29-item instrument. The factor analysis approach has become popular in the UIS, EUCS, and IS job satisfaction fields.

Before identifying the factor structure of customer information satisfaction construct using factor analysis, a chi-square value of 10976.1 and significance level of .000 were obtained using Bartlett's sphericity test, which suggests that the intercorrelation matrix contains sufficient common variance to make factor analysis worthwhile. The sample data of 520 responses was examined using principal components factor analysis as the extraction technique and varimax as the orthogonal rotation method. To improve the

unidimensionality/convergent validity (Nunnally 1978) and discriminant validity (Price and Mueller 1986) of the instrument through exploratory factor analysis, four commonly employed decision rules (Hair et al. 1998; Straub 1989) were applied to identify the factors underlying the CIS construct: (1) using a minimum eigenvalue of 1 as a cutoff value for extraction; (2) deleting items with factor loadings less than .5 on all factors or greater than .5 on two or more factors; (3) a simple factor structure; and (4) exclusion of single item factors from the standpoint of parsimony.

The iterative sequence of factor analysis and item deletion was repeated, resulting in a final instrument of 21 items representing seven distinct factors. These factors were interpreted as customer support, security, ease of use, digital products/services, transaction and payment, information content, and innovation, explaining 82 percent of the variance in the dataset. Table 1 summarizes the factor loadings for the condensed 21-item instrument. The significant loading of all the items on the single factor indicates unidimensionality, while the fact that no cross-loadings items were found supports the discriminant validity of the instrument.

Each factor within CIS construct represents a product or process where a company interacts with a customer and provides a useful frame for understanding the measurement of CIS. "Customer Support" refers to customer services, feedback, and responsiveness, which can build loyalty for future purchases. "Security" refers to the extent to which a website protects customers' transaction data and privacy from interception or misuse. "Ease of Use" means the usability of a website's user interface. "Digital Products/Services" includes the core item and the entire package of offerings, such as the design and quality of the digital products or services. "Transaction and Payment" is characterized by the payment systems and transaction procedure offered by a web site. "Information Content" involves the information quality (e.g., accuracy and relevancy) provided by the sales force or the online site. "Innovation" refers to the ability of a web site to provide innovative products and timely information. In sum, web customers in digital marketing contexts have become end users of information systems (web sites), thus making them emphasize several aspects of information satisfaction (e.g., IS content, security, and interface), which seem to be omitted in the traditional framework of customer satisfaction.

Table 2. Item-to-total Correlations of CIS Measures

| Item Code | Original Item Code | Item Description | Corrected Item-to-total Correlation |
|---|---|---|---|
| CS1 | P33 | You are satisfied with the customer support provided by the website. | .56 |
| CS2 | P34 | You are satisfied with the after-sales service provided by the website. | .53 |
| CS3 | P35 | The website understands your problems and requests. | .47 |
| CS4 | P36 | The website responds to your requests fast enough. | .67 |
| SE1 | P32 | The website provides for the security of your transaction data and privacy. | .51 |
| SE2 | P31 | You feel safe in your transactions with the website. | .49 |
| SE3 | P15 | You feel the website is secure. | .49 |
| EU1 | P11 | The website is user friendly. | .49 |
| EU2 | P3 | The output format is easy to read. | .43 |
| EU3 | P4 | The website is easy to use. | .49 |
| DP1 | P19 | You are satisfied with the products or services provided by the website. | .50 |
| DP2 | P16 | The digital products or services provided by the website meet your needs. | .53 |
| DP3 | P17 | The website provides high-quality products or services. | .53 |
| TP1 | P29 | You are satisfied with the payment system provided by the website. | .48 |
| TP2 | P27 | You are satisfied with the transaction procedures. | .49 |
| TP3 | P26 | The website provides clear transaction and price information. | .58 |
| IC1 | P5 | The website provides information that exactly fits your needs. | .44 |
| IC2 | P7 | The website provides accurate information. | .48 |
| IC3 | P10 | The website provides information that you trust. | .49 |
| IV1 | P21 | The website provides innovative products or services. | .56 |
| IV2 | P8 | The website provides up-to-date information. | .63 |

## 5. Assessing Reliability and Validity

### 5.1 Reliability

Reliability was evaluated by assessing the internal consistency of the items representing each factor using

Cronbach's alpha. The 21-item instrument had a reliability of .90, exceeding the minimum standard of .80 suggested for basic research (Nunnally 1978). The reliability of each factor was as follows: customer support = .895; security = .906; ease of use = .905; digital products/services = .838; transaction and payment = .845; information content = .823; innovation = .921. Furthermore, each of these 21 items had a corrected item-to-total correlation of above .43 (See Table 2).

5.2 Content Validity

To summarize, the CIS instrument meets requirements of reliability and consistent factor structure. However, while high reliability and internal consistency are necessary conditions for a scale's construct validity – the extent to which a scale fully and unambiguously captures the underlying, unobservable, construct it is intended to measure – they are not sufficient (Nunnally, 1978; Churchill, 1979; Parasuraman et al., 1988). The basic qualitative criterion concerning construct validity is content validity. Content validity implies that the instrument considers all aspects of the construct being measured. Cronbach (1971) presents a review process whereby experts in the field familiar with the content universe repeatedly assess versions of the instrument until a consensus is reached. Generally, "specifying the domain of the construct, generating items that exhaust the domain, and subsequently purifying the resulting scale should produce a measure which is content or face valid and reliable" (Churchill 1979, p.70). Therefore, the procedure used herein to develop the construct conceptualization and the initial item list, the results of experiential surveys and personal interviews with several practitioners and experts, the consensus between the expanded item list and the recommendation of the focus group, and the procedure of the scale purification suggest that the CIS instrument has strong content validity.

5.3 Criterion-Related Validity

Criterion-related validity[6] is assessed by the correlation between the total scores on the instrument (sum for 21 items) and the measures of valid criterion (sum for two global items). A positive relationship was expected between the total score and the valid criterion if the instrument is capable of measuring the CIS construct. The 21-item instrument had a criterion-related validity of .876 and a significant level of 0.000, representing an acceptable criterion-related validity.

5.4 Reliability and Criterion-Related Validity by Type of Web Site

Table 3 lists the reliability and criterion-related validity of the 21-item instrument by type of web site. The correlations between the criterion and the 21-item scale consistently range from .80 to .92 across different types of web site. The reliability consistently exceeds .84 and varies slightly by type of web site. With a minimum reliability standard of .80 being suggested for basic research (Nunnally 1978), the final instrument presented herein is adequate for academic research and practical applications. Because characteristics still differ slightly among various web sites marketing digital products, reliability and criterion-related validity causes some variation by type of web site. Accordingly, the measurement model can be adapted or supplemented as necessary to fit the characteristics or specific practical needs of a particular environment.

Table 3. Reliability and Criterion Validity by Type of Web Site

| | Correlation Between Criterion and 21-Item Scale | Reliability for 21-Item Scale |
|---|---|---|
| For All Web Sites | .88* | .90 |
| | | |
| Type of Web Site | | |
| Paper-Based Information Products | .91* | .93 |
| Product Information | .90* | .84 |
| Graphics | .81* | .86 |
| Audio | .92* | .93 |
| Video | .84* | .87 |
| Tickets and Reservations | .90* | .93 |
| Financial Instruments | .87* | .85 |
| Government Services | .80* | .86 |
| Electronic Messaging | .91* | .93 |
| Business Value Creation Processes | .86* | .88 |
| Auctions and Electronic mark | .90* | .93 |
| Remote Education | .86* | .85 |
| Interactive entertainment | .85* | .90 |

* Significant at p< .000.

[6] Criterion-related validity refers to concurrent validity in this study where the total scores on the CIS instrument and scores on the valid criterion are measured at the same time.

5.5 Discriminant and Convergent Validity

The correlation matrix approach (Doll and Torkzadeh 1988; Palvia 1996) was applied to evaluate the convergent and discriminant validity of the 21-item instrument developed herein. Convergent validity tests whether the correlations between measures of the same factor are different than zero and large enough to warrant further investigation of discriminant validity. Table 4 presents the measure correlation matrix. The smallest within-factor correlations are: customer support = .60; security = .63; ease of use = .71; digital products/services = .58; transaction and payment = .61; information content = .52; innovation = .86. These correlations are significantly different than zero ($p < .000$), and large enough to proceed with discriminant validity analysis.

Discriminant validity for each item is tested by counting the number of times that the item correlates higher with items of other factors than with items of its own theoretical factor. For discriminant validity, Campbell and Fiske (1959) suggested that the count should be less than one-half the potential comparisons. However, examining the correlation matrix in Table 4 reveals no violations of the discriminant validity condition from 376 comparisons.

Table 4. Correlation Matrix of Measures

| | CS1 | CS2 | CS3 | CS4 | SE1 | SE2 | SE3 | EU1 | EU2 | EU3 | DP1 | DP2 | DP3 | TP1 | TP2 | TP3 | IC1 | IC2 | IC3 | IV1 | IV2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CS1 | 1.0 | | | | | | | | | | | | | | | | | | | | |
| CS2 | .86 | 1.0 | | | | | | | | | | | | | | | | | | | |
| CS3 | .70 | .65 | 1.0 | | | | | | | | | | | | | | | | | | |
| CS4 | .64 | .60 | .62 | 1.0 | | | | | | | | | | | | | | | | | |
| SE1 | .30 | .32 | .37 | .50 | 1.0 | | | | | | | | | | | | | | | | |
| SE2 | .34 | .38 | .34 | .44 | .86 | 1.0 | | | | | | | | | | | | | | | |
| SE3 | .17 | .22 | .27 | .40 | .80 | .63 | 1.0 | | | | | | | | | | | | | | |
| EU1 | .20 | .25 | .07 | .27 | .14 | .18 | .21 | 1.0 | | | | | | | | | | | | | |
| EU2 | .14 | .18 | .02 | .25 | .11 | .10 | .18 | .80 | 1.0 | | | | | | | | | | | | |
| EU3 | .20 | .21 | .09 | .31 | .12 | .11 | .17 | .81 | .71 | 1.0 | | | | | | | | | | | |
| DP1 | .31 | .27 | .21 | .27 | .16 | .16 | .12 | .26 | .24 | .19 | 1.0 | | | | | | | | | | |
| DP2 | .29 | .25 | .22 | .33 | .18 | .25 | .16 | .21 | .18 | .17 | .75 | 1.0 | | | | | | | | | |
| DP3 | .19 | .14 | .19 | .38 | .33 | .33 | .31 | .23 | .19 | .20 | .58 | .59 | 1.0 | | | | | | | | |
| TP1 | .40 | .33 | .32 | .34 | .19 | .20 | .16 | .23 | .14 | .21 | .16 | .10 | .24 | 1.0 | | | | | | | |
| TP2 | .38 | .29 | .27 | .43 | .19 | .22 | .17 | .16 | .11 | .21 | .17 | .12 | .29 | .69 | 1.0 | | | | | | |
| TP3 | .34 | .36 | .25 | .31 | .15 | .20 | .16 | .29 | .24 | .29 | .34 | .36 | .32 | .64 | .61 | 1.0 | | | | | |
| IC1 | .04 | .05 | .03 | .08 | .15 | .11 | .24 | .29 | .33 | .36 | .20 | .31 | .21 | .23 | .21 | .32 | 1.0 | | | | |
| IC2 | .05 | .10 | .03 | .19 | .29 | .26 | .35 | .32 | .30 | .32 | .34 | .45 | .36 | .15 | .13 | .28 | .71 | 1. 0 | | | |
| IC3 | .18 | .19 | .20 | .27 | .16 | .15 | .25 | .31 | .27 | .34 | .22 | .35 | .27 | .35 | .33 | .26 | .60 | .52 | 1.0 | | |
| IV1 | .32 | .21 | .25 | .46 | .26 | .18 | .30 | .19 | .23 | .36 | .37 | .34 | .33 | .27 | .29 | .41 | .28 | .19 | .18 | 1.0 | |
| IV2 | .34 | .23 | .24 | .47 | .31 | .22 | .33 | .29 | .30 | .41 | .36 | .41 | .38 | .29 | .30 | .43 | .38 | .31 | .27 | .86 | 1.0 |

5.6 Nomological Validity

An instrument has nomological validity if it "behaves as expected with respect to some other construct to which it is theoretically related" (Churchill 1995, p.538). To test the hypotheses H1 and H2, Westbrook's (1987) 2-item complaint behavior measure was adopted to represent the extent of respondents' postpurchase complaint behavior. Respondents were questioned about (a) the number of complaint incidents and (b) the number of topics voiced. This instrument had a reliability (Cronbach alpha) of .85. Additionally, a continuous measure of repurchase intention was obtained by asking respondents to indicate the likelihood that they would repurchase digital products from the same web site on a 7-point scale ranging from "no chance" to "certain". Using correlation analysis, hypotheses H1 and H2 are significantly supported at $p < 0.01$, thus supporting the nomological validity of the proposed CIS measures.

## 6. A Model for Measuring Customer Information Satisfaction

In sum, the 21-item CIS instrument that emerged from the purification process was demonstrated to produce acceptable reliability estimates, and evidence also supported its content validity, criterion-related (concurrent) validity, discriminant validity, convergent validity, and nomological validity. Based on previous analysis, a comprehensive model for measuring customer information satisfaction is presented (see Figure 2).

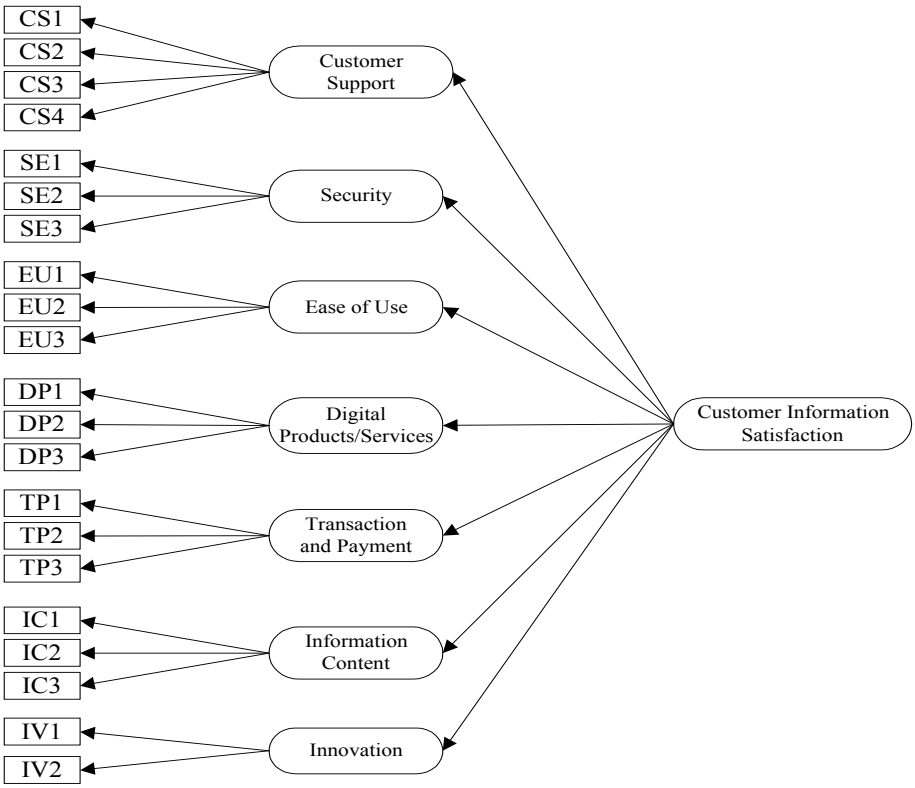


Figure 2. A Model for Measuring Customer Information Satisfaction

Table 5. Comparison of Underlying Dimensions Between UIS, EUCS, and CIS

| UIS | EUCS | CIS |
|---|---|---|
| Knowledge and Involvement | | |
| EDP Staff and Service | | |
| | Ease of Use | Ease of Use |
| Information Product | Format | |
| | Content | Information Content |
| | Accuracy | |
| | Timeliness | Innovation |
| | | |
| | | Security |
| | | Customer Support |
| | | Digital Products/Services |
| | | Transaction and Payment |

The researchers roughly compare the underlying dimensions between UIS (Ives et al. 1983), EUCS (Doll and Torkzadeh 1988), and CIS constructs (see Table 5) according to their item lists. While there exist some overlap in dimensions between these three constructs, it clearly shows that CIS construct in the digital marketing environment is different to the UIS construct in the traditional DP environment and EUCS construct in the end-user computing environment. In fact, the CIS measurement model can be characterized as containing three distinct components, i.e., elements similar to traditional UIS construct (e.g., information content), dimensions much the same as EUCS construct (e.g., ease of use), and special factors making up the CIS construct (e.g., transaction and payment). Specifically, both UIS and EUCS exclude several factors unique to CIS, i.e., customer support, digital products/services, security, and transaction and payment.

## 7. Developing Norms and Applications for the CIS instrument

The CIS instrument can be utilized to assess customer information satisfaction for web sites marketing digital products and services. Churchill (1979) suggested that a better way of assessing individual satisfaction is to compare individual scale scores with norms -- the total distribution of the scores achieved by other people. Table 6 lists percentile scores for the 21-item CIS instrument. Other relevant sample statistics are: minimum = 48; maximum = 103; mean = 71.52; median = 71; mode = 71; standard deviation = 9.715; and skewness = .243; kurtosis = .902. Researchers and practitioners can use these statistics to assess customer information satisfaction

regarding specific web sites. As the concise CIS instrument with good reliability and validity is periodically administered to a representative set of customers, digital marketers can use this CIS instrument to enhance their understanding of customer information satisfactions and to take necessary corrective actions to improve them.

Table 6. Percentile Scores – 21-item instrument

| Percentile | Value |
|---|---|
| 10 | 59 |
| 20 | 64 |
| 30 | 67 |
| 40 | 69 |
| 50 | 71 |
| 60 | 73 |
| 70 | 76 |
| 80 | 79 |
| 90 | 83 |

Besides making an overall assessment, the CIS instrument can be used to compare customer information satisfaction for different websites with specific factors (i.e., customer support, security, ease of use, digital products/services, transaction and payment, information content, and innovation). This instrument has been designed to be applicable across a broad spectrum of digital products, and to provide a common framework for comparative analysis. As described earlier, the framework, when necessary, can be adapted or supplemented to fit the specific research or practical needs of a particular environment.

Conventional consumer research that focuses primarily on satisfaction can be divided into three categories: (1) considering the satisfaction construct as antecedent to remedial behaviors such as complaining and word-of-mouth communication (e.g., Folkes et al. 1987; Tax 1998), (2) identifying the relationships among expectation, perceived performance, disconfirmation, satisfaction, and postpurchase behaviors (e.g., Churchill and Surprenant 1982; Oliver 1993; Spreng et al. 1996), and (3) discussing the directionality between service quality and customer satisfaction (cf. Cronin and Taylor 1992, 1994; Parasuraman et al. 1988, 1994). Correspondingly, future research efforts could develop and test research hypotheses and theories relating to consumer behavior in digital marketing contexts. Based on the theoretical framework described in Figure 1, researchers should recognize the need to investigate the causal relationship between CIS and other constructs in the boundary of digital marketing. The multiple-item CIS instrument with good reliability and validity provides researchers with a basis for explaining, justifying, and comparing differences across results.

## 8. Limitations

The rigorous validation procedure allows a general instrument for measuring customer information satisfaction in digital marketing environments to be developed. Nevertheless, this work contains limitations that could be addressed in future studies.

First, while the valid instrument was developed using the large sample gathered in Taiwan, a confirmatory analysis and cross-cultural validation using another large sample gathered elsewhere is required for greater generalization of the novel instrument. As Churchill (1979) contends, while exploratory factor analysis may be a satisfactory technique during the early stages of research on a construct, the subsequent use of factor analysis in a confirmatory fashion seems necessary in the later stages. The advantages of applying CFA as compared to classical approaches such as common factor analysis and multi-trait multi-method analysis to determine convergent and discriminant validity are widely recognized (e.g., Anderson and Gerbing 1988). Additionally, the sampling method used in this study has potential bias since a sample of willing attendees of an e-business symposium may not be a generalizable sample. Consequently, other samples from different areas or nations should be gathered to confirm, and likely refine, the factor structure of the CIS instrument, and to assess its reliability and validity using confirmatory factor analysis.

Second, the nomological validity should also be validated using structural equation modeling (SEM). A limitation of the nomological validity test herein is that a seven-point scale of repurchase intention was used with another five-point scale. Additionally, both the CIS and complaint behavior scores were computed just by totaling each instrument's items. Future research may rigorously explore the causal relationships using SEM.

Third, the test-retest reliability of the instrument should be evaluated. Measures of reliability include internal consistency, generally evaluated by coefficient alpha, and stability, while test-retest reliability examines the stability of an instrument over time. Galletta and Lederer (1989) also contend that test-retest is necessary for establishing the reliability of an instrument. Therefore, the stability of customer information satisfaction instrument, including short- and long-range stability, should be further investigated using the test-retest correlation method.

Finally, an instrument measuring customer satisfaction for non-digital product marketing should be

developed. The CIS instrument developed herein is limited to digital marketing contexts, decreasing its generalization and applicability. The development of a new instrument suitable for non-digital marketing, as well as the development of a comparison of factor structures between the CIS instrument and the new instrument should be addressed in future studies.

## 9. Conclusion

This study achieves significant progress towards developing a general instrument for measuring customer information satisfaction with web site marketing digital products and services. Current instruments for measuring user information satisfaction are geared towards the traditional data processing or end-user computing environments, thus making the development of CIS measures in digital marketing environments necessary. This study has conceptually defined the domain of the CIS construct, operationally designed the initial CIS item list, and empirically validated the general CIS instrument. The final instrument indicates adequate reliability and validity across a variety of web sites marketing digital products and services. The authors encourage practitioners and researchers to use the instrument for various applications. The generality of this proposed instrument provides a common framework for the comparative analysis of results from various researches.

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## APPENDIX

### Measurement of Customer Information Satisfaction – Forty-Three Items Used in Pilot Study

P1. You obtain desired information quickly.
P2. The website provides precise information.
P3. The output format is easy to read.
P4. The website is easy to use.
P5. The website provides information that exactly fits your needs.
P6. The website provides comprehensive information.
P7. The website provides accurate information.
P8. The website provides up-to-date information.
P9. The website provides sufficient information.
P10. The website provides information that you trust.
P11. The website is user friendly.
P12. The website is efficient.
P13. The operation of the website is stable.
P14. The website is flexible.
P15. You feel the website is secure.
P16. The digital products or services provided by the website meet your needs.
P17. The website provides high-quality products or services.
P18. The website provides convenient search engines for finding product and service reviews.
P19. You are satisfied with the products or services provided by the website.
P20. The website provides customized products or services.
P21. The website provides innovative products or services.
P22. You are satisfied with the advertisements provided by the website.
P23. You are satisfied with how the website advertises.
P24. You are satisfied with the promotion activities conducted by the website.
P25. Products or services are reasonably priced.
P26. The website provides clear transaction and price information.
P27. You are satisfied with the transaction procedures.
P28. The website deals with your order fast enough.
P29. You are satisfied with the payment system provided by the website.
P30. You are satisfied with the refund process.
P31. You feel safe in your transaction with the website.
P32. The website provides for the security of your transaction data and privacy.
P33. You are satisfied with the customer support provided by the website.
P34. You are satisfied with the after-sales service provided by the website.
P35. The website understands your problems and requests.

P36. The website responds to your requests fast enough.
P37. The website provides the personalized customer support you need.
P38. The website responds to your problems and requests promptly.
P39. The website can understand what you need via interactive communication.
P40. You are satisfied with the image of the website.
P41. You are satisfied with the beliefs and values of the website.
P42. You are satisfied with the website. *
P43. The website is successful. *

* Criterion questions

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