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Determinants of Satisfaction at Different Adoption Stages of Internet-Based Services*

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Abstract

Early IS research on satisfaction investigated system characteristics affecting end-user satisfaction, relying mostly on the IS success model. More recent research, on the other hand, studied satisfaction formation in the context of web-based products and services, using the disconfirmation theory. The IS context, however, is different from the marketing context where the theory was originally developed. One important difference is the novelty effect associated with the constant and rapid advancement of information technology. Previous satisfaction studies did not account for the dynamic nature of satisfaction and the changeability of its determinants. Such variability may be more salient in the IS context due to the novelty effect. In this paper, we develop, operationalize and empirically test a model for explaining/predicting satisfaction with Internet-based services at adoption and post-adoption stages. We argue and empirically demonstrate the need to consider the evolutionary nature of satisfaction and the variability of its determinants. Our results show that desires and expectations are both important factors that need to be considered simultaneously in explaining satisfaction at adoption. The role of desires, however, diminishes significantly in the post-adoption stage. The results also show no significant relationship between post-adoption satisfaction and satisfaction at adoption. The augmented disconfirmation model resulting from this study constitutes an important step towards the development of an IS satisfaction theory that accounts for the evolution of satisfaction over adoption stages.

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Keywords: Internet-based services, Satisfaction, Disconfirmation, Expectations, Desires

Introduction

In the last few years we have witnessed a substantial growth of Internet-based services, both from Internet businesses and from traditional companies that are developing online services as an important customer relationship management (CRM) initiative. As of May 2001, more than 65% of B2B companies had implemented customer services online (Jupiter Media matrix, May 18 2001). And between 1999 and 2000, corporate expenditures on Internet-based services had increased by 30% (Gartner's Group Dataquest Inc., December 20, 2000), indicating the recognition of the importance and benefits of these services. Internet-based services are believed to be superior to conventional services in many aspects. Supposedly more effective in enhancing customer satisfaction and ultimately retention, these services claim advantages such as better convenience, enhanced interactivity and a higher degree of customization/personalization (Bitner et al., 2000). Furthermore, the online channel is expected to be cheaper to operate and maintain than the regular channels. The important CRM objective of channel optimization is therefore dependent on attaining a higher rate of conversion from the regular channels to the online channel. The achievement of this objective, however, depends to a great extent on customer satisfaction with the online channel. Despite the importance of this issue, we still lack a good understanding of factors affecting customer satisfaction with Internet-based services.

Satisfaction is considered to be an important research topic due to its theoretical and practical significance. In the literature on information systems (IS), the construct of satisfaction was initially conceptualized as user satisfaction (DeLone and McLean, 1992; Ives, Olson and Baroudi, 1983; Bailey and Pearson, 1983). As such, it has been widely adopted as a primary surrogate for MIS success because of its close conceptual and empirical linkages to the success construct (Bailey and Pearson, 1983). Compared to other common proxies for success, such as usage and perceived usefulness, user satisfaction renders a higher degree of content and construct validity (e.g. see Ein-Dor and Segev, 1978). Satisfaction is also of great interest to practitioners because of its important effect on customer retention (Patterson et al., 1997; Neal, 1999). Retention is a major challenge in Internet-based services particularly, as customers can easily switch from one service provider to another at low cost.

Although satisfaction has been studied extensively in IS, its scope was primarily limited to system characteristics for end-users (e.g., Doll and Torkzadeh, 1988; Seddon, 1997; McHaney et al., 2002). There are a few studies that also included service quality (e.g. Pitt et al., 1995; DeLone and McLean, 2002). On the other hand, the marketing literature examined customer satisfaction and explained it in terms of product/service attributes, in some cases including the purchase process and after-sale service (e.g. Churchill and Surprenant, 1982; Oliver and DeSarbo, 1988).

With e-commerce, the distinction between end-users and customers is blurred. Consequently, it is difficult to distinguish between customer satisfaction and end-user satisfaction (Kettinger and Lee, 1995; Pitt et al., 1995). Thus, the marketing models alone no longer give a sufficient explanation of customer satisfaction. The determinants of satisfaction cannot be restricted to product/service attributes, but need to include the support provided by the information system to the pre-purchase, purchase and post-

purchase stages of the shopping cycle (Krishnan et al., 1999). Both product attributes (marketing models) and system characteristics (IS models) play an important role in satisfaction formation. Furthermore, the digital component of the product has become more prominent (Bitner et al., 2000; Wilson, 2001; Liechty, 2001), stressing the importance of information quality (IS models).

Thus, in the context of Internet-based services, satisfaction factors encompass product/service attributes (e.g. price, delivery terms, packaging), system attributes (e.g. loading speed, user-friendliness, navigational efficiency), and information quality attributes (e.g. information worthiness, relevance, currency). In support of the argument that satisfaction is not solely an evaluative outcome of a product/service (as in the marketing literature) nor of a system (as in the IS literature), Palmer and Griffith (1998) suggested that there is an interaction of marketing and technological elements in the Internet context. The marketing theory hence cannot be applied directly in the IT context without further development to incorporate the system/information quality attributes. Likewise, the IS theory is not sufficient to account for the total online experience of the customers. It is therefore imperative to integrate the marketing and IS models in order to address the theoretical gap and more specifically to account for the end-user/customer's total experience in explaining satisfaction. Such integration is especially important in the context of Internet-based services, which are information intensive by nature.

In the marketing literature (e.g. Churchill and Surprenant, 1982; Oliver and DeSarbo, 1988) as well as in recent IS studies (e.g. McKinney et al., 2002), the disconfirmation theory emerges as the primary foundation for satisfaction models. According to this theory, satisfaction is determined by the discrepancy between perceived performance and cognitive standards such as expectations and desires. The expectation disconfirmation models were initially developed and validated in the context of physical products (mainly brand names) where customers were familiar with the attributes of the product and could develop expectations based on their prior experience/knowledge. With Internet-based services, however, the offerings are changing so *rapidly* introducing an important *novelty* element that the customer's ability to form accurate expectations is limited. More recent studies proposed desire disconfirmation models as an alternative (e.g., Suh et al., 1994; Spreng et al., 1996). Yet, it is not clear which cognitive standard (expectations or desires) provides a better explanation of satisfaction. The empirical results are not conclusive (Spreng and Page, 2001). They vary depending on whether the service encounter is technology-based or interpersonal (Srijumpa et al., 2002). Some early researchers proposed expectations while more recent studies suggested desires (e.g. Suh et.al., 1994; Spreng et.al., 1996) but none provided strong justification or empirical evidence in support of their arguments. In light of this shortcoming, we develop, conceptually justify, and empirically verify a contingency theory that accounts for both desire disconfirmation and expectation disconfirmation. More specifically, we argue that the relative importance of these two determinants *varies* across different stages of adoption and that the role of desire disconfirmation diminishes as the customer becomes more familiar with the object of evaluation. Most previous research relied on cross-sectional studies and hence overlooked the *variability* and *dynamic* nature of satisfaction and of its determinants. To address this void, this study follows a longitudinal approach.

This paper is organized as follows. The next section presents the literature review on satisfaction. A discussion of the theoretical foundations of the research model follows. We then describe the research methodology. After interpreting the empirical results, we

conclude the paper with a discussion of the implications and directions for future research.

Toward the Development of an IS Satisfaction Theory

User satisfaction, or more specifically termed as end-user satisfaction in the late 1970's has been on the IS research agenda for decades (Davis and Olson, 1985). Satisfaction in the context of end-user computing was originally explained by five key system characteristics: content, format, accuracy, timeliness, and ease of use (Doll and Torkzadeh, 1988). The construct was hence operationalized in terms of specific satisfaction with each of these factors. DeLone and McLean (1992) subsequently modelled user satisfaction as an antecedent to MIS success. In their model, satisfaction is determined by both information quality and system quality. With its relatively higher face validity and well-developed measurement instruments, satisfaction has been more frequently adopted as a surrogate for MIS success compared to other potential proxies such as usage (e.g. Swanson, 1974; Olson and Ives, 1981; Ives et al., 1983; Gelderman, 1998).

Subsequent studies modelled satisfaction with antecedents other than information quality and system quality. For instance, Seddon (1997) extended the scope of user satisfaction in DeLone and McLean's model to account for net benefits of IS use to individuals/organizations/society in studying IS continuance but did not operationalize the construct. As IS evolved from systems providers to service providers, DeLone and McLean (2002) added "service quality" of IS departments as another determinant of satisfaction. They argued that end-users take into account not only the system performance but also the services provided by technical staff. They recommended the use of the SERVQUAL instrument developed by Pitt et al. (1995) for measuring satisfaction with service quality. The SERVQUAL instrument measures service quality in terms of responsiveness, tangibles, reliability, assurance and empathy.

While the IS literature was thus focused on the relationship between satisfaction and system characteristics, the marketing literature studied the satisfaction formation process (Churchill and Surprenant, 1982).

As explained by the expectation disconfirmation theory in the late 1980s, in the marketing context, customer satisfaction is a collective outcome of perception, evaluation, and psychological reactions to the consumption experience with a product/service (Yi, 1990). This theory suggests that satisfaction is determined by the intensity and direction of the gap between expectations and perceived performance. As such, expectations are defined as a set of beliefs held by users about a product/service's performance (Teas, 1993; Szajna and Scamell, 1993). In the domain of disconfirmation, expectations are defined using the expectancy theory as "predictive expectations" or "expected expectations" (Miller, 1977).

Expectations are shaped by personal experience and understanding of the environment, taking into account practical feasibility (Tolman, 1932). For instance, one may expect the security level of academic websites to be low 1) if he/she has visited several universities' homepages (personal experience) or 2) if he/she perceives resources available for online security management to be generally limited (environmental factors & practical

feasibility). Perceived performance is a relatively less biased evaluation of performance based on objective judgments rather than emotional reactions (Swan and Combs, 1976).

Expectation disconfirmation occurs in three states: 1) positive disconfirmation, where perceived performance exceeds expectations; 2) confirmation, where perceived performance meets expectations; and 3) negative disconfirmation, where perceived performance falls below expectations. An individual is more likely to be satisfied if the service performance meets (confirmation) or exceeds (positive disconfirmation) his/her expectations (Oliver and DeSarbo, 1988). On the other hand, he/she is more likely to be dissatisfied if the service performance falls below his/her expectations (negative disconfirmation). By proposing expectation disconfirmation as the sole determinant of satisfaction, this theory does not account for the possibility that the confirmation of high expectations is more likely to lead to satisfaction than the confirmation of low expectations. To resolve this drawback, Tse and Wilton (1988) included perceived performance as an additional determinant of satisfaction. Their rationale was that if actual perceived performance is expected and confirmed to be low, it may still negatively affect satisfaction and override the impact of confirmation or positive disconfirmation, resulting in dissatisfaction. The authors found perceived performance to be a direct and independent determinant of satisfaction.

Although developed by marketing researchers, the expectation disconfirmation theory has been applied to the IS context. For example, McKinney et al. (2002) developed a measurement instrument for web-customer satisfaction with the information search phase of online shopping. In their study, the customers of an online store were asked to evaluate their overall satisfaction with the information and features provided on the website. Satisfaction was measured using a scale ranging from "very pleased" to "very displeased." The authors specified information quality and system quality as the determinants of satisfaction and measured expectation disconfirmation at each specific dimension of these determinants. The dimensions for information quality were: understandability, reliability and usefulness, while those for system quality included access, usability, and navigation.

Another application of the disconfirmation theory in IS is the study of Suh et al. (1994). They examined satisfaction in the context of end-user computing success and operationalized it using formative items such as satisfaction with accuracy, specificity, sufficiency, currency, presentation format, ease of use, accessibility, and flexibility. With support from subsequent marketing research (e.g. Spreng et al., 1996), Suh et al. (1994) proposed the use of desires rather than expectations as the comparison standard in the disconfirmation process. The main distinction between the desire disconfirmation theory and the expectation counterpart lies in the way the cognitive standard is defined. According to the means-end theory (Gutman, 1982), the formation of desires is not based on realistic predictions of actual performance, but rather on inner emotional needs or wants that are not necessarily constrained by rational cognitive understanding of situation factors (such as practical feasibility). Expectations, on the other hand, are formed mainly based on past experience and the knowledge available (Zeithaml et al., 1990) and are therefore more pragmatic. In addition, desires are generally more present-oriented and stable when compared to expectations, which are relatively more future-oriented and malleable (Spreng and Olshavsky, 1993). An individual may desire/want a certain service to be good, but nevertheless expect it to be poor from his/her past experience and understanding of the actual environment. Using the previous example of web security, the difference between expectations and desires can be illustrated as

follows: a user may desire a high level of security for a particular website (inner want), but does not expect it to be so, based on his/her previous experience with the site or his/her knowledge of limitations of current security technologies and measures. Under the desire disconfirmation theory, low performance, though meeting the individual's expectations, can fall below the desired performance (negative disconfirmation) and is hence more likely to lead to dissatisfaction.

Although promising, the desire disconfirmation model has not been properly operationalized and tested. For example, Suh et.al. (1994) did not include any reflective items, but rather borrowed only formative items from previous end-user computing success literature without any validation, i.e. belief elicitation. It is also not clear which--expectation disconfirmation or desire disconfirmation--is more dominant in determining satisfaction.

More recently, Chin and Lee (2000) and Khalifa and Liu (2002) developed models that include both expectations and desires in explaining overall satisfaction with information systems and with online services, respectively. They both adopted direct measures of overall satisfaction using reflective items (i.e. "Overall I am satisfied with..."), arguing that expectations and desires might have direct and independent effects over satisfaction. While Chin and Lee (2000) provided the argument, it was Khalifa and Liu (2002) who empirically verified it—through their examination of satisfaction with online services in the adoption stage.

Theoretical Development and Research Model

Researchers have debated the roles of expectations and desires in explaining satisfaction. McKinney et al. (2002) applied the expectation disconfirmation theory in the IS context without taking into account the potential role of desire disconfirmation that may possibly be a salient factor in satisfaction formation. Other studies (e.g. Suh et.al., 1994; Spreng et.al., 1996) argued for the superiority of desires over expectations as a comparison standard, but did not operationalize or empirically validate the proposed desire disconfirmation models. These studies suggested that desires should be used *instead of* expectations rather than *in addition to* expectations. But expectations and desires are different concepts that can both play important roles in explaining satisfaction. The main argument used by the desire disconfirmation proponents (e.g. Suh et al., 1994) is that services that exceed the expected levels, but not the desired levels, may still lead to feelings of dissatisfaction. Conversely, one can argue that a customer's desires for a particular service may be lower than his/her expectations (i.e., the service is not really wanted by the customer). In such a case, meeting the customer's desired level of service while failing to meet his/her expected level (e.g., based on what the merchant promised to deliver) may also lead to dissatisfaction. The customer may still feel dissatisfied if his/her expectations are not fulfilled, independently of his/her desires. We therefore agree with Chin & Lee (2000) and Khalifa and Liu (2002) on the need to include both desires and expectations as comparison standards for disconfirmation.

Prior studies argued only for the use of desire disconfirmation theory in the IS context but did not provide strong justification and empirical evidence. Unlike traditional products/services, the rapid evolution of novelty elements inherent in IT-enabled capabilities (e.g. Internet-based services) hinders the formation of concrete expectations. When not well defined, expectations play a minimal role as a comparison standard, and

desires therefore become more salient determinants of satisfaction since their formation is less dependent on past experience/knowledge. Hence we argue that the disconfirmation theory developed in the marketing literature should be further refined by adding desire disconfirmation to more fully explain/predict satisfaction in the IS context.

Furthermore, previous satisfaction studies were cross-sectional (e.g. Doll and Torkzadeh, 1988; Chin and Lee, 2000; McKinney et al., 2002; Khalifa and Liu, 2002 etc.), implicitly assuming satisfaction to be static, and therefore overlooking the evolutionary/dynamic nature of satisfaction. Although desire disconfirmation, expectation disconfirmation and perceived performance are all three important determinants of satisfaction, their relative importance varies depending on the customer's experience (Tse and Wilton, 1988). When the customer is familiar with the product (e.g., brand names), his/her expectations are well defined, and thus the dominant comparison standard. In the context of Internet-based services, however, the novelty element may make it more difficult for the customer to form accurate expectations prior to the adoption of the services. In such a case, the customer may rely on his/her desires in addition to his/her expectations in performing the evaluation. After adoption, the customer's direct experience may increase his/her confidence in his/her expectations (Spreng and Page, 2001). This should strengthen the role of expectations as a comparison standard (Spreng and Page, 2001). Therefore, we believe that the relative importance of expectations and desires varies considerably depending on the adoption stage (at-adoption versus post-adoption) for innovations such as Internet-based services. This is consistent with Bhattacharjee's (2001) argument for the evolution of satisfaction over time as a result of the dynamic nature of its determinants. More specifically, we hypothesize that desire disconfirmation carries a significant weight in the adoption stage and an insignificant weight in the post-adoption stage after the customer has acquired a higher level of usage experience.

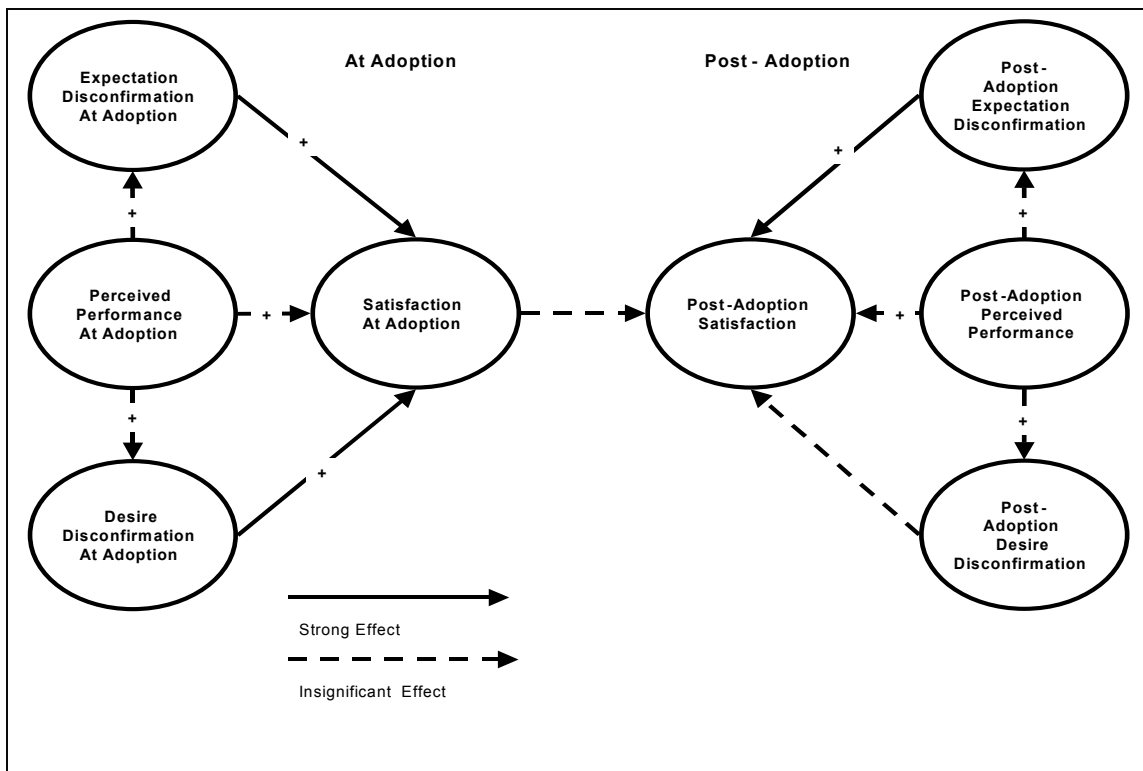


Figure 1. Research Model

Based on the discussion above, our research model (see Figure 1) proposes the three constructs “expectation disconfirmation”, “desire disconfirmation” and “perceived performance” as the main determinants of satisfaction, and differentiates between the adoption and post-adoption stages.

Our research model is grounded in the disconfirmation theory, which is developed based on the adaptation level theory (Helson, 1964, Bearden and Teel, 1983). According to this theory, one only perceives stimuli in connection with a standard that represents an adaptation level that is formed based on perception of the stimulus, the context, and the organism. The adapted standard will serve as a benchmark in any subsequent evaluation processes. Applying this theory, Oliver (1980) argued that expected expectations are adapted standards and could therefore be regarded as a frame of reference in making comparative judgments in the disconfirmation process. Suh et al. (1994), on the other hand, argued that desires should be adopted as the cognitive standard. Building upon the arguments in previous studies, we propose several hypotheses as follows.

Consistent with Oliver (1980), Oliver and DeSarbo (1988) and McKinney et al. (2002), we hypothesize that expectation disconfirmation will have a significant and positive effect on satisfaction. We do not anticipate that the significance of the hypothesized effect will vary depending on the adoption stage.

Consistent with previous studies, we believe that perceived performance has both a direct positive effect on satisfaction (Tse and Wilton, 1988; Spreng et al., 1996; Patterson et al., 1997) and mediated effects through expectation disconfirmation and desire disconfirmation (Oliver and DeSarbo, 1988; Suh et al., 1994). Satisfaction is more probable with higher perceived performance. Alternatively, perceived performance also affects satisfaction through determining the outcome of expectation/desire disconfirmation. Higher performance is more likely to meet or exceed desires/expectations, leading to more positive disconfirmation and hence higher satisfaction. We do not anticipate the significance of the hypothesized effect to vary depending on the adoption stage.

Consistent with Khalifa and Liu (2002), Chin and Lee (2000) and Suh et al. (1994), we also hypothesize that desire disconfirmation will affect satisfaction significantly and positively. When the formation of concrete expectations is restricted, e.g. by lack of experience or knowledge, desires may emerge to be the salient benchmarks for judging satisfaction. Unlike these prior studies, however, we anticipate the effect of desire disconfirmation to vary depending on the adoption stage based on the suggestions of Bhattacharjee (2001) and Fazio and Zanna (1981) that post hoc evaluation standards are likely to be shaped by actual experience rather than inner wants. More specifically, the effect of desires should be strong in the adoption stage and become insignificant in the post-adoption stage.

Several researchers argued that subsequent judgment (e.g. satisfaction) is likely to be affected by prior judgment, as one tends to reduce the cognitive effort required for performing the re-evaluation (e.g. Fiske and Neuberg, 1990; Mattila, 1998). Other studies, however, suggest other possibilities. According to the cognitive dissonance theory (Festinger, 1957), an individual decides whether to alter his subsequent judgment/attitude depending on the deviation between his prior judgment/attitude and the succeeding perception. If he perceives a substantial difference in the latest

circumstances (i.e. state of dissonance), he is likely to adjust his subsequent judgment/attitude toward the direction of such perceptions in order to save mental efforts in reconciling such dissonance. In other words, initial judgment may not always predict subsequent judgment. Based also on the cognitive dissonance theory, Karahanna (1999) presented similar arguments that usage experience introduces changes to one's perceptions and attitudes, and therefore post-adoption beliefs (e.g. expectations) may not be the same as those before adoption. Some other studies also suggest that initial comparison standards may be primarily formed based on inner wants while post standards are more likely to be affected by the actual experience (e.g. Bhattacharjee, 2001; Fazio and Zanna, 1981). This is likely to produce different disconfirmation outcomes and to change the evaluation of satisfaction accordingly. With fast evolving IT capabilities like Internet-based services, comparison standards after adoption are likely to be different from those formed previously as affected by rapid changes of circumstances. Satisfaction is therefore more likely to change over time as new experience-based drivers emerge. In other words, satisfaction is likely to be more dynamic in the IS context as a result of the rapid changes in comparison standards (e.g. expectations). Satisfaction at adoption could not have a significant effect on post-adoption satisfaction over and above other factors (i.e. expectation/desire disconfirmation and perceived performance). None of the previous studies (e.g. Chin and Lee, 2000; Khalifa and Liu, 2001) on satisfaction has attempted to investigate this issue. Based on the cognitive dissonance theory (Festinger, 1957), we expect the relationship of initial and subsequent satisfaction to be insignificant. Individuals are more likely to re-evaluate satisfaction at the post-adoption stage instead of relying on their previous judgment in order to be in line with the subsequent comparison standards.

The following is a summary of the hypotheses:

- Expectation Disconfirmation has a significant and positive effect on Satisfaction.
- The effect of Expectation Disconfirmation on Satisfaction is significant at both the adoption and post-adoption stages.
- Perceived Performance has both a direct positive effect on Satisfaction and mediated positive effects through Expectation Disconfirmation and Desire Disconfirmation.
- The significance of the direct and mediated effects of Perceived Performance does not vary depending on the adoption stage.
- The positive effect of Desire Disconfirmation on Satisfaction at Adoption is significant at the adoption stage and is insignificant at the post-adoption stage.
- Satisfaction at Adoption does have a significant effect on Post-Adoption Satisfaction.

Research Methodology

We validate the research model through a longitudinal online survey study, presented as advantageous by Pitkow and Recker (1995). We administer the survey to the new members of an online knowledge community that aims to provide an electronic and social platform through which its members exchange knowledge and experiences relating to electronic business. The community consists of more than 1,300 members who are middle/senior managers from various industries including IT, marketing and banking/insurance etc.. The *Internet-based services* offered by the community include 1) online e-business seminars (e.g., videos, text files); 2) access to case studies and

reports synthesizing a large variety of e-business topics; 3) online discussion forums where members can contribute feedback on the reports and interact with the author for exchange ideas and opinions; 4) a “news and events” section for informing members of major offline events; and 5) a loyalty program that rewards members who participate frequently and regularly in online activities with bonus points that they can redeem for discounts on courses and conference registration.

We selected this online knowledge community to be the research context because it constitutes a novelty to its new members. During an informal assessment, we found that most members had little or no exposure to other similar initiatives prior to their registration with the knowledge community. Though some of them may be aware of similar Internet-based services, rapidly evolving web capabilities introduce constant novelty that minimizes the members’ ability to form accurate expectations. The descriptive statistics, including demographics and response frequencies, are presented in Table 1.

We conducted the study in two stages: at adoption and post-adoption. For a period of eight weeks, every new member was invited to answer an online survey three days after the completion of the membership registration. This survey measured expectation/desire disconfirmation, perceived performance, and satisfaction with the Internet-based services at adoption. We offered discounts on upcoming community events (e.g. conferences) to induce the new members to complete the survey. A total of 131 out of 356 new members completed the first survey, implying a response rate of 37%. Twelve weeks later, we asked the respondents of the first survey to complete the same survey again (post-adoption stage), offering gift coupons for several retail stores and restaurants to encourage participation. Before administering the second survey, we verified the actual usage of all respondents to ensure they had acquired sufficient experience with the Internet-based services. A total of 107 questionnaires were completed, representing a response rate of 82%. As the verification of the link between satisfaction at adoption and post-adoption satisfaction required matching the answers of the same individuals to both surveys, we included only subjects that responded to both surveys in our final data analysis.

Table 1. Descriptive Statistics		
		Percentage
Gender	Male	56%
	Female	44%
Industries	Information Technology	23%
	Marketing	25%
	Banking & Insurance	17%
	Engineering	12%
	Accounting/ Consultancy	19%
	Others	4%
Post-qualification Professional Experience	>10 years	33%
	7 – 9 years	21%
	4-6 years	32%
	<3 years	14%
	Satisfaction at Adoption	Post-Adoption Satisfaction
Dissatisfied[#] (1-25)	2%*	1%
Somewhat dissatisfied (26-50)	25%	21%
Somewhat satisfied (51-75)	64%	65%
Satisfied (76-100)	9%	13%
	Desire Disconfirmation at Adoption	Post-Adoption Desire Disconfirmation
Very negative (1-25)	1%	2%
Negative (26-50)	30%	30%
Positive (51-75)	59%	57%
Very Positive (76-100)	10%	11%
	Expectation Disconfirmation at Adoption	Post-Adoption Expectation Disconfirmation
Very negative (1-25)	1%	1%
Negative (26-50)	29%	31%
Positive (51-75)	58%	54%
Very Positive (76-100)	12%	14%
	Perceived Performance at Adoption	Post-Adoption Perceived Performance
Very low[#](1-25)	1%*	1%
Low (26-50)	21%	19%
High (51-75)	67%	70%
Very high (76-100)	11%	10%

*A slider of 100-point resolution was used as a measurement scale

[#] An overall construct score is calculated by averaging the scores of the constructs' items.

Measurement Development

The survey instruments used in the two stages, at adoption and post-adoption, were identical. Since we believe that satisfaction in the context of Internet-based services is affected by information and system quality in addition to service attributes, we emphasized to the respondents the consideration of all these aspects in specifying their *overall* evaluations to account for their total experience as both end-users and customers. We gave the respondents specific examples of each of the three types of attributes in advance, and asked them to consider such things as the information relevance, page loading speed, and quality of membership profile. Based on the procedure proposed by Moore and Benbasat (1991), we measured all constructs with reflective items in order to verify the construct, face, and discriminant validity. The card sorting procedure consisted of two stages involving two different panels of four judges each. The judges were academics who were familiar with the topic. In the first stage, each judge was asked to categorize the items and name the groupings accordingly. In the second stage, similar procedures were performed except that all labels of constructs were provided to the judges. The average overall placement ratios (see Appendix II) of 78 % and 95% for the two sorting rounds, respectively, indicated that the items reflected adequately the constructs' meanings.

In addition to overall placement ratios, we assessed inter-rater reliabilities of the items using the Cohen's Kappa coefficient (Cohen, 1960). A score of 0.65 or above is generally considered to be acceptable (Moore and Benbasat, 1991). An average Kappa score of 65.4% (see Appendix III) for the first sorting round and 86.4% (see Appendix III) for the second round indicated adequate reliability.

The measurement of disconfirmation of desires (expectations), validated by Spreng et al. (1996), involved a comparison of the actual and the originally desired (expected) performance, e.g., a scale ranging from "much less adequate than what I *wanted (expected)*" to "much more adequate than what I *wanted (expected)*." A recent study verified that measuring disconfirmation using direct perception is superior to using the differential approach that obtains the disconfirmation scores by comparing the perceived performance scores with the expectation/desire scores (Dabholkar, 2000). To further ensure that the respondents had a clear understanding of the concepts of desire/expectation disconfirmation, we gave definitions of both constructs at the beginning of the questionnaire. A practical example was also provided to illustrate and highlight the differences. We used a semantic differential scale in form of a slider was used to record the respondents' answers (see Appendix I). The slider is a graphical scale with anchors at both ends (e.g. extremely satisfied; extremely dissatisfied). With a resolution ranging from 1-100, the slider provides 100 scale steps. According to numerous psychometric studies, the reliability of individual rating scales is a monotonically increasing function of the number of steps (Nunnally, 1978). Graphical scales are reported to be superior to numeric scales as people usually think of quantities as represented by degrees of physical extensions (e.g. the yardstick). Graphical scales can also help to convey the idea of a rating continuum and lessen clerical errors in making ratings (Nunnally, 1978).

Data Analysis

We completed the data analysis in a holistic manner according to the Partial Least Squares (PLS) procedure (Wold, 1989), using PLS Graph (Chin, 1994). PLS enables a

simultaneous analysis of 1) how well the measures relate to each construct and 2) whether the hypothesized relationships at the theoretical level are empirically confirmed. We conducted tests of significance for all paths using the bootstrap resampling procedure (Cotterman & Senn, 1992) and the standard approach for evaluation that requires path loadings from construct to measures to exceed 0.70. For checking internal consistency, we relied on composite reliability measures (ρ) as suggested by Chin (1998) and on the average variance extracted (AVE) as suggested by Fornell and Larcker (1981). We tested the discriminant validity by comparing the square root of the AVE for a particular construct to its correlations with the other constructs (Chin, 1998) and by examining cross-loadings of the constructs.

Results

Before testing the measurement and structural models, we tested for a potential response bias, since all our respondents continued their knowledge community membership and were more likely to be satisfied. It is therefore possible for most or even all satisfaction scores to be high (i.e. satisfaction score above 50 out of 100), rather than having an even mix of high and low scores. An examination of the response frequencies of the satisfaction items (see Table 1), however, revealed sufficient response variability, implying the improbability of a response bias effect.

We performed several tests on the measurement model to examine its validity and reliability. Table 2 presents the loadings of the measures to their respective constructs along with composite reliability scores, standard errors and t-statistics. All items are significant at the 0.01 level with high loadings (all above 0.80 and most above 0.90), therefore demonstrating convergent validity. Furthermore, all AVE scores exceed 0.8. The composite reliability scores of all constructs are higher than the recommended value of 0.80 (Nunnally, 1978), demonstrating internal consistency.

Table 3 presents the discriminant validity statistics. The square roots of the AVE scores (diagonal elements of Table 3) are all higher than the correlations among the constructs, demonstrating discriminant validity. We provide cross-loadings of constructs in Table 4. All items loaded higher on their respective constructs than on others, providing additional support for discriminant validity. We also performed a complementary test on discriminant validity for constructs with potentially high correlations by examining whether the confidence interval (+/- two standard errors) around the correlation estimate between the two factors included 1.0 (Anderson and Gerbing, 1988). The results indicate that none of the intervals included 1, confirming discriminant validity.

The results of the PLS analysis are illustrated in Figure 2. The test of each link can be mapped to each specific path in the structural model. We provide the estimated path coefficients along with their respective t-statistics. Solid lines represent significant links between constructs, while dotted lines denote insignificant relationships. The R^2 is indicated next to each dependent construct. All links are found to be significant and important in magnitude *except* those between 1) satisfaction at adoption and post-adoption satisfaction and 2) post-adoption desire disconfirmation and post-adoption satisfaction. The model explains 73% of the variance in satisfaction at adoption and 68% of the variance in post-adoption satisfaction, providing strong evidence of its explanatory power at both stages of adoption.

The structural model (Figure 2) shows dissimilar results for the different stages of adoption. At adoption, all three determinants of satisfaction, i.e., desire disconfirmation, expectation disconfirmation and perceived performance, were found to be significant. Desire and expectation disconfirmation both carry comparable weights on driving satisfaction with path coefficients that are similar in magnitude (0.36). This stresses the importance of considering all three determinants in explaining/predicting satisfaction at the adoption stage of an innovation. In the post-adoption stage, however, only expectation disconfirmation and perceived performance have significant effects on satisfaction. The respondents did not seem to rely on their desires as a comparison standard after gaining some experience with the Internet-based services.

Table 2. Measurement Model Statistics				
Factors	Variables	Loadings	Std. Error	T - statistics
Satisfaction at Adoption ($\alpha = 0.97$)	Item 1	0.9132	0.037	24.3069
	Item 2	0.9452	0.016	58.2883
	Item 3	0.9506	0.014	6709651
	Item 4	0.9614	0.011	86.7936
Desire Disconfirmation at Adoption ($\alpha = 0.97$)	Item 1	0.9251	0.016	56.7441
	Item 2	0.9563	0.011	81.3636
	Item 3	0.9432	0.015	59.3302
	Item 4	0.9451	0.011	80.6303
Expectation Disconfirmation at Adoption ($\alpha = 0.97$)	Item 1	0.9265	0.023	39.2306
	Item 2	0.9575	0.012	78.8441
	Item 3	0.9513	0.014	67.9339
	Item 4	0.9192	0.025	35.9943
Perceived Performance at Adoption ($\alpha = 0.95$)	Item 1	0.8792	0.037	23.2369
	Item 2	0.9231	0.023	39.496
	Item 3	0.9302	0.016	57.4242
	Item 4	0.8781	0.027	32.2186
Post-Adoption Satisfaction ($\alpha = 0.97$)	Item 1	0.9533	0.009	105.0234
	Item 2	0.937	0.015	61.042
	Item 3	0.9196	0.042	21.4538
	Item 4	0.9318	0.02	46.1967
Post-Adoption Desire Disconfirmation ($\alpha = 0.95$)	Item 1	0.9068	0.022	43.9545
	Item 2	0.9073	0.028	31.8833
	Item 3	0.9285	0.014	63.1606
	Item 4	0.9153	0.04	22.7391
Post-Adoption	Item 1	0.9391	0.016	56.7232
Factors	Variables	Loadings	Std. Error	T - statistics
Expectation Disconfirmation ($\alpha = 0.97$)	Item 2	0.9539	0.011	82.8697
	Item 3	0.939	0.018	51.3078

	Item 4	0.9477	0.014	63.8419
Post-Adoption	Item 1	0.9093	0.024	37.1797
Perceived Performance	Item 2	0.8928	0.031	28.3622
($\alpha = 0.95$)	Item 3	0.9061	0.022	40.2565
	Item 4	0.8974	0.031	28.0922

Table 3. Correlations and Average Variance Extracted (AVE) (Diagonal)

	Satisfaction at Adoption	Desire Disconfirmation at Adoption	Expectation Disconfirmation at Adoption	Perceived Performance at Adoption	Post-Adoption Satisfaction	Post-Adoption Desire Disconfirmation	Post-Adoption Expectation Disconfirmation	Post-Adoption Perceived Performance
Satisfaction at Adoption	0.94							
Desire Disconfirmation at Adoption	0.8	0.94						
Expectation Disconfirmation at Adoption	0.8	0.81	0.94					
Perceived Performance at Adoption	0.73	0.72	0.74	0.9				
Post-Adoption Satisfaction	0.63	0.55	0.55	0.57	0.94			
Post-Adoption Desire Disconfirmation	0.64	0.68	0.62	0.6	0.73	0.92		
Post-Adoption Expectation Disconfirmation	0.65	0.63	0.65	0.55	0.73	0.82	0.95	
Post-Adoption Perceived Performance	0.7	0.6	0.56	0.68	0.79	0.77	0.77	0.9

Table 4. Cross-Factor Loadings

		Perceived Performance at Adoption	Desire Disconfirmation at Adoption	Expectation Disconfirmation at Adoption	Satisfaction at Adoption	Post-Adoption Perceived Performance	Post-Adoption Desire Disconfirmation	Post-Adoption Expectation Disconfirmation	Post-Adoption Satisfaction
Performance at Adoption	Item 1	0.879	0.649	0.680	0.682	0.666	0.597	0.512	0.587
	Item 2	0.923	0.618	0.644	0.622	0.593	0.485	0.481	0.494
	Item 3	0.930	0.661	0.693	0.700	0.624	0.560	0.507	0.543
	Item 4	0.878	0.656	0.650	0.624	0.569	0.532	0.477	0.428
Desire Disconfirmation at Adoption	Item 1	0.723	0.925	0.727	0.777	0.587	0.604	0.555	0.519
	Item 2	0.692	0.956	0.786	0.732	0.559	0.638	0.597	0.518
	Item 3	0.653	0.943	0.784	0.767	0.567	0.692	0.623	0.523
	Item 4	0.626	0.945	0.751	0.726	0.537	0.628	0.588	0.512
Expectation Disconfirmation at Adoption	Item 1	0.751	0.758	0.927	0.746	0.585	0.585	0.644	0.576
	Item 2	0.662	0.782	0.958	0.765	0.529	0.607	0.636	0.523
	Item 3	0.661	0.798	0.951	0.808	0.529	0.613	0.632	0.537
	Item 4	0.702	0.695	0.919	0.691	0.436	0.507	0.524	0.415
Satisfaction at Adoption	Item 1	0.727	0.736	0.744	0.913	0.657	0.590	0.617	0.534
	Item 2	0.660	0.720	0.750	0.945	0.623	0.560	0.562	0.573
	Item 3	0.689	0.768	0.762	0.951	0.682	0.643	0.634	0.638
	Item 4	0.676	0.781	0.771	0.961	0.669	0.627	0.625	0.628
Post-Adoption Perceived Performance	Item 1	0.546	0.491	0.450	0.591	0.909	0.721	0.623	0.760
	Item 2	0.620	0.548	0.465	0.626	0.893	0.654	0.603	0.669
	Item 3	0.697	0.532	0.571	0.659	0.906	0.706	0.648	0.693
	Item 4	0.593	0.586	0.516	0.642	0.897	0.692	0.670	0.716
Post-Adoption Desire Disconfirmation	Item 1	0.526	0.581	0.517	0.566	0.716	0.907	0.740	0.673
	Item 2	0.569	0.598	0.562	0.584	0.682	0.907	0.752	0.663
	Item 3	0.576	0.600	0.555	0.546	0.720	0.928	0.728	0.677
	Item 4	0.535	0.709	0.623	0.656	0.698	0.915	0.774	0.645
Post-Adoption Expectation Disconfirmation	Item 1	0.480	0.569	0.596	0.581	0.643	0.766	0.939	0.691
	Item 2	0.504	0.593	0.590	0.627	0.679	0.761	0.954	0.688
	Item 3	0.556	0.556	0.621	0.597	0.680	0.781	0.939	0.707
	Item 4	0.528	0.651	0.651	0.641	0.665	0.785	0.948	0.675
Post-Adoption Satisfaction	Item 1	0.566	0.543	0.569	0.635	0.785	0.731	0.724	0.953
	Item 2	0.534	0.466	0.479	0.553	0.701	0.676	0.649	0.937
	Item 3	0.450	0.525	0.480	0.599	0.686	0.629	0.684	0.920
	Item 4	0.576	0.521	0.517	0.570	0.769	0.677	0.673	0.932

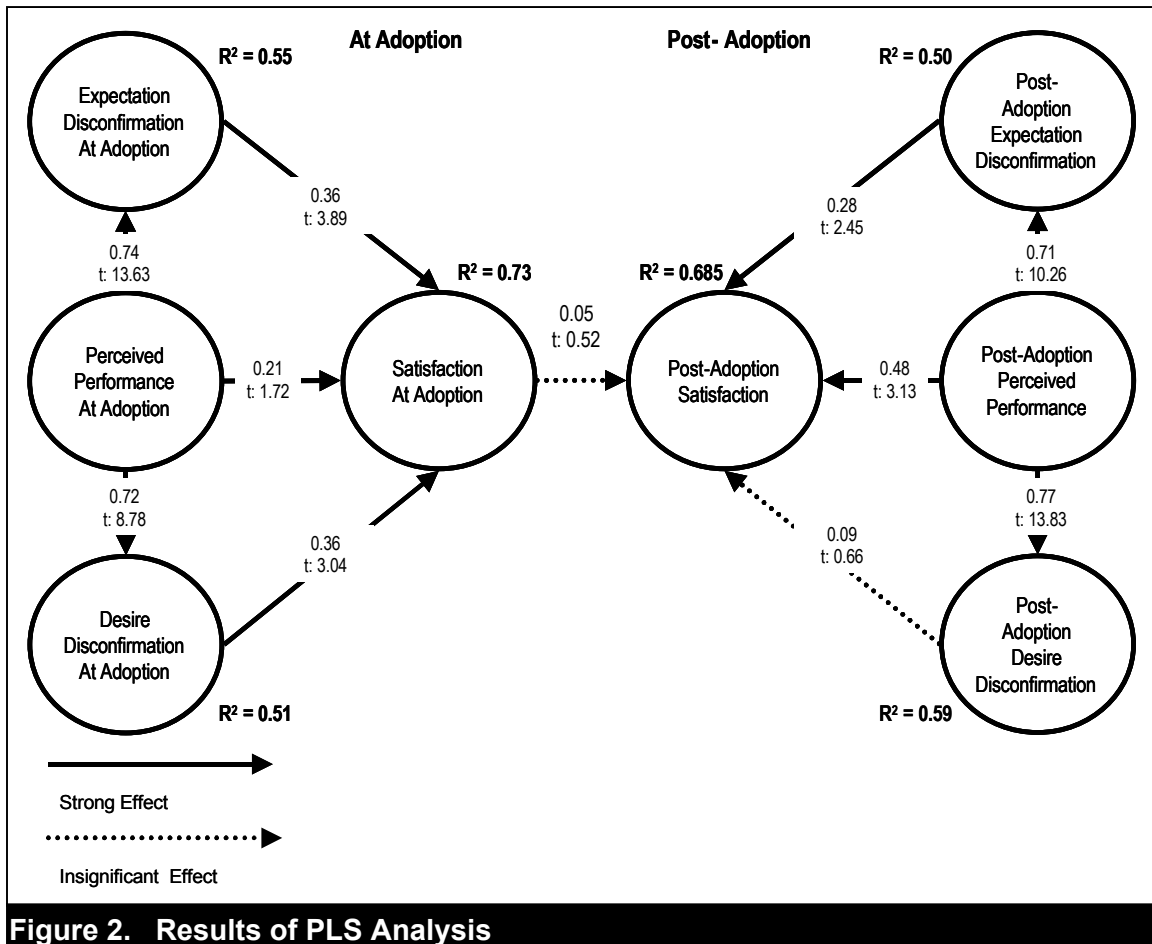


Figure 2. Results of PLS Analysis

The dissimilarity of results between the different adoption stages supports our earlier argument about the evolution of satisfaction and the variability of its determinants. Customers rely on desires in addition to expectations to evaluate their satisfaction when they have little experience with a novel service. The role of desires, however, diminishes as the customers acquire usage experience. Direct experience enables the customers to form more realistic expectations and to be more confident in these expectations (Spreng and Page, 2001). In such a case, they tend to rely more on their expectations than on their desires in the evaluation of their satisfaction. This argument is consistent with the Chin and Lee's (2000) claim that expectation disconfirmation is likely to be more prominent in shaping satisfaction with known products/services. Another important result that is worth discussing is the insignificance of the link between satisfaction at adoption and post-adoption satisfaction, confirming our earlier hypothesis. As suggested by the cognitive dissonance theory (Festinger, 1957), when subsequent perceptions deviate remarkably from the earlier judgment (i.e. satisfaction at adoption), individuals tend to adjust the latest judgment to save mental costs in reconciling the dissonance. This result is also supported by a paired t-test (see Table 5) that we conducted to verify whether significant differences exist between the levels of initial and subsequent satisfaction. The results indicate that post-adoption satisfaction is significantly different from satisfaction at adoption for three out of four items, implying that the magnitude of satisfaction changed over time. We re-performed the test using factor scores of satisfaction, which also

indicate similar results. The initial judgment (satisfaction at adoption) does not seem to play an important role in subsequent judgments (e.g., post-adoption satisfaction).

We have performed additional analysis to further investigate the relationship between satisfaction at adoption and post-adoption satisfaction. Our results show that the relationship is significant when considered in isolation (path coefficient = 0.631; $t = 8.51$). However, it becomes insignificant once the other satisfaction factors (i.e. post-adoption expectation/desire disconfirmation and perceived performance) are introduced into the model as shown in Figure 2 (path coefficient = 0.05; $t = 0.52$). As hypothesized, satisfaction at adoption does not seem to have an effect on post-adoption satisfaction over and above the other factors.

Table 5. Results of Paired T-test for Satisfaction at Adoption and Post-adoption Satisfaction

	Satisfaction at Adoption	Post-Adoption Satisfaction	t	Sig. (2-tailed)
Pair 1	Item 1	Item 1	-2.427	.017
Pair 2	Item 2	Item 2	-1.987	.050
Pair 3	Item 3	Item 3	-1.394	.166
Pair 4	Item 4	Item 4	-2.639	.010
Pair 5	Factor score (mean = 59.19; standard deviation = 13.43)	Factor score (mean = 61.99; standard deviation = 13.76)	-2.877	.005

Discussion

The empirical results provide strong evidence for the explanatory power of the proposed model. Furthermore, they demonstrate the evolutionary nature of satisfaction and the variability of its determinants. Satisfaction at adoption did not have a significant relationship with post-adoption satisfaction, and the determinants of satisfaction changed depending on the adoption stage. More specifically, expectation disconfirmation, desire disconfirmation and perceived performance were found to be important in explaining satisfaction at adoption. In the post-adoption stage, on the other hand, only expectation disconfirmation and perceived performance had significant effects on satisfaction, undermining the role of desires.

These findings confirm our argument for the need to distinguish between different adoption stages. Static satisfaction models proposed in the marketing literature are not applicable to IS contexts where constant change hinders the formation of accurate expectations at the early stages of adoption. Our study represents a crucial step toward the development of an IS satisfaction theory. Such a theory should build upon several major findings. First, desires are *not* always superior to expectations in explaining satisfaction, as claimed by some researchers (e.g. Suh et al., 1994). Second, it is not *always* necessary to consider expectations and desires simultaneously, as their relative importance on determining satisfaction varies over time. Third, it is essential to account for the customer's experience in explaining/predicting satisfaction. Although both desires and expectation are important, their significance and relative importance vary depending on the adoption stage. Future research should investigate further the role of experience in affecting the effects/significance of expectation disconfirmation and desire

disconfirmation on satisfaction. The effect of experience is probably not direct, but rather mediated through the customer's confidence in his expectations. Experience is an important antecedent to confidence (White et al., 1991). With a higher level of prior experience, and hence greater familiarity with the subject of evaluation, individuals may be more confident about the realization of their expectations. Thus, satisfaction may be more significantly affected by the degree to which their expectations, *rather than* their desires, are met. Conversely, the effect of expectation disconfirmation on satisfaction may be considerably weakened when confidence in expectations is low or minimal. In other words, confidence in expectations may moderate the relationships between expectation/desire disconfirmation and satisfaction. With IT initiatives that inherently carry novelty elements, the level of prior experience is likely to vary among individuals. The moderating role of confidence is therefore of particular relevance to satisfaction studies in the IS context.

Future research may also elicit the specific expected/desired IT factors (e.g. system quality and information quality) in different stages of adoption to examine their evolution over time and to observe their possible convergence. The current research may be extended to ascertain whether the evolution of significant expectations/desires will cease at a certain point of time. It will also be interesting to examine the relative importance of system/information quality factors in determining satisfaction as compared to service quality factors.

Our results also have important implications for practitioners. As we found no significant relationship between satisfaction at adoption and post-adoption satisfaction, companies offering IT-related products/services should therefore constantly monitor customer satisfaction. Managers should take advantage of an important web capability, that is, *embedded systematic feedback*. This feature allows for customers' opinions to be elicited *continuously* and not just periodically. The changing roles of desires and expectations over time observed in our results also present important implications relating to customer relationship management (CRM). Efforts should be made to gain a good understanding of the new customers' desires *in addition* of their expectations for novel products/services. The diminishing role of desires and the increasing importance of expectations with usage experience highlight the necessity of expectation management in the post-adoption stage. The usage experience should help customers develop adequate expectations that fit the intended purpose of the product/service. The Internet enables and facilitates customer education. Practitioners should therefore make good use of Internet capabilities to educate customers and help them to develop the right expectations. Customer education may also accelerate the formation of more concrete expectations leading to an earlier transition from the simultaneous consideration of desires and expectations to the reliance on expectations as the main comparison standard. An earlier transition is desirable as expectations (experienced-based and practical) are usually easier to manage than desires.

One of the limitations of this study is that the entire research was conducted in the specific context of a knowledge community. More empirical evidence regarding the applicability of our research model to the general context of IT innovation is still needed. Future research should test the model in other contexts to further verify the generalizability of the results. Furthermore, we did not examine the formation of expectations and desires. Future research should investigate the evolution of expectations and desires over time and possible convergence of and interactions between the two comparison norms. We also acknowledge that the cross-loadings and

correlations among some constructs are relatively high, which may present potential threats to discriminant validity and may also be an indicator of multi-collinearity.

Conclusion

Prior research did not provide conclusive results regarding what cognitive standard to use in explaining or predicting satisfaction. Some researchers argued for the superiority of desires over expectations, while others argued for the simultaneous use of both comparison standards. Furthermore, most previous studies ignored the evolutionary nature of satisfaction and the variability of its determinants. To address these problems, we developed a satisfaction model that includes expectation disconfirmation, desire disconfirmation, and perceived performance simultaneously as determinants of satisfaction, differentiating between satisfaction at adoption and post-adoption satisfaction. The model is especially applicable to IS contexts such as Internet-based services, which are characterized by novelty elements that hinder the formation of accurate expectations at the initial stage of adoption.

The empirical study provided strong support for the proposed model and demonstrated the need to consider the evolutionary nature of satisfaction and the variability of its determinants. Our results show that desires and expectations are both important factors that need to be considered simultaneously in explaining satisfaction at adoption. The role of desires, however, diminishes significantly in the post-adoption stage. The results also show no significant relationship between post-adoption satisfaction and satisfaction at adoption.

Our research presents important theoretical and practical contributions. On the theoretical side, we provide a better conceptualization of the formation of satisfaction by examining its evolution and the variability of its determinants. On the practical side, our empirical results provide a better understanding of the respective roles and relative importance of the determinants of satisfaction at different stages of adoption of Internet-based services.

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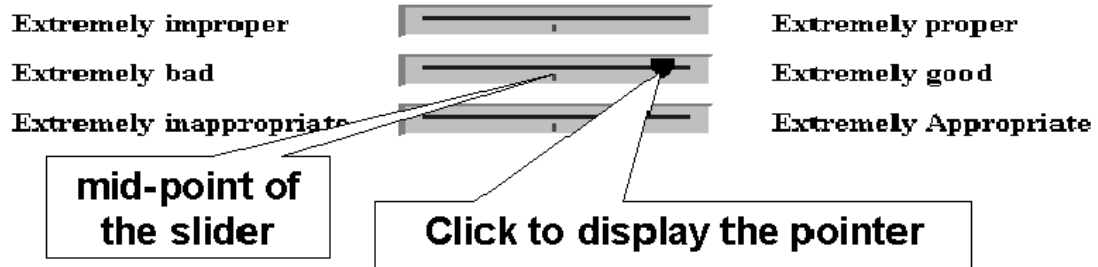
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APPENDIX I – ONLINE SURVEY

Overall, I **desire** the Online offerings provided by _____ to be



An Illustration of Indicating Responses using the Slider

I – Items Measuring Perceived Performance

Overall, the Online offerings by XXX are

Extremely inadequate
Extremely improper
Extremely bad
Extremely inappropriate

Extremely adequate
Extremely proper
Extremely good
Extremely Appropriate

II - Items Measuring Desire Disconfirmation

Overall, the online offerings provided by XXX have been _____ than I desired

<i>Much less adequate</i>	<i>Much more adequate</i>
<i>Much less proper</i>	<i>Much more proper</i>
<i>Much worse</i>	<i>Much better</i>
<i>Much less appropriate</i>	<i>Much more appropriate</i>

III - Items Measuring Expectation Disconfirmation

Overall, the online offerings provided by XXX have been _____ than I expected

<i>Much less adequate</i>	<i>Much more adequate</i>
<i>Much less proper</i>	<i>Much more proper</i>
<i>Much worse</i>	<i>Much better</i>
<i>Much less appropriate</i>	<i>Much more appropriate</i>

IV- Items Measuring Satisfaction

How would you rate your satisfaction with the online offerings of XXX

<i>Extremely dissatisfied</i>	<i>Extremely satisfied</i>
-------------------------------	----------------------------

Are you satisfied with the online offerings of XXX ?

<i>Extremely dissatisfied</i>	<i>Extremely satisfied</i>
-------------------------------	----------------------------

All things considered, I am ----- with the online offerings of XXX.

<i>Extremely dissatisfied</i>	<i>Extremely satisfied</i>
-------------------------------	----------------------------

Overall, I am ----- with the online offerings of XXX

<i>Extremely dissatisfied</i>	<i>Extremely satisfied</i>
-------------------------------	----------------------------

APPENDIX II – PLACEMENT RATIOS

Labels given by sorting Judges	Online Offerings (Performance)	Desire disconfirmation	Expectation disconfirmation	Overall satisfaction	Total Placements	Placement Ratio
Original Constructs						
Online Offerings (Performance)	13		2	2	17	76%
Desire disconfirmation		12	3		15	80%
Expectation disconfirmation		4	11		15	73%
Overall satisfaction	3			14	17	82%
	16	16	16	16	64	0
					Average:	78%

Results of First Sorting Round

Results of the Second Sorting Round

Labels given by sorting Judges	Online Offerings (Performance)	Desire disconfirmation	Expectation disconfirmation	Overall satisfaction	Total Placements	Placement Ratio
Original Constructs						
Online Offerings (Performance)	15				15	100%
Desire disconfirmation		15	1		16	94%
Expectation disconfirmation		1	15		16	94%
Overall satisfaction	1			16	17	94%
	16	16	16	16	64	
					Average:	95%

APPENDIX III – ASSESSMENT RESULTS OF INTER-RATER RELIABILITIES

Judges		First Round	Second Round
		<i>Cohen's Kappa Coefficients</i>	
A	B	0.510	0.825
A	C	0.559	0.925
A	D	0.706	0.950
B	C	0.600	0.780
B	D	0.750	0.804
C	D	0.800	0.902
Average		0.654	0.864

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