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End-User Expectations, Perceptions, and the Success of Information System

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ABSTRACT

Noting considerable alienation or dissatisfaction on the part of computer users, MIS literature has looked at a variety of social science techniques, including consumer satisfaction theory, for solutions to these problems. The dominant model of consumer satisfaction and dissatisfaction has been based on the disconfirmation of expectations paradigm. However, a critique of the disconfirmation of expectations model shows that using predictive expectation as comparison standard reveals a number of conceptual and empirical problems. To overcome these problems, this paper suggests desired expectations as an alternative comparison standard.

This paper proposes a desired expectations model of end-user computing (EUC) success that describes that the success of EUC be determined by discrepancy between end-user desires and actual performance of information systems. Analysis of data from 150 end-users in Korean business firms shows that attitudinal measures of EUC success (i.e., overall user satisfaction and perceived usefulness) were significantly influenced by the level of discrepancy. This empirical result supports the assumption that the success of EUC depends on how end-users perceive the actual performance of information systems in the context of what they want.

1. INTRODUCTION

It is commonly believed that information technology offers a substantial potential for improving end-users' performance. However, people's unwillingness to use available systems (Davis,1989; Igbaria, 1993) and considerable alienation or dissatisfaction of end-users often turn technically-successful system into failures (Doll and Torkzadeh, 1989). These problems have been a major impetus for

seeking a variety of social science theory, including consumer satisfaction theory, for resolving these problems.

The construct 'disconfirmed expectations' (i.e., the discrepancy between expectation and actual product performance) in the consumer satisfaction literature has been broadly accepted as one of key determinants of consumer satisfaction (Oliver, 1989; Stayman et al., 1992). Hence one would speculate the same relationship should be held for the information consumer, end-users. However, the influence of end-users' disconfirmed expectation on the success of information systems (often measured by end-user satisfaction and system use) has received little research attention in MIS research area.

The importance of user expectations on the success of an information system can be found in MIS research. For example, Edmundson and Jeffery (1984) investigated the relationship between the performance of information requirements determination and post-implementation satisfaction with the software acquired. The authors concluded that end-user expectations about the information system play a significant role in determining user satisfaction.

The purpose of this paper is to empirically investigate the impact of end-user's disconfirmed expectations on the success of end-user computing (EUC). We first identify unique aspects of the end-user computing environment and describe the construct of disconfirmed expectations appropriate for this context. In this paper, the disconfirmed expectations concept is defined as the gap between desired and actual levels of IS performance, including information quality and system's interface quality. After establishing end-user's disconfirmed expectations model, research hypotheses are derived and empirically examined.

2. BACKGROUND

2.1. Influencing factors of end-user computing success

End-user computing (EUC) refers to direct interaction with application software by managerial, professional, and operational level personnel in user departments (Doll and Torkzadeh, 1989). The dependent variable in many EUC studies is EUC success. Measures for it include end-user satisfaction (Doll and Torkzadeh, 1988), information system use (Ghani, 1992), and perceived usefulness of the information system (Davis, 1989).

A close examination of the existing EUC literature reveals that EUC phenomenon has been characterized by the following two dimensions : information consumption and direct user interaction. These two dimensions are closely linked to the definition of end-users in that they are defined as those users who consume

information through direct interaction with application systems (Doll and Torkzadeh, 1989). From this vantage point, the performance of end-user information systems includes both information quality and interface quality.

The quality of information is typically evaluated by measuring information attributes. For example, in their efforts to develop a measure of information quality in the context of EUC, Doll and Torkzadeh (1988) developed a measure that included content, accuracy, relevancy, format, and timeliness of systems' output. The information quality has been considered important because providing high quality information to users has been consistently viewed as a key determinant of user acceptance (Davis, 1989).

The quality of the interface has also been regarded as a primal factor of EUC success. The importance of the interface may matter more to end-users than traditional DP users who use IS indirectly by other people (e.g., DP operator). That is, unlike DP users, end-users consume information primarily through their own interaction process, i.e., the interaction between the end-users and the computer system. The interface consists of hardware device (e.g., screens, keyboard), software, and other means (e.g., telecommunication facilities) by which the user exchanges inputs and outputs with the computer system. Since computer systems are operated directly by end-users - those who benefit from their outputs but may know very little about their internal aspects - a well-designed interface is critical to the success of a system.

In contrast to the widely accepted notion that the performance of information systems (IS) is a prerequisite for IS use, previous research on the relationships revealed mixed results. For example, Mawhinney and Lederer (1990) found a strong relationship between IS performance and system usage (often employed as a measure of IS success), while Srinivasan (1985) found no significant relationship between them. One possible reason for the mixed findings may be due to difference in users' expectation levels in various research contexts. For example, low level of usage could be observed because some important features of IS do not meet the users' expectation level even when the performance of IS is high.

In this regard, determining a correct and complete set of user information needs is generally recognized to be one of the most critical factors to MIS success (Kim, 1989). However, there are some reasons for the difficulties in obtaining a correct and complete set of information needs. Davis and Olson (1985) summarized the reasons as follows : (1) the constraints on human as information processors, (2) the variety and complexity of information requirements, (3) the complex patterns of interaction among users and analysts, and (4) the unwillingness of some users to provide requirements for political and behavioral reasons. For these reasons, MIS development personnel or software vendors may not understand what features connote high quality information to users in advance. Thus, there could be a

discrepancy between users expectations and features of a developed system, which in turn influences success of information systems (e.g., more satisfaction and active use by the users).

The importance of the disconfirmation of expectations has been well discussed in consumer satisfaction research (Oliver and DeSarbo, 1988; Spreng and Olshavsky, 1992). The disconfirmation of expectations theory suggests that the success of product, measured by consumer satisfaction, is determined by the size and directions of one's discrepancy between expectations and perceived product performance. Since this paper aims at studying the effect of the discrepancy between end-users' expectations and IS performance on the success of EUC, this theory can be a useful reference theory.

2.2 The disconfirmed expectations model

In the consumer satisfaction literature, a number of studies have been conducted on the effect of the disconfirmed expectations on consumer satisfaction. In the disconfirmation of expectations model, expectations have generally been included as the criterion by which performance is compared. The result of the cognitive comparison between pre-use expectations and post-use perception is called unfilled expectations, and the discrepancy between what is expected and what is received has been shown to be a predictor of satisfaction in some situations (Oliver, 1989).

The unfilled expectations theory suggests that consumer will compare actual performance of a product to their expectations about performance (Oliver and DeSarbo, 1988). On the basis of the theory, if obtained performance is less than expected (negatively disconfirmed), consumers will be dissatisfied. On the other hand, if expectations are met (confirmed) or performance exceeds expectations (positively disconfirmed), consumers will be satisfied.

However, past studies on the effects of the unfilled expectations on consumer satisfaction indicated mixed results. While some studies supported the significant relationship between the unfilled expectations and consumer satisfaction (Cadotte et al., 1987; Olshavsky and Spreng, 1989), others found no significant relationship between them (Churchill and Suprenant, 1982; Tse and Wilton, 1988).

Several authors indicated that the mixed finding was mainly due to the logical inconsistency stemming from the inappropriateness of expectations concepts as consumers' comparison standards (Tse and Wilton, 1988; Spreng and Olshavsky, 1992). Expectations used in the disconfirmation of expectations research were generally predictive ones, in that the construct has been operationalized in terms of the probability of future occurrence (Westbrook 1989; Oliver, 1989). One possible logical inconsistency with the use of predictive expectations as comparison standard

is the situation in which a user predicts an application system to perform poorly, but uses it anyway and finds that the system performs poorly, thereby confirming the users predictive expectations. The disconfirmation of expectations model would predict that this will result in neutral or satisfied feelings. Intuitively, however, one would anticipate that users will be dissatisfied with the poor system.

For this problem, consumers' desired expectations, rather than predictive expectations, have been suggested as alternative comparison standard (Olshavsky and Spreng, 1989; Spreng and Olshavsky, 1992). Desired expectations were generally conceptualized in terms of the levels of product performance that consumer wants. For example, Spreng and Olshavsky (1992) defined consumer desire as the levels of aspects of product or service that the consumer judges will lead to higher level values.

Using consumer's desires as comparison standard does not seem to have logical inconsistencies previously noted for the disconfirmation model based on predictive expectations. That is, when using an application system that one predicts to perform poorly, using desires as the comparison standard will result in negative discrepancy between what is desired and what is received.

The importance of consumer desires has received empirical support. For example, Swan et al. (1981) showed that the discrepancy between consumer desires and performance is more suitable in explaining satisfaction than the discrepancy between predictive expectations and performance.

Another major problem with the disconfirmation of expectations model is that the model does not differentiate between the two different states of confirmations - low expectations with low performance and high expectations with high performance. The disconfirmation of expectations model would predict that consumers in these two confirmed states are equally satisfied, although intuitively confirmed consumers with high performance would be more satisfied than those with low performance.

To overcome this problem, it has been suggested that both disconfirmation of expectations and actual performance should be included in the model as independent predictors of consumer satisfaction (Tse and Wilton, 1988). In many instances, a strong relationship between actual product performance and consumer satisfaction has been found (Tse and Wilton, 1988; Oliver and DeSarbo, 1988; Oliver, 1989). For example, when estimating a multiple determinant model that included actual performance, disconfirmation, and expectations as direct antecedents of satisfaction, Tse and Wilton (1988) found that actual performance dominates the formation of satisfaction. This indicates that a model that incorporates both disconfirmation and actual performance is likely to explain more of satisfaction than one that include disconfirmation alone.

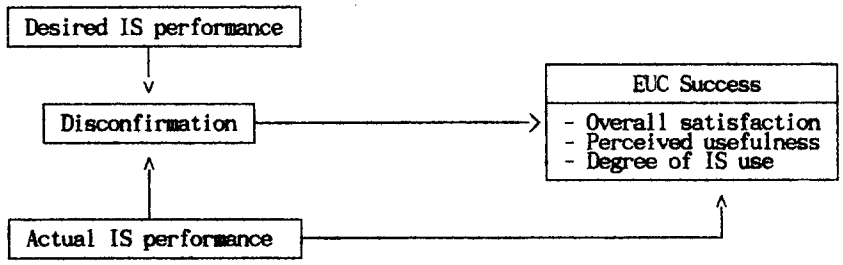
3. RESEARCH MODEL AND HYPOTHESES

The relationships observed between disconfirmation, performance and satisfaction in consumer satisfaction literature suggest that a similar relationship might exist for EUC: (1) actual IS performance deviating from end-user desires will cause the subject to favorably or unfavorably react to the disconfirmation experience in that a negative disconfirmation is believed to result in a dissatisfaction whereas a positive disconfirmation should produce satisfied feelings, and (2) perceived IS performance will have a direct influence on end-user satisfaction.

The above notions focus on explaining end-user satisfaction. However, if satisfaction is closely related to other dimensions of EUC success, particularly perceived usefulness and the amount of system usage, these too will be influenced by the levels of disconfirmation and actual IS performance. The information system literature provides some clues of the intimate associations between the key indicators of EUC success. For example, Guimaraes et al. (1992) show that overall user satisfaction toward DSS was closely related to the perceived usefulness of it, suggesting that users who perceive that a system is useful to them are likely to be satisfied with the system. Davis (1989) finds that the usefulness of an IS to be significantly correlated with system usage. Extrapolating from these, we might expect that the dissatisfied end-users will perceive a system not useful and will avoid the system by limiting his/her use of it.

These discussions lead us to assume that the success of EUC is determined by the disconfirmation level - degree of discrepancy between end-users' desires - and actual IS performance, as depicted in Figure 1.

Figure 1. A Discrepancy Model of End-user Desires



Two hypotheses were derived from the research model (Figure 1). The first hypothesis is related to the effects of disconfirmation on EUC success, based on the assumption that users' desires are key criteria on which an information system

is evaluated. This assumption has been suggested by some MIS researchers. For example, Ives et al. (1983) defined user information satisfaction as "the extent to which users believe the information system available to them meets their information requirements". Here, user requirements are similar to user desires. Also, Kim (1989) has suggested that unfavorable user attitudes toward an IS could be interpreted to mean that designers and users had failed to communicate adequately to reach consensus on user requirements. Hence it can be suggested that the gap between end-user desires and actual IS performance will influence EUC success in the way that a high level of positive disconfirmation produces favorable user responses. On the other hand, unfavorable responses are thought to be made as the level is lower and moreover negative. These assumptions leads to the following hypothesis.

Hypothesis 1: The success of EUC will be positively correlated with the level of positive disconfirmation between end-user desires and actual IS performance.

The second hypothesis is concerned with the effect of IS performance on the success of EUC. The importance of IS performance in determining EUC success could be inferred from studies in the consumer satisfaction literature. Tse and Wilton (1988), for example, came to a conclusion that a consumer is likely to be satisfied whenever a product performs well, regardless of the levels of the pre-existing comparison standard and disconfirmation. If it is also true for the information consumer (end-user), it is expected that subjects within a high IS performance group will reveal more favorable responses than those within a low performance group under the same level of disconfirmation. Hence, it is expected that IS performance positively affects EUC success even when degree of disconfirmation is held constant, leading to the following hypothesis.

Hypothesis 2: The success of EUC will be positively correlated with the actual level of IS performance.

4. RESEARCH METHODS

4.1. Consideration of factors to be controlled

Before going further, it should be noted that the weakness common to the studies using information systems' (IS) success as a dependent variable is a lack of control over factors that are outside of a research model but may have affected success (Kim, 1988). These factors may not be included in research design

because of the difficulties in identifying and measuring them. However, without controlling the effects of as many of factors other than research variables as possible, it is hard to detect pure effects of the research variables (disconfirmation and IS performance) on the success of EUC. In addition, as this paper is concerned with examining the effects of disconfirmation and IS performance on EUC success holding other factors constant, several important factors of EUC success are considered.

In order to identify factors that may affect EUC success, reference is made to the IS research framework provided by Mason and Mitroff (1973). In a discussion of research program for information systems, Mason and Mitroff (1973) suggested that an information system serves an individual with a certain cognitive style, faced with a particular decision problem in some organizational setting. Their definition of MIS implies some important contextual factors such as decision environments, individual differences, and organizational setting. These factors are considered to affect EUC success directly or indirectly (henceforth, specific variables associated with these factors are called 'control variables').

Although not complete, typical variables that have been suggested as key determinants of EUC success were included in this study. Regarding decision environments, Gorry and Scott Morton (1971) suggested the level of management activities and relative degree of structure in the decisions being made are important factors affecting IS success. Thus rank of users and unstructuredness of user tasks were selected as control variables.

Based on an extensive survey of end-user computing (EUC), Rockart and Flannery (1983) suggested that individual difference is key factor affecting his or her usage behavior. Within the EUC environment in which non-professional computer users interact directly with computer systems, end-user's computing abilities (Cheney and Nelson, 1988) and length of computer experience (Rivard and Huff,1988) have been consistently viewed as primal factors affecting their attitude and usage behavior. Hence, computing abilities and computer experience were selected as control variables.

Concerning the organizational setting, key environments that surround end-users may be IS development environments and IS operations environment (Ives et al., 1980). Within the IS development environment, user involvement (including end-user development as one extreme point) has been identified as a critical factor of IS success (Ives and Olson, 1984). Concerning the IS operations environment, top management support for IS has been identified as a key factor affecting user attitude and system use (Guimaraes et al., 1992; Igbaria, 1993).

In summary, the control variables included in the research design are organizational rank of end-user (RANK), unstructuredness of task (UNST), computing abilities (ABILITY), length of computer experience (EXP), user involvement

(INV), and top management support (TOP).

4.2 Data Collection

In order to test research hypotheses, a sample of 32 firms was obtained. In the sampled firms, the heads of the user departments were asked to identify the major applications and the major users who directly interact with each application.

Data were gathered through questionnaires and personal interviews with end-users. The personal interviews enabled us to verify that the respondents were end-users who directly interacted with application software and used the outputs to make decisions in their work. We assigned a Likert-type questionnaire to each end-user to measure perceived IS performance, level of disconfirmation between desired and actual IS performance, and three measures of EUC success - overall satisfaction with the application system, perceived usefulness of the system, and degree of IS use. Questionnaires concerned with control variables were also administered to end-users.

A sample of 150 end-user responses was obtained. This sample was made of 125 different applications with an average 2.5 responses per application.

4.3 Measures

4.3.1 Level of IS performance

To measure level of IS performance, eight items were selected from the instrument developed by Doll and Torkzadeh (1988). Of these items, five items are related to the quality of information (i.e., accuracy, specificity, sufficiency, recency, and clearness of presentation format) and the other three items are related to the quality of interface (i.e., ease of use, accessibility, and flexibility).

Each item required the respondents to indicate their perceptions on the performance of a system (For example, subjects were asked to respond the accuracy of the system: "Is the system accurate ?"). Response was based on a five-point scale with the 'never to almost always' endpoints: never=1; some of the time =2; about half of the time = 3; most of the time = 4; almost always =5. In this sample, IS performance scale has reliabilities (Cronbach's alpha) of 0.94.

The validity of the IS performance items was assessed using factor analysis. The factor analysis used principal components as the extraction technique and Varimax as the method of rotation. A measure of criterion validity was also used to assess how closely each item was related to the overall performance scale. The criterion used was a global five-point scale measuring overall IS performance : "Overall, how do you evaluate the performance of the application system you currently use ?" The extent to which each item was correlated with this criterion

scale provided a measure of criterion-related validity.

Table 1 presents data on construct validity and criterion-related validity for the IS performance items. The factor analysis resulted in one factor that explained 78.5% of the variance and item loadings ranged from 0.84 to 0.92. The eight-item scale had a correlation of 0.85 with the criterion, the correlations between each item and the criterion ranged from 0.70 to 0.85. These results suggest that the eight-item scale for IS performance has adequate reliability and some evidence of validity.

Table 1. Validity Analysis of the Level of IS Performance

Performance Items	Factor Loadings	Correlation with Criterion
Accuracy	0.86	0.72
Specificity	0.92	0.81
Sufficiency	0.92	0.82
Recency	0.90	0.73
Presentation Format	0.92	0.76
Easy of use	0.89	0.72
Accessibility	0.84	0.70
Flexibility	0.88	0.74

4.3.2. Level of disconfirmation

As most prior studies have manipulated disconfirmation experimentally, the literature on the disconfirmation of expectations provides little precedent for measuring this construct on a self-report instrument. Consequently, this paper measured disconfirmation level in a straightforward manner on the post-use questionnaire. Subjects were asked to rate the information system in terms of the levels they wanted before using the system. A five point scale was used in a way that negative disconfirmation points are assigned with negative scores and positive disconfirmation with positive ones : poorer than I wanted = -2; a little poorer than I wanted = -1 ; just as I wanted = 0 ; a little better than I wanted = 1; better than I wanted = 2. In this way, level of disconfirmation indicates the degree to which perceived actual IS performance exceeds end-users' desires.

4.3.3. End-user computing (EUC) success

Previous research has suggested several surrogate measures for information system success (Melone, 1990; Igbaria, 1993). Surrogate measures for it often include user satisfaction, perceived usefulness, and information system use. Since we agree with the argument of Melone (1990), who pointed out that including separate measures of the various surrogates of IS success in a study is likely to be far more useful than a study employing single success measure, all of these constructs are employed as measures of EUC success.

User satisfaction focuses on a user's affective response toward using specific applications. Previous studies on the measure of end-user satisfaction usually include performance items such as accuracy and timeliness of system's outputs. However, because this study posits that performance items are predictors of user satisfaction rather than subcomponents of a satisfaction construct, we adopted single measure of satisfaction - overall satisfaction. The measure was a global five-point scale measuring "Overall, are you satisfied with the application system ?": very dissatisfied = 1; dissatisfied = 2; moderate = 3; satisfied = 4; very satisfied = 5.

Perceived usefulness is defined as the degree of certainty that using a particular application system will increase his or her job performance within an organizational context. Perceived usefulness was measured with the items developed by Davis (1989). The five usefulness measurement items are: (1) using the system in my job enables me to accomplish tasks more quickly, (2) using the system improves performance in my job, (3) using the system increases my productivity, (4) using the system enhances effectiveness in my job, and (5) using the system makes it easier to do my job. These were measured on a five-point scale with the 'strongly disagree to strongly agree' endpoints. The reliability and validity of this instrument are more fully reported in the previous research (Davis, 1989). In this study, coefficient alpha for the five item scale was 0.91.

System usage was measured using two questions regarding the frequency of contact with the application system (frequency of use) and the degree to which users depend on the system in their daily work (reliance of use). Frequency of use was measured on a five-point scale, with categories for current use : less than once a week, about once a week, 2 or 3 times a week, 4 to 6 times a week, more than once a day. Reliance of use was measured on a five-point scale with the 'very low to very high' endpoints. In this sample, coefficient alpha for the two item scale was 0.94.

4.3.4. Control variables

The rank of end-user was measured on a three-point ordinal scale by a single item measuring three levels of management activities - operational control, management control, and strategic planning.

Task unstructuredness was measured by five questionnaire items that represented its concept : to what extent (1) the task is standardized, (2) the task procedures are documented in the job manual, (3) the objectives and ranges of the task are specified, (4) the task is routinely performed, and (5) the task is simple to carry out. The scoring of each item was done on a five-point scale.

Computing ability was measured by using eleven items based on the instruments developed by Cheney and Nelson (1988): (1) ability to program, (2)

ability to use application development software, (3) ability to use packaged applications software, (4) ability to use office automation systems, (5) ability to build models, (6) ability to access data, (7) ability to handle data communication software, (8) ability to use hardware, (9) ability to utilize graphics techniques, (10) ability to use operating systems, and (11) ability to understand and interpret outputs. With five-point Likert-type scales, individual users were asked to assess their current level of computing ability for each of the eleven items with the 'very low to very high' endpoints. After eliminating two items that decrease reliability of the construct, coefficient alpha for the remaining nine scale was 0.87.

Computer experience was measured by one item, asking the respondents to indicate how many months they had been using any computer software of application systems.

Based on the work of Guimaraes et al. (1992), user involvement was measured by a single item dealing with participation in the development of the application system. Subjects were asked to respond to the following item : "In terms of your contribution to the development of this application system, you have ... ." Response was based on a five-point scale with the following anchors : (1) developed it completely; (2) participated to a great extent; (3) participated to a significant extent; (4) participated to a minor extent; (5) did not participate at all.

Top management support was measured by a two-item scale based on Sanders and Courtney (1985). Each item required the respondents to indicate their agreement or disagreement on a five-point scale ranging from (1) strongly disagree to (5) strongly agree to a statement. The two statements are, first, "In this organization, top management feels that the time and resources spent on the development of computerized information systems is wisely invested," and the second, "In this organization, top management is strongly in favor of the computerization of the business work." Since current study's unit of analysis is an individual and top management variable must be measured at the organizational level, each user's ratings on this top management score was averaged by the number of respondents in the same organization. The reliability of the scale was 0.91.

5. RESULTS AND DISCUSSION

5.1. Zero-order correlation among variables

The data were analyzed for the 150 respondents who answered all the research variables. Table 2 presents descriptive statistics for the independent and dependent variables, including the zero-order correlations.

Table 2. Zero-order Correlations Among Variables

	Mean	SD	Variable Number 2.	3.	4.	5.
Predictor Variables						
1. Performance (PERF)	3.09	0.64	.43***	.45***	.47***	.19**
2. Disconfirmation (DISC)	-0.12	0.75		.65***	.51***	.14*
EUC Success						
3. User Satisfaction (SAT)	3.01	0.92			.50***	.29***
4. Perceived Usefulness (USEF)	3.47	0.72				.32***
5. Degree of Use (USE)	3.53	0.90				—

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

As Table 2 shows, IS performance (PER) was significantly correlated with level of disconfirmation (DISC). That is, as users evaluate an information system highly, they tend to express themselves positively disconfirmed with the system. This high correlation makes sense since an axiomatic positive correlation between performance and disconfirmation is implied : high performance is assumed to result in a positive disconfirmation and low performance in negative disconfirmation.

From this, one could argue that a model including only one of two constructs - performance and disconfirmation - as determinants of success should produce a result similar to that of a model that incorporates both constructs. However, as Oliver and DeSarbo (1974) argued, a disconfirmation effect may exist independently of the performance measure. For example, in the event that one rated a system very highly, he or she could still feel as if the system performed worse than desired, whether these feelings were, in fact, accurate or not. Nonetheless, we believe that both disconfirmation and performance are needed to fully specify user attitudes (user satisfaction and usefulness perception) and user behavior (amount of IS use).

Table 2 shows that both performance (PER) and disconfirmation (DISC) were significantly correlated with three indicators of EUC success - overall satisfaction (SAT), perceived usefulness (USEF), and degree of IS use (USE) in the hypothesized direction. These results, however, do not necessarily support our research hypotheses because other variables are not controlled. As expected, the three indicators of success were positively correlated with one another.

5.2 Hypothesis testing

The hypotheses were tested using a multiple regression model. Each of the three success measures - overall satisfaction (SAT), perceived usefulness (USEF), and degree of use (USE) - were regressed on IS performance (PERF) and disconfirmation (DISC). To control the confounding effects of variables that may influence EUC success, such variables as task unstructuredness (UNSTR), organizational rank of end-user (RANK), end-user's computing (ABILITY) and computing experience (EXP), user involvement in the system development (INV), and top management support (TOP) were also incorporated into the regression model. That is, the regression equation is developed as follows :

$$\text{EUC Success} = \beta_0 + \beta_1 * \text{PERF} + \beta_2 * \text{DISC} + \beta_3 * \text{RANK} + \beta_4 * \text{UNSTR} + \beta_5 * \text{ABILITY} + \beta_6 * \text{EXP} + \beta_7 * \text{INV} + \beta_8 * \text{TOP} + \alpha$$

The regression results of testing the effects of disconfirmation (H1) and performance (H2) on the three EUC success measures appear in Table 3. A shown in Table 3, the regression results indicated the standardized beta coefficients of disconfirmation on overall satisfaction(β = .412, p<.01) and perceived usefulness (β = .256, p<.01) were significantly different from zero when performance and control variables are held constant. The positive sign of the coefficients indicates that the more positively users are disconfirmed with a system, the more satisfied they are with the system and the more useful the system is rated to be. Hence, hypothesis 1 was supported regarding attitudinal measures of EUC success. Contrary to hypothesis 1, however, no significant disconfirmation effect was observed when degree of use was regressed as dependent variable.

Table 3. Multiple Regression Results

Independent Variables	Standardized Beta Coefficients		
	SAT	USEF	USE
1. DISC	.412***	.256***	.264
2. PERF	.224**	.315***	-.155
3. RANK	-.061	-.070	-.188*
4. UNSTR	.068	.039	-.069
5. ABILITY	.190**	.209**	.196*
6. EXP	.009	-.003	.030
7. INV	.159**	.213**	.241**
8. TOP	.210***	.136*	.052
R^2	.566	.408	.160
Adjusted R^2	.537	.369	.105
F-statistic (model)	19.744	10.418	2.874
Significance Level	.000	.000	.006

* p<.1, ** p<.05, *** p<.01

As predicted in hypothesis 2, IS performance was found to exert significant influence on overall satisfaction (β= .224, p<.05) and perceived usefulness (β= .315, p<.01). These indicate that the success of EUC, when measured by overall satisfaction and perceived usefulness, is positively associated with the level of actual IS performance, holding end-users' disconfirmation level and control variables constant. However, the relationship between performance and IS usage was not supported.

It is interesting to note that user behavior (IS usage) was not influenced by the disconfirmation level and actual IS performance, while user attitudes (overall satisfaction and perceived usefulness) were. Although it is difficult to interpret these results, one possible reason may be that computer use is often involuntarily: some people in an organization are obliged to use application systems in accordance with organizational policy or management mandate (Ives et al., 1983). When users operated computer systems involuntary, their desires or perceptions of the system may not influence their overt usage behavior.

The results of the regression test also show that variables other than the disconfirmation and actual IS performance are closely related to the success of EUC. Within our data set, computing ability (ABILITY) and user involvement (INV) were consistently found to significantly influence the measures of EUC success. In addition, top management support (TOP) and the rank of the end-user (RANK) were significantly correlated with attitudinal (i.e., user satisfaction, perceived usefulness) and behavioral (i.e., degree of use) measures of EUC success respectively.

Overall, the regression results suggest that both actual IS performance and disconfirmation have distinct effects on attitudinal measures of EUC success. From these findings, it can be argued that by merely increasing computer system's actual performance alone could not be sufficient for guaranteeing EUC success: the probability of EUC success would be enhanced when actual performance meets or exceeds end-users' desired levels than when not, whether their desires are realistic or not. This is consistent with the basic premise of the disconfirmation theory that negative disconfirmation results in unfavorable attitudes, while positive disconfirmation results in favorable user attitude (Stayman et al., 1992).

6. CONCLUSION AND IMPLICATIONS

This study empirically tested a model that posits that the discrepancy between end-users' desires and actual performance of information system can influence end-user computing (EUC) success. The findings of this study suggest that the success of EUC depends on how users perceive actual performance of an

application system in the context of what they desire from the system.

It should be noted, however, that the results of this study are limited due to methodological and measurement issues. First, since the data were gathered after the applications were implemented, an alternative interpretation of the results is always possible. Though the data permits hypothesis testing, they do not support causal inferences. That is, users may have re-evaluated their desire or perceived performance based upon their satisfaction or perceptions on the usefulness of the applications. It is possible that satisfied users adjust their desires to the actual performance level to reduce cognitive dissonance.

Second, the disconfirmation may not be independent from actual IS performance since this study was conducted by field investigation in a manner that would allow both disconfirmation and perceived IS performance to be related to post-use evaluations. The study's data showed that the disconfirmation's correlation with perceived performance ($r = 0.4320$; $p<0.001$) was significant, suggesting that positively disconfirmed users tend to rate IS performance highly, and vice versa. The significant association between the independent variables (disconfirmation and actual IS performance) in a regression model cause multi-collinearity problem, rendering the standardized beta-coefficients unstable. Hence, the study's results should be cautiously interpreted.

Third, the instruments for measuring information systems performance in this study are not sufficiently validated. Other attributes of information systems performance need to be identified and valid and reliable scales need to be developed to measure it.

Within these limitations, the study clearly shows that users' disconfirmed expectations are important factors in determining the success of EUC. The importance of constructs similar to the users' disconfirmed expectations or expectations gap in the successful implementation of IS could also be inferred from previous research. For example, Ginzberg (1981) found that the differences between the user expectations and the IS expert expectations in an early stage of IS development were significantly correlated with the users' post-implementation satisfaction. Hirschheim and Newman (1988) suggested that users tend to resist from using a system when the system does not meet users' expectations concerning the system's benefits. Recent works conducted by Lawrence and Low (1993) showed that the user's perceptions of the extent to which his or her desires are being represented in the design of a system are key determinants of the user's satisfaction.

From a practical viewpoint, we believe that the findings of this study can make several important contributions. By including separate measures for disconfirmation and perceived performance, managers can assess an information system in terms of whether the system meets each user's desire. From a diagnostic standpoint this

should indicate more precisely the source of dissatisfaction on the part of end-users. On the other hand, by only measuring perceived performance managers may not understand why some users are dissatisfied with an application. It may be that IS performance is actually low or it may be due to increase in the number of aspects or the types of aspects desired in the systems. Understanding changing desires for the systems' outputs and interface may therefore help in improving existing IS, developing new IS development, and training the end-users.

Also, some implications for practicing managers can also be derived from the proposed model. The model suggests that the success of EUC is function of the discrepancy between desired IS performance and perceived IS performance. If users' desires play a significant role in their satisfaction with the information system and usefulness perceptions, the vendors or systems developer should pay more time and efforts in identifying correct and complete set of end-user desires. To minimize the gap between user desires of information systems quality and IS developers' interpretations of the user desires, active communications between end-users and systems developers should be facilitated at an early stage of IS development (Doll and Torkzadeh, 1989; Lawrence and Low, 1993).

Further research is needed to identify the factors influencing user desires. Research focusing on the impact of these factors on user desires of information systems will have useful implications for developers in identifying the characteristics and features of an information system that should be more carefully considered. It is also encouraged to replicate this study to validate and generalize the study's findings in other research contexts and locations.

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