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# Extending the Understanding of End User Information Systems Satisfaction Formation: An Equitable Needs Fulfillment Model Approach[1]

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## Abstract

*End user satisfaction (EUS) is critical to successful information systems implementation. Many EUS studies in the past have attempted to identify the antecedents of EUS, yet most of the relationships found have been criticized for their lack of a strong theoretical underpinning. Today it is generally understood that IS failure is due to psychological and organizational issues rather than technological issues, hence individual differences must be addressed. This study proposes a new model with an objective to extend our understanding of the antecedents of EUS by incorporating three well-founded theories of motivation, namely expectation theory, needs theory, and equity theory. The uniqueness of the model not only recognizes the three different needs (i.e., work performance, relatedness, and self-development) that users may have with IS use, but also the corresponding inputs required from each individual to achieve those needs fulfillments, which have been ignored in most previous studies. This input/needs fulfillment ratio, referred to as equitable needs fulfillment, is likely to vary from one individual to another and satisfaction will only result in a user if the needs being fulfilled are perceived as "worthy" to obtain.*

*The partial least squares (PLS) method of structural equation modeling was used to analyze 922 survey returns collected form the hotel and airline sectors. The results of the study show that IS end users do have different needs. Equitable work performance fulfillment and equitable relatedness fulfillment play a significant role in affecting the satisfaction of end users. The results also indicate that the impact of perceived IS performance expectations on EUS is not as significant as most previous studies have suggested. The conclusion is that merely focusing on the technical soundness of the IS and the way in which it benefits employees may not*

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*be sufficient. Rather, the input requirements of users for achieving the corresponding needs fulfillments also need to be examined.*

**Keywords**: User satisfaction, information systems, measurement, equitable needs fulfillment, equity, expectations, IS implementation, PLS

## Introduction

End-user satisfaction (EUS) is one of the most widely used measures in assessing the success of an information system (Delone and Mclean 1992), and also is particularly critical in IS implementation. Several studies have suggested that IS failures are due to psychological and organizational issues, rather than technological issues (Garrity and Sanders 1998; Regan and O'Connor 1994). One of the main issues in the failure of IS projects is a lack of support and commitment from users (Udo and Guimaraes 1994). Information systems do not independently fulfill the needs of users. They require people to exploit their capabilities before producing organizational benefits. Therefore, in addition to having a sound technical system, it is also necessary to ensure that employees are both willing and able to use the new technology. Several previous studies have discovered that there are strong relationships between user satisfaction and intended use or actual use of IS (Athanassopoulos et al. 2001; Iivari 2005), which can serve as useful predictors of IS implementability (Iivari and Ervasti 1994).

To improve EUS, understanding the antecedents of EUS or the factors affecting the formation of user satisfaction is crucial for organizations before, during, and after the implementation of an information system. A large amount of previous research was concerned with factors that influence IS user satisfaction (Bailey and Pearson 1983; Doll and Torkzadeh 1988; Ives et al. 1983). However, the assumption made by many researchers that a technically well-performing information systems will automatically lead to higher user satisfaction has not been consistently demonstrated (Goodhue and Thompson 1995). More importantly, many current measures of user satisfaction have been criticized for lacking a strong theoretical underpinning (Aladwani 2003; Goodhue and Thompson 1995; Melone 1990). The use of expectancy disconfirmation theory represents a good initial step toward the development of an IS satisfaction theory. Yet, Khalifa and Liu (2004) considered application of expectancy disconfirmation theory in the IS context questionable. Indeed, with the dynamic nature of IS development and advancement, it may be difficult for users to articulate accurate expectations of IS performance. In some cases end users may have no prior expectations or are unaware of what an information system can offer. Hence, previous models may not have fully captured the real reasons for such differences, nor explained fully the underlying reasons for end-user satisfaction or dissatisfaction with IS use.

Based on equity (Adams 1965) and needs theories (Alderfer 1969), a new EUS model is proposed. Each individual user benefit received (needs fulfilled) is compared against the corresponding input required with IS use. The three equitable needs fulfillments proposed in the new EUS model were conceptually described in Au et al. (2002). This paper is a follow-up study, with the primary objective being to test empirically the key concepts and relationships of the theoretical EUS model that incorporates the three new constructs of equitable work performance fulfillment, equitable relatedness fulfillment, and equitable self-development fulfillment as references for comparison. The secondary objective is to explore their relative impact on EUS. It is believed that the model provides a more comprehensive theoretical framework to investigate the underlying factors affecting EUS. Hence the research question of this study is: *What are the antecedents of IS satisfaction formation under the increasingly advanced and dynamic IS environment?* Such information can help managers identify the strengths and weaknesses of their current information system, which can guide them to plan for more fruitful IS development in the future.

## Background and Research Model

### General Background

User satisfaction has continued to be an important topic for IS researchers (Aladwani 2003; Melone 1990; Whitten 2004-2005). Yet progress on theoretical development for understanding the way in which EUS was created in the early days seems to be taking place very slowly. A comprehensive review of factors that affected EUS in the past can be found in the studies by Myers (1994), Au et al. (2002), and Shaw et al. (2003). However, not only were most of the relationships found in earlier studies lacking a strong theoretical underpinning, contradictory or mixed results have also been reported on the relationships between EUS and different user variables (such as user demographics), and user involvement and participation (Ang and Soh 1997; Benard and Satir 1993). On the other hand, technological frames of reference and personality (e.g., self-monitoring, moods, and self-awareness) continue to be popular foci in recent EUS studies (Aladwani 2003; Shaw et al. 2003). However, not all of the personality attributes identified in the Aladwani (2003) study have a significant impact on EUS.

It was not until the 1990s that new variables such as equity (Joshi 1990, 1992), training method (Simon et al. 1996), task uncertainty (Kim et al. 1998), task complexity (McKeen et al. 1994), user source of power (Cho and Kendall 1992), and cognitive ability (Simon et al. 1996) were included in EUS research as factors affecting EUS. In the late 1990s, several researchers started proposing new models such as the CUSP model (Sethi and King 1998) and the task contingent model (Kim et al. 1998). Unlike previous approaches, these models were based on various theories in an attempt to understand the EUS construct. Yet there are still gaps in the ability of these researchers to either generalize their models to embrace broader IS fields under different platforms or to validate their models with actual data. For instance, the CUSP model assumes a nonlinear relationship between IS satisfaction and different IS-related attributes. Yet Sethi and King conducted the study with only two control variables (level of involvement and extent of use) based on a relatively small sample of 55 faculty members in a U.S. academic institution. It is doubtful that such a nonlinear relationship exists across different sectors under different IS environments. Similarly, Woodroof and Kasper (1998) suggested that for an IS to be considered successful, it must be designed to enhance the user process and outcome satisfaction based on equity, expectancy, and needs theories. Although Woodroof and Kasper pointed out that any dimension of user affective response could be mapped into the model, it is not yet clear how this would be achieved and operationalized without getting too complicated. In practice, most of the inputs and returns being evaluated are intrinsic and subjective to an individual, so it would be very difficult to know and directly compare the input-return ratios of others. It is also questionable why the equity theory merely focuses on the fairness of the process but does not center on the outcome. In addition, the model is yet to be validated with actual data. To address the above issues, a closer examination of what satisfaction is and how the theories of satisfaction can better be applied to the IS environment is needed.

Landy and Becker (1987) identified three theories of motivation—expectancy theory, needs theory, and equity theory—that use satisfaction as the dependent measure. Indeed, by integrating these three well-founded theories of organizational behavior, it is possible to gain more insights into the formation of EUS, which in turn can help IS researchers and practitioners fill the existing gaps and overcome the deficiencies identified above.

## Expectancy Theory and Satisfaction

Oliver (1997) defined product satisfaction as the consumer's pleasurable level of consumption-related fulfillment response. Fulfillment can only be judged with reference to a standard that forms the basis for comparison; hence, disconfirmed expectation has been widely accepted as one of the key reference standards and determinants of consumer satisfaction (Oliver 1989; Stayman et al. 1992). It is one of the primary theories for explaining satisfaction in the marketing literature (Yi 1990). A number of IS researchers also found that the expectations of IS end users have an impact on their levels of overall satisfaction with the information system (Bhattacherjee 2001; Ryker et al. 1997). While contradictory findings have been obtained for the relationships between disconfirmed expectation and user satisfaction (Churchill and Surprenant 1982; Tse and Wilton 1988), it is believed that such a problem is mainly due to the different types of hierarchical expectations (ranging from desired to minimally tolerable) that consumers bring to product experiences during the evaluation process (Spreng and Olshavsky 1992).

## Equity Theory and Satisfaction

Equity theory (Adams 1965) has been applied in consumer behavior research as a determinant of transaction or product satisfaction (Oliver and Swan 1989). It has received relatively firm empirical support (Austin and Walster 1974; Carrell and Dittrich 1978; Goodman and Friedman 1971). Equity theory in its most pristine form suggests that an individual will feel dissatisfied if his/her own inputs are greater than the benefits achieved, regardless of the benefit-input ratios of other people (Pritchard 1969; Oliver 1980). Such a concept can also be found in Howard and Sheth (1969, p. 145) definition of satisfaction as "the buyer cognitive state of being adequately or inadequately rewarded for the sacrifice he has undergone." According to Adams (1965), input is regarded as what an individual perceives to be his/her contribution to an exchange, for which a just return is expected. In an IS environment, while similar concepts can be found in the studies of Boddy et al. (2002), Goodhue and Thompson (1995), Joshi (1989), and Mahmood et al. (2000) in predicting satisfaction, the inputs and benefits for IS end users are either not clearly specified or too narrowly defined. For example, Woodroof and Kasper (1998) and Goodhue (1998) identified only physical effort and time as the major inputs of IS end users with the use of the system.

## Needs Theory and Satisfaction

A basic assumption of all of the theories of needs is that when deficiencies of a need exist, individuals are motivated to take action to remove them in order to satisfy the need (Steers and Porter 1991). Needs fulfillment has been found to be a significant correlate of satisfaction (Oliver 1995). The needs theory is primarily based on the work of Alderfer (1969),

Herzberg et al. (1959), Maslow (1943), and McClelland (1965). One of the major commonalities of these theories is that different types of needs do exist among human beings. It has been argued in consumer behavior research that satisfaction is more likely to be determined by the extent to which product performance fulfills innate needs, rather than the extent to which performance compares with prepurchase expectations (Sirgy 1984). Hence, the emphasis that an individual places on different categories of needs is critical to predicting satisfaction. Although a number of IS studies have included the concept of meeting the user's needs as part of the measure of an overall user-satisfaction construct (Bailey and Pearson 1983; Goodhue 1998), few, if any, considered that IS end users have different types or hierarchical levels of needs. For instance, the technology acceptance model focuses mainly on how useful information systems are in meeting the end user's job performance-related needs, whereas the higher level of intrinsic needs have largely been ignored. Ironically, it is often the unawareness of these intrinsic needs, such as social and self-development needs, that has potentially caused a lot of user resistance in IS implementation (Wang 1997).

## An Equitable Needs Fulfillment Model

In view of the deficiencies in previous approaches, a new model, shown in Figure 1, is proposed by incorporating all three theories of motivation. It is believed that the new model will offer higher explanatory power beyond the current models, and will uncover the psychological processes of end users in transforming IS performance into different levels of satisfaction or dissatisfaction.

### End User IS Satisfaction

With reference to Oliver (1997) and Doll and Torkzadeh (1988), EUS in this research is defined as the IS end-user's overall affective and cognitive evaluation of the pleasurable level of consumption-related fulfillment experienced with IS. The output of the comparison evaluation will be the overall EUS construct. Based on expectancy disconfirmation theory, equity theory, and needs theory, EUS is proposed as a function of IS performance, IS performance expectations, equitable work performance fulfillment, equitable relatedness fulfillment, and equitable self-development fulfillment.

### IS Performance

Based on the definitions in Laudon and Laudon (2000), *information system* in this study is defined as a set of interrelated components that consist of technology, organizational environment, and people who collect, process, store, and distribute information to support decision making and control in an organization. *IS performance* is defined as the perceived outcome from IS use. The commonly used IS attributes in many previous studies can be classified into three groups: system quality, information quality, and support services quality (Myers et al. 1997; Tafti 1995). Performance of product attributes is one of the primary standards of comparison by which satisfaction is assessed (Oliver 1997). A number of previous studies have found a relationship between perceived performance and satisfaction (Suh et al. 1994; Tse and Wilton 1988), as in the case for IS (Iivari 2005; Tan and Lo 1990). Hence, the higher the performance level of an IS, the higher the level of user satisfaction. This is represented by the link H1 in the model.

**Hypothesis 1:** Higher levels of IS performance result in higher levels of EUS.

### IS Performance Expectation

*User expectations of IS* are defined as "a set of beliefs held by the targeted users of IS associated with the eventual performance of IS and with their performance using the system" (Szajna and Scamell 1993, p. 494). A number of studies have found support for the influence of predicted expectations (e.g., beliefs in the likelihood of a given level of performance from the existing product) on satisfaction (Swan and Trawick 1980; Tse and Wilton 1988). Other studies on expert systems have found a strong positive correlation between expectations, improved performance, and satisfaction levels too (Mahmood et al. 2000; Yoon and Guimaraes 1995). Due to the limitations of data accessibility (before and after IS use), recalled expectations are often used as a substitute for predicted expectations, as the former are generally believed to be more influential and realistic (Zwick et al. 1995). This means that respondents are likely to have implicitly taken current system performance into account. It also eliminates the need to measure expectation disconfirmation. It is proposed that the higher the levels of expectations with regard to IS performance are, the higher the levels of satisfaction will be due to the so-called "halo" effect. This leads to the next hypothesis, which is represented by the link H2 in the model.

**Hypothesis 2:** Higher levels of IS performance expectations result in higher levels of EUS.

### Equitable Needs Fulfillment

In the IS environment, with reference to the ERG needs category set (i.e., existence, relatedness, and growth), it is pro-

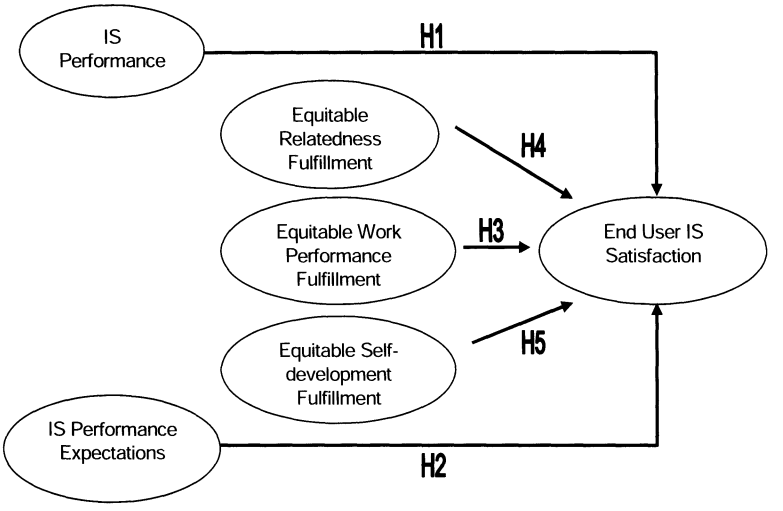


Figure 1. An Equitable Needs Fulfillment Model

posed that the IS fulfills three categories of needs of IS end users: work performance fulfillment, relatedness fulfillment, and self-development fulfillment. Alderfer's (1972) needs categories are chosen as a basis because, in the initial study, the scale he developed received significant convergent and discriminate validity support, and this was further supported in a follow-up study (Schneider and Alderfer 1973). It has also been preferred by other researchers for measuring categories of needs (Lussier et al. 2000; Wanous and Zwany 1977). The identification of three separate needs fulfillments is likely to reveal more insights and additional information on the way in which various needs affect EUS.

Work performance fulfillment refers to the user needs that are fulfilled from using an IS at the workplace in carrying out assigned job duties. These are the basic and fundamental needs that an information system is expected to fulfill. Typical examples include the improvement of work efficiency, functional effectiveness, and service quality (Laudon and Laudon 2000; O'Brien 2004). Relatedness fulfillment includes all the socially oriented needs of the user that require interactions with other human beings. Examples of such needs that are obtained from an information system include recognition and status, social relations, and power and control (Alter 1999; Eason 1988). Finally, self-development fulfillment focuses on the user higher-order needs, in terms of individual self-growth and self-advancement, that are brought about by using the information system in areas such as job promotion, work challenges, and job security (Eason 1988; Regan and O'Connor 1994; Rosenberg 1997).

### *Significance of the New Approach*

An end user satisfaction with an IS depends not only on the levels of different needs being fulfilled (i.e., benefits received) but also whether the effort (i.e., inputs) required to fulfill each category of those needs is worthy or not. The ratio between benefits and inputs is referred to as ***equitable needs fulfillment***. The main contribution of the new model is to recognize that a user's rating of the benefits that an IS can bring depends on the amount of effort or input that is required to gain those benefits. Simply asking an end user to give an indication of the level of benefits and inputs independently resulting from IS use is unlikely to uncover the underlying reasons for EUS. Using an equity approach forces the user to compare the worth of each benefit gained against the corresponding inputs made in order to gain the benefit. In addition, both the inputs and benefits for IS end users cover a much broader range than those suggested by Goodhue and Thompson (1995) or Joshi (1990).

The new approach is also different from the traditional cost-benefit measurement, where the cost-benefit identification is from an organizational perspective, instead of from an individual perspective. Employment is essentially a relationship of exchange. The fact that an individual employee is dissatisfied may simply be because the benefits obtained from an IS, even if they are better than expected, are not fair or worthy of the large inputs required from the user. The belief is that possession of the benefit-input ratio by an individual partly explains, as predicted by equity theory, the varied

levels of user satisfaction with the information system. Such information is certainly useful in providing management with more insights into the impact of the IS during its implementation.

### Measurement of Equitable Needs Fulfillment

Many of the negative impacts of the use of an IS as identified in the literature are likely to be the inputs or costs incurred by an IS end user. This input refers to what a user may need to invest or sacrifice in using the IS in the hope of obtaining a desirable benefit. The input of an individual may include cognitive or intellectual effort in learning to use the IS, or physical effort and time, as identified in the studies of Woodroof and Kasper (1998) and Goodhue and Thompson (1995). Other possible inputs or negative impacts of the use of an IS may consist of extra work load and work stress (Alter 1999; Rosenberg 1997), a reduction in social contact, and a diminishing recognition of non-IT experiences and traditional skills (Boddy et al. 2002; Regan and O'Connor 1994), all of which have been reported in the literature. Unlike other product consumers, IS end users rarely have to purchase the system for their use, so financial costs are not normally considered to be an input.

The benefits are measured in terms of the levels of three different categories of needs fulfillment that result from the use of an IS, as identified above. Hence, they are referred to in the model as equitable work performance fulfillment, equitable relatedness fulfillment, and equitable self-development fulfillment. It is believed that when perceived benefits are more than the inputs required (i.e., using the IS generates a needs-fulfillment-to-input ratio of greater than 1), according to equity theory prediction, it is likely that the user will be satisfied and vice versa (Au et al. 2002). The next three hypotheses, represented by links H3, H4, and H5 in Figure 1, are as follows:

**Hypothesis 3:** Higher levels of equitable work performance fulfillment result in higher levels of EUS.

**Hypothesis 4:** Higher levels of equitable relatedness fulfillment result in higher levels of EUS.

**Hypothesis 5:** Higher levels of equitable self-development fulfillment result in higher levels of EUS.

## Research Methodology

### Sampling Design

The population of this study included the hotel and airline industries as representatives of the service sector. The sampling frame for the hotel industry was obtained from the *Hong Kong Hotels Directory* published by the Hong Kong Hotels Association in 2001. A total of 78 member hotels are listed in the directory. The sampling frame for the airline industry was obtained from an internal database compiled by an industry expert. A total of 23 airlines were identified as having a local office in, and travel routes to, Hong Kong. Target departments were restricted to those in which employees frequently need to use the IS at work and who also have direct contact with customers. For the hotel industry, typical examples included the front office and food and beverage. For the airline industry, counter check-in, ticketing, and reservations were chosen for this study.

A disproportionate stratified sampling technique was adopted in this study, in which a subsample is randomly drawn from within each stratum (i.e., department) in the sampling frame. In order to make comparison between different strata meaningful, the percentage of samples drawn from each stratum was higher if the number of participating companies was small, or if the total number in each stratum in proportion to the overall population was small. A letter was initially sent to the general managers or executive directors of the organizations within the sampling frame to solicit their support to participate in the study. Upon their agreeing to participate, they were asked to refer to the researchers the names of the relevant department heads for further contact. A total of 1,950 questionnaires (790 for airlines; 1,160 for hotels) were distributed to companies in the two industries. A structured questionnaire was developed based on a review of prior studies and feedback from a focus group interview. The instrument was then refined in a pretest and pilot test.

### Response Analysis and Sample Characteristics

Following the single round of data collection, a total of 922 usable questionnaires were obtained. The response rate from the hotel sector was 61 percent (i.e., 709) while from the airline sector it was 27 percent (i.e., 213). The detailed breakdown of the response rates by area for each company is shown in Appendix A. The distributions of position grade and gender between the front office and the food and bever-

age departments in the hotel sector were rather different. The majority of staff working in the front office were ranked as operational staff (46.9 percent), followed by supervisory staff (31 percent), and then by management (19.9 percent). The distribution of gender was skewed toward females (60.8 percent). By contrast, the food and beverage department had a relatively higher percentage (51.6 percent) of employees at the supervisory level, who were mostly male (66.3 percent). With respect to age of respondents, the front office samples tended to be younger than the food and beverage samples. The majority of the former samples fell in the category of 22 to 29 years old (50.4 percent) and 30 to 39 years old (32.5 percent), whereas the reverse was the case for the food and beverage department.

As for the airline sector, the distributions of position grade, gender, and age were similar to those in the front office of the hotel sector. All three sections—reservation, ticketing, and counter check-in—featured a high (68 percent) to very high (88 percent) percentage of employees at the operational level. Female employees in the age group of 22 to 39 years were the dominant workers in the airline sector, as is common in the service industry.

## *Instrument Development*

Six constructs are measured in this study based on seven-point Likert scales: IS performance, IS performance expectations, equitable work performance fulfillment, equitable relatedness fulfillment, equitable self-development fulfillment, and EUS. Details of all of the measures and their sources are listed in Appendix B.

### IS Performance

Based on the prior research findings mentioned earlier, and especially on the often-cited instrument developed by Baroudi and Orlikowski (1988), the major dimensions of IS performance used in this study are information quality, system quality, and system support services. Although system quality was not mentioned in Baroudi and Orlikowski's measurement, it was, however, included in many other instruments (see Bailey and Pearson 1983; Delone and McLean 1992). It has also been suggested that EUS is a product of information satisfaction, system satisfaction, and support satisfaction (Tafti 1995). User involvement is omitted from the model as high labor turnover is typical in the service industry, and it is expected that many IS end users have no opportunity to participate in the design of the IS that they use to perform their job functions. However, certain sectors in the service industry such as hotels and airlines feature a piece-meal approach to IS use, whereby many independent information systems are used in various individual departments (Ashford et al. 1997). Determining whether the output from the information system is useful to the end user often depends on how it is integrated with other relevant systems in the organization (Kasavana and Smith 1992). Hence, an additional attribute—system integration—is added as one of the items within the dimension of system quality. There are nine items (scales) to measure information quality, six items to measure system quality, and six items to measure system support quality. To simplify the analysis and presentation, summated scales were used to measure each dimension of IS performance, and the resulting three summated scales form the IS performance construct.

### IS Performance Expectations

IS performance expectations were measured by asking the respondents to evaluate the quality of IS performance originally expected given their current experience. The measurement items are based on the same 21 IS performance attributes in terms of the 3 dimensions identified above. The items were all expressed in the first person to ensure that subjects responded based on their own personal feelings and not their opinion of how others feel. Similar approaches were used in Tse and Wilton (1988). Again, to simplify the analysis and presentation, summated scales were used to measure each dimension of the construct of IS performance expectations.

### Equitable Work Performance Fulfillment

Equitable work performance fulfillment refers to the ratio of benefits in terms of work performance fulfillment to inputs. Based on equity theory, the more benefits gained in comparison with the inputs required, the higher the ratio will be. Previous measures of equity have typically involved asking respondents to compare benefits and inputs, and to judge whether the deal is a fair one (Joshi 1989 1990). The measurement of the three kinds of equitable needs fulfillment in this study adopts a similar approach.

The two benefits of work performance fulfillment are "helping to work more efficiently and effectively" and "helping to improve service quality." Examples of improving work efficiency and effectiveness may be better decision-making or higher productivity. For inputs, five indicators are identified from the literature: time required to learn to use the system, intellectual skills required to learn to use the

system or interpret the information generated, work pressure and stress the user faces, physical strain the user suffers, and gradual reduction in the recognition of the user's non-IT experiences/ skills. These five inputs are also applied to the measurement of equitable relatedness fulfillment and equitable self-development fulfillment. The respondents were asked to compare each input against each benefit obtained and evaluate whether or not it is fair. This gives a total of 10 items for measuring this construct.

#### Equitable Relatedness Fulfillment

Equitable relatedness fulfillment refers to the ratio of benefits in terms of relatedness fulfillment to inputs. The two benefits of relatedness fulfillment are "higher recognition/better relationships and communications with colleagues" and "more power and control over colleagues." Again, the respondents were asked to compare each input against each benefit obtained and to evaluate whether or not it is fair. This gives a total of 10 items for measuring this construct.

#### Equitable Self-Development Fulfillment

Equitable self-development fulfillment refers to the ratio of benefits in terms of self-development fulfillment to inputs. The two benefits of self-development fulfillment are "job security" and "career advancement/meeting new challenges." Again, the respondents were asked to compare each input against each benefit obtained and to evaluate whether or not it is fair. This gives a total of 10 items for measuring this construct.

#### End User Satisfaction

The use of a single-item measure for EUS has been criticized as unreliable as it is likely to incur a large measuring error (Zviran and Erlich 2003). Other studies using various product-service attributes to operationalize the EUS construct have also created a lot of confusion as these are also commonly regarded as factors affecting EUS, rather than measures of EUS themselves. As defined earlier, overall EUS refers to affective and cognitive evaluation of the entire IS user experience; hence, its measure must take an individual emotions as well as cognition into consideration. Oliver (1989) suggested that an individual has four possible different adaptive states or response modes for satisfaction: content, pleasure, delight, and relief. Each response mode is distinguished from the others by the nature of the cognitions, attributions, and emotions operating during product consumption. In this study, five items are selected as being relevant to measuring overall EUS: being contented, pleased, delighted, relieved, and satisfied. The measures for overall satisfaction are therefore designed to measure both high- and low-intensity reactions as used by Spreng et al. (1996).

### Pretest and Pilot Test

A pretest of the survey was carried out to improve the face validity of the instrument. A small focus group interview was conducted with 10 part-time students who were working either in the hotel or airline industry, and who had over 5 years' worth of experience in the related industry. Feedback was gathered on the applicability of the items used to measure each construct in the related industry, the layout of the questionnaire, the time required to complete the questionnaire, and the conciseness of the sentence structure and wording used. As a result, one item—ability of support staff to keep accurate records—was added to the measure for the support service dimension within the IS performance construct, and five items related to service quality benefits were removed from the equitable work performance construct. In addition, six items related to costs in terms of skills required, physical strain, and nonrecognition of non-IT skills were removed from the equitable relatedness fulfillment construct. Finally, four items related to costs in terms of physical strain and time consumption were removed from the equitable self-development fulfillment construct. The reasons for the removal of each of these items are detailed in Appendix C.

A pilot test was conducted using the improved survey instrument that resulted from the pretest to assess the validity and reliability of the instrument before the questionnaire was distributed to the chosen samples in the field. To establish content validity, a convenience sample of 65 questionnaires was distributed to part-time students working in either the hotel or airline industry, and to the departments within the sampling frame. To assess the reliability of the measures, Cronbach alpha coefficient was used. To further validate the scale items, an exploratory factor analysis with a principal component method was conducted for each construct and subconstruct to establish unidimensionality. To determine the appropriateness of performing the factor analysis, the Kaiser-Meyer-Olkin measure of sampling adequacy was calculated, and the Barlett test of sphericity was conducted. All of the items with a poor factor loading (less than 0.70) were removed from further analysis. The results are summarized in Appendix D and the finalized items contained in the instrument are shown in Appendix E.

## Data Analysis and Results

### Measurement Model Assessment

The research model was tested using the partial least squares (PLS) method of structural equation modeling (PLS-Graph version 3) in view of PLS method's ability to handle formative constructs and highly complex predictive models. Unlike reflective indicators, whereby the latent variable causes the observed variables, formative indicators can be viewed "as causing rather than being caused by the latent variable measured by the indicators" (Diamantopoulos 1999, p. 444). The acceptability of the measurement model was assessed by the reliability of individual items, internal consistency between items, and the model's convergent and discriminant validity. Those items that share a high degree of residual variance with other items in the instrument were eliminated from further analysis (Gefen et al. 2000; Gerbing and Anderson 1988). Table 1 shows the composite reliability, average variance extracted (AVE), and square root of the AVE, as well as the correlations between the constructs. The composite reliability values of all of the constructs were above the recommended level of 0.70, indicating adequate internal consistency (Bagozzi and Yi 1988). Convergent validity is demonstrated as the AVE values for all constructs were higher than the suggested threshold value of 0.50 (Fornell and Larcker 1981). Comparing the square root of the AVE (bold figures on the diagonal) with the correlations among the constructs indicates that each construct is more closely related to its own measures than to those of other constructs, and discriminant validity was therefore supported (Chin 1998).

The weights (for formative items), loadings (for reflective items), and their t-values are shown in Table 2. Unlike reflective items (i.e., items caused by a latent construct), for formative items (i.e., items themselves causing a latent construct) only the weights rather than the loadings need to be considered in assessing the measurement model (Chin 1998). It can be seen that the loadings for all the constructs with reflective measures were well above the 0.70 guideline and statistically significant at the 0.01 level (Hair et al. 1998). Similarly, the weights for the formative measures were also statistically significant at the 0.01 level, indicating satisfactory item reliability for both the reflective and formative measures.

### Structural Model Assessment and Hypothesis Testing

Figure 2 presents a graphical depiction of the PLS results, which shows the standardized path coefficients among the constructs using the bootstrap resampling method and the $R^2$ value for EUS. As hypothesized, IS performance is positively correlated with EUS, with a path coefficient of 0.45 and a significant t-value of 13.12 at the 0.05 level of significance. Hypothesis H1 was supported. The paths from equitable work performance fulfillment (H3) and equitable relatedness fulfillment (H4) to EUS were also found to be positive and significant, with path coefficients of 0.19 ($t = 3.40$) and 0.17 ($t = 3.51$) at the 0.05 level of significance, respectively. Hypotheses H3 and H4 were also supported. These constructs explained over half (53.5 percent) of the variance of EUS.

Against expectations, IS performance expectations and equitable self-development fulfillment have no significant effects (with $t = 1.39$ and $t = 1.71$, respectively) on EUS as shown by the two dotted lines. Hypotheses H2 and H5 were not supported. To gain further insight into the possibility of interaction effect of IS performance expectations on the IS performance/EUS relationship, an interaction score was computed by multiplying the scores for IS performance and IS performance expectations. The results give a standardized path coefficient of 0.435 from IS performance to EUS, –0.013 from IS performance expectations to EUS, and an insignificant interaction effect of 0.059 ($t = 1.5475$) with a total $R^2$ of 0.538. Hence there was insufficient evidence of a moderating influence of IS performance expectations on the relationship between IS performance and EUS.

An additional analysis was also performed in order to highlight the significant impact of the three equitable needs fulfillment constructs on EUS. This was done by comparing the amount of variance explained between the full and the reduced models (i.e., removing all of the equitable needs fulfillment constructs) using the F-test. The resulting $f^2$ value was 0.202. Cohen (1988) suggested that the values of 0.02, 0.15, and 0.35 be used as operational definitions of small, medium, and large effect sizes, respectively. This provides further reinforcement that the inclusion of the three equitable needs fulfillment constructs as antecedents of EUS has in fact enhanced our understanding of the factors that drive EUS.

Data analysis using the PLS method was also performed by subindustry. It was found that there was little difference in the model fit. The total variance ($R^2$) of EUS for the hotel industry explained by the five constructs was 53.6 percent, whereas for the airline industry it was 56.8 percent, compared with the combined impact of 53.5 percent in the original full model. In terms of hypothesis testing results, they were almost the same as the original model except for H4 in the airline industry, where there was no significant impact of equitable relatedness fulfillment on EUS.

**Table 1. Inter-Construct Correlations: Consistency and Reliability Tests**

| Construct | Composite Reliability | *AVE | IS_Per | IS_Exp | Equ_Re | Equ_Sd | Equ_Wp | EUS |
|---|---|---|---|---|---|---|---|---|
| IS_Per | 0.929 | 0.813 | **0.902**† | | | | | |
| IS_Exp | 0.967 | 0.907 | 0.480 | **0.952** | | | | |
| Equ_Re | 0.892 | 0.734 | 0.505 | 0.274 | **0.857** | | | |
| Equ_Sd | 0.900 | 0.692 | 0.542 | 0.296 | 0.726 | **0.832** | | |
| Equ_Wp | 0.870 | 0.627 | 0.583 | 0.328 | 0.679 | 0.745 | **0.792** | |
| EUS | 0.925 | 0.804 | 0.664 | 0.304 | 0.564 | 0.567 | 0.604 | **0.897** |

†The shaded numbers on the diagonal are the square root of the variance shared between the constructs and their measures. Off-diagonal elements are correlations among constructs. For discriminant validity, diagonal elements should be larger than off-diagonal elements.
* Average Variance Extracted

**Table 2. Weights, Loadings, and t-statistics for the Full Model**

| Construct | Measurement Item | Weight | Loading | T-statistics |
|---|---|---|---|---|
| **IS Performance (Reflective)** | | | | |
| inf | Information quality | | 0.912 | 41.973* |
| sys | System quality | | 0.934 | 51.189* |
| sup | System support service quality | | 0.857 | 27.241* |
| **IS Performance Expectations (Reflective)** | | | | |
| exp_inf | Information quality expectations | | 0.950 | 29.852* |
| exp_sys | System quality expectations | | 0.959 | 32.730* |
| exp_sup | System support service quality expectations | | 0.949 | 29.372* |
| **Equitable Work Performance Fulfillment (Formative)** | | | | |
| wp_time1 | Helps me to work more efficiently and effectively vs. the time required to learn to use the software/system | 0.384 | | 6.099* |
| wp_skil1 | Helps me to work more efficiently and effectively vs. the intellectual skills required to learn to use the software/system and interpret the information generated | 0.323 | | 4.891* |
| wp_stre1 | Helps me to work more efficiently and effectively vs. the level of work pressure and stress faced | 0.331 | | 4.893* |
| wp_nit1 | Helps me to work more efficiently and effectively vs. the gradual reduction in the recognition of non-IT experiences and skills at work | 0.216 | | 3.460* |
| **Equitable Relatedness Fulfillment (Formative)** | | | | |
| re_stre1 | To have higher recognition and better relationships/communication with colleagues at work vs. the level of work pressure and stress faced | 0.445 | | 6.937* |
| re_time2 | To have more power and control vs. the time required to learn to use the software/system | 0.475 | | 7.480* |
| re_stre2 | To have more power and control vs. the level of work pressure and stress faced | 0.242 | | 3.239* |
| **Equitable Self-Development Fulfillment (Formative)** | | | | |
| sd_skil1 | Allows me to secure my job vs. the intellectual skills required to learn to use the software/system and interpret the information generated | 0.376 | | 4.849* |
| sd_stre1 | Allows me to secure my job vs. level of work pressure and stress faced | 0.234 | | 3.504* |
| sd_nit1 | Allows me to secure my job vs. the gradual reduction in the recognition of non-IT experiences and skills at work | 0.198 | | 2.649* |
| sd_skil2 | Opportunity for career advancement and meeting new challenges at work vs. the intellectual skills required to learn to use the software/system and interpret the information generated | 0.382 | | 5.708* |
| **EUS (Reflective)** | | | | |
| contented | I am very contented with the information system | | 0.877 | 41.541* |
| delighted | I am delighted with the information system | | 0.917 | 46.431* |
| satisfied | Overall, I am very satisfied with the information system | | 0.896 | 43.360* |

*Significant at .01 level

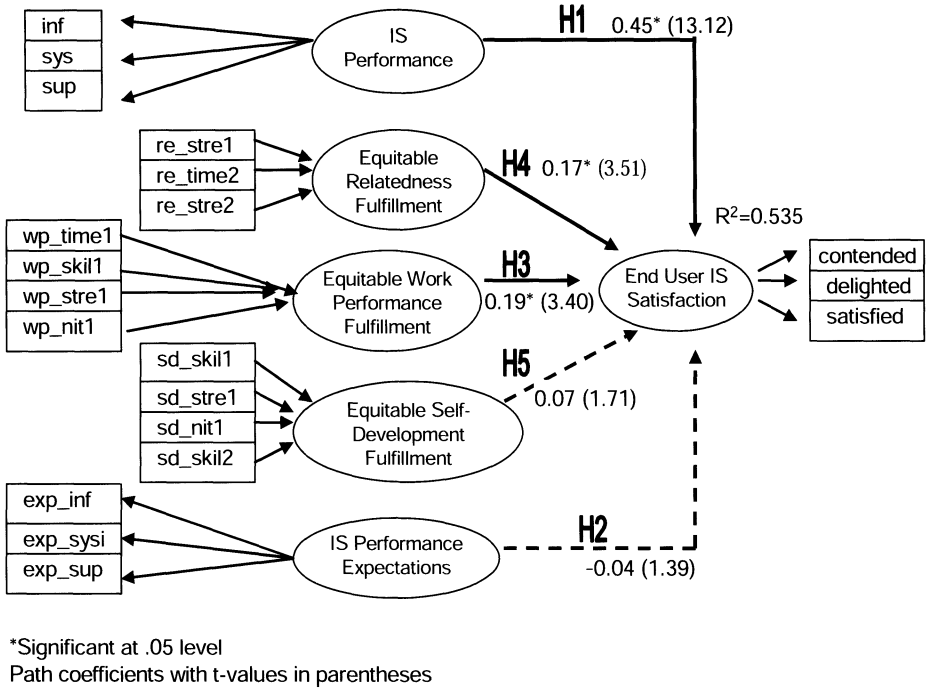


Figure 2. Results

## Discussion

This study seeks to provide a theoretical framework to investigate the antecedents of EUS formation. In particular, the main objective is to identify the impact of perceived IS performance, IS performance expectations, equitable work performance fulfillment, equitable relatedness fulfillment, and equitable self-development fulfillment on EUS.

The results of the study indicate that perceived IS performance is the most significant determining factor of EUS, with a standardized coefficient of 0.45 (H1). This is consistent with previous research findings (Suh et al. 1994; Swan and Trawick 1980) and implies that product performance as perceived by end users is still the core determinant of satisfaction. Nevertheless, equitable work performance fulfillment and equitable relatedness fulfillment do play a significant role in directly affecting satisfaction (H3 and H4), with standardized coefficients of 0.19 and 0.17, respectively. Hence there is evidence to suggest that both constructs have a more or less equal impact in affecting users' levels of satisfaction.

In contrast, the absence of a direct significant impact of equitable self-development fulfillment on EUS (H5) could be explained in two ways. First, the application of IS in the service industry still mainly focuses on operational work. The scope of IS use is therefore likely to be routine-based. Hence, those employees who have the opportunity to seek greater challenges from the information system are likely to be in the minority. Second, as information systems are mainly used for routine operational work, employees can get acquainted quickly with the required technical skills. To relate job security or career advancement to an individual's exceptionally poor or outstanding IT performance would be difficult, and therefore equitable self-development fulfillment is not significantly linked to EUS. If this model is applied to higher level strategic information systems in other industries, it is likely that such an impact would be more significant.

Similarly, both the direct (H2) and moderating effects of IS performance expectations on EUS were found to be insignificant, suggesting that the expectations of end users are not a dominating factor that influences EUS, as documented in many previous studies. In the hotel industry in Hong Kong, the majority of the hotels use the same small set of off-the-shelf software packages, so it is likely that the IS users in hotels have had previous experience in using the software. The lengthy time frame may have caused users recollection of their expectations to decay, which could diminish the impact of expectations on satisfaction, as found in the study by Droge and Halstead (1991). Expectations may be important for EUS only in the early IS adoption stage, but this may not be the

case for experienced users when the IS has been implemented for some time.

Caution needs to be exercised with the results from the airline industry, as the responses mainly came from three airlines, two of which use the same information system. Similar to the hotel sector, their expectations of IS performance may decay over time. Due to the complex nature of their operations, most airline information systems are specifically developed for the exclusive use of the airline, and have special features and functions. Users, especially new employees, may not know for sure what level of performance to expect from an information system. As long as the information system can perform the tasks that it is designed to accomplish, user satisfaction is likely to be dependent on how well the information system meets users needs, rather than on how well it meets their expectations.

## Theoretical Implications

This study provides a number of unique contributions to EUS research. First, it provides empirical support for a new approach to understanding the antecedents of EUS formation by incorporating three additional comparison referents: equitable work performance fulfillment, equitable relatedness fulfillment, and equitable self-development fulfillment. The major implication of successfully applying equity theory by focusing on the individual benefit-input ratio in this study is that it demonstrates that IS users needs are fulfilled at a cost (tangible and intangible), which has been overlooked in past research. This study gives evidence to suggest that when users feel that their input requirements are unfair or far outweigh the benefits gained from the use of the information system, dissatisfaction is likely to occur. The identification of the various inputs involved in the fulfillment of different types of needs helps to uncover the complex relationships between perceived IS performance and EUS. Through the examination of the results of the individual item of each equitable needs fulfillment construct, a better picture of the underlying causes for user satisfaction or dissatisfaction with an IS emerge. It also points to another worthwhile direction for future research in identifying other possible types of users inputs that are applicable only to certain information systems in specific industries. For example, a web-based (networked) strategic IS enables senior managers to monitor business and communicate with employees, as well as external business partners anywhere outside their normal work place. Creativity, flexibility, and self-discipline are likely the crucial inputs required of senior managers in realizing significant business values from such an IS.

Second, the results of various reliability and validity tests provide evidence to support the notion that work performance needs, relatedness needs, and self-development needs are three distinct constructs, and that IS end users do have different needs related to IS use. Although it was found that equitable self-development fulfillment has no direct impact on EUS, whether it has any indirect impact mediated through other variables is yet to be determined. This may help to partly explain why a higher level of user evaluation of IS performance has not always resulted in a high level of user satisfaction.

Finally, contrary to previous findings, IS performance expectations were found to have no significant relationship with user satisfaction, nor do they have any moderating effect on the relationship between IS performance and EUS. This highlights the potential importance of taking the equitable needs fulfillment approach to "predict" EUS, particularly for evaluating current IS use where long-serving users expectations of IS performance have faded away. It would be interesting to explore duration of IS usage as a control variable in future studies. As new technologies emerge with new features and capabilities, the manipulation of user expectations of IS performance alone may not be an effective way to enhance EUS.

## Managerial Implications

The findings of this study reveal that IS performance is the most critical factor affecting EUS. Therefore, managers need first of all to ensure that an information system is technically sound, with a good support service provided to end users. In realizing that equitable work performance fulfillment and equitable relatedness fulfillment are two other factors that significantly affect EUS, managers need to ensure an IS has the needed functions to fulfill the work performance needs of the employees, as well as be aware of the importance of workers social interaction needs at work brought about by IS use.

The results also reveal that human nature dictates, and employees in general accord, a higher priority to their own interests when it comes to the use of the IS. If managers would like to ensure EUS in their organizations, then they need to address the issues from the employees points of view by examining their benefit-input ratios, rather than simply focusing on the technical performance of the IS. One major contribution of the application of equity theory in the model, in addition to needs theory, is that it emphasizes the fact that an IS that benefits employees is not enough to achieve user satisfaction. Technically advanced information systems can only be desirable if employees equally perceive that the IS

can actually help them at work and, more importantly, at a cost that is worthwhile for them to achieve those benefits. The following example demonstrates how this could be the case. A feasibility study was undertaken by a large Canadian financial services company to examine the degree of employee resistance to the implementation of telework in its web-based IS for its sales and customer service operations (Wicks 2002). The results indicated that while employees generally believed it would bring improved performance (work performance fulfillment) due to fewer distractions by working remotely, significant relationships were also found between social isolation (relatedness fulfillment) and unwillingness to telework. Most employees also indicated telework inhibited their promotional opportunities (self-development fulfillment) due to less contact with their superiors. With such insights, managers can examine these complex relationships for each individual in ensuring the successful implementation of new technologies.

In addition, resistance from users may simply be due to a small benefit-input ratio (less than 1), which is a relative concept. This may vary not only from one individual to another, but also may vary depending on what benefits are obtained in return. For instance, the benefit-input ratio is likely to be high for employees with sound IT skills when learning advanced software at work, rather than for those who are less experienced and require more effort. On the other hand, an employee may regard the effort spent in using an e-mail system as worthwhile as it makes communication with colleagues much easier, but not so worthwhile as this creates extra workload resulting from handling many irrelevant e-mails. Hence an examination of the input requirements of individual employees will reveal the inputs required from users in achieving the benefits, which in turn can shed light on the hidden cause for dissatisfaction (e.g., e-mail in this case).

This has important implications for managers in terms of determining the appropriate levels or interchangeability of inputs and benefits so as to manipulate the benefit-input ratios of IS end users. The common inputs required of users to fulfill the various needs identified in this study are the time and skills needed to learn to use the system and the work pressure and stress they face. Managers can ensure EUS by minimizing the corresponding input requirements or by making the benefits more valuable in the user mind.

## Limitations of the Study

The nature of the samples and the selected sampling frame in this study impose several limitations. One limitation of the study is that the focus is on front-line departments in the hotel and airline sectors. This means that only information systems used by front-line employees who are mainly at operational levels in these two sectors are addressed. If the survey were expanded to include IS end users in other departments in the back office, as well as in other types of industries, then, due to the differences in the nature of their work and in the role of their information system, the levels of influence of IS performance, performance expectations, and equitable needs fulfillment of EUS might be different. Similarly, if the focus is restricted only to managerial employees using a higher level strategic IS, then their needs priorities are likely to be different from operational employees, as are their benefit-input ratios of IS use. This might offer a partial reason why equitable self-development was found to have no significant impact on EUS in the current study.

Another limitation is that other variables that might affect the constructs such as internal and external communications and users backgrounds were excluded from the boundary set for the analysis of the proposed EUS model. In terms of the study of down-stream chains, no attempt was made to link satisfaction with other behavioral actions such as improvement in performance. Future studies might expand the boundaries of the analysis to other sectors and include the variables mentioned above. It is worth conducting a future study to examine the types of performance-related behavior that might be linked to EUS in specific industries, and to consider how these could be measured and carried out.

## Conclusions

The model presented in this study provides a broad conceptual framework with a strong theoretical platform that helps enhance our understanding of the antecedents of EUS formation. As mentioned earlier, the findings have significant contributions both to theoretical development related to EUS formation and managing IS users before, during, and after IS implementation. The results uncover the underlying factors that affect EUS in addition to IS performance and expectations and, more importantly, their relative impacts. The application of needs theory and equity theory also allow us to appreciate that IS users have different needs with information systems, and that it is in fact the individual evaluation of the *worthiness* of inputs required to achieve different needs fulfillments that partly explains EUS variations. Such insight of various input/needs fulfillment relationships of each individual should be of benefit to an industry in developing more effective strategies to enhance EUS in the future.

It is clear that the recognition of the *inputs* side in achieving different levels of IS users needs represents an important initial step on which future research in EUS can build. Although the category of needs with IS use will remain the same for individuals, it is likely that fine-tuning may be required for certain industries where specific inputs are needed. Such inputs may be intangible and hidden in nature, which could well be the underlying reasons for subsequent behaviors toward IS implementation such as resistance to change. This will shed some light on research in the downstream link in a causal chain explaining the behavior affected by EUS. Organizations are to benefit most as studies in downstream activities (i.e., employees behaviors) will bring greater practical implications and have a direct impact on resulting profits and repeat business.

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# Appendix A

## Breakdown Response Rates by Areas for Hotel and Airline Sector

| | Department for Hotel | | | |
|---|---|---|---|---|
| | Front Office | Food & Beverage | Total | % of Total |
| Charterhouse Hotel | 8 | 5 | 13 | 1.8 |
| Excelsior Hotel | 33 | 11 | 44 | 6.2 |
| Grand Hyatt Hong Kong Hotel | 19 | 4 | 23 | 3.2 |
| Grand Stanford Inter-Continental Hotel | 16 | 0 | 16 | 2.3 |
| Great Eagle Hotel | 23 | 14 | 37 | 5.2 |
| Harbour Plaza Hotel | 21 | 29 | 50 | 7.1 |
| Harbour View International House | 15 | 0 | 15 | 2.1 |
| Hyatt Regency Hong Kong Hotel | 9 | 1 | 10 | 1.4 |
| Island Shangri-La Hotel | 12 | 28 | 40 | 5.6 |
| JW Marriott Hong Kong Hotel | 25 | 36 | 61 | 8.6 |
| Kowloon Shangri-La Hotel | 15 | 26 | 41 | 5.8 |
| Mandarin Oriental Hotel | 10 | 12 | 22 | 3.1 |
| Mirmar Hotel | 17 | 23 | 40 | 5.6 |
| New World Renaissance Hotel | 0 | 10 | 10 | 1.4 |
| Newton Hotel Hong Kong | 7 | 0 | 7 | 1.0 |
| Nikko Hong Kong Hotel | 20 | 10 | 30 | 4.2 |
| Novotel Century Harbourview Hotel | 4 | 2 | 6 | 0.8 |
| Novotel Century Hong Kong Hotel | 10 | 11 | 21 | 3.0 |
| Regal Airport Hotel | 19 | 27 | 46 | 6.5 |
| Regal Kowloon Hotel | 21 | 19 | 40 | 5.6 |
| Royal Pacific Hotel & Towers | 29 | 7 | 36 | 5.1 |
| Royal Park Hotel | 12 | 2 | 14 | 2.0 |
| Sheraton Hong Kong Hotel & Towers | 22 | 5 | 5 | 3.8 |
| The Emperor (Happy Valley) Hotel | 1 | 4 | 5 | 0.7 |
| The Park Lane Hong Kong Hotel | 21 | 15 | 36 | 5.1 |
| The Peninsula | 7 | 5 | 12 | 1.7 |
| Windsor Hotel | 7 | 0 | 7 | 1.0 |

| | Functional Area for Airline | | | | |
|---|---|---|---|---|---|
| | Reservation | Ticketing | Counter | Total | % of Total |
| Cathay Pacific Airways Ltd. | 66 | 35 | 43 | 144 | 67.6 |
| Dragonair | 25 | 5 | 0 | 30 | 14.1 |
| United Airlines | 12 | 11 | 16 | 39 | 18.3 |

# Appendix B

## Sources of References for Information Quality, System Quality, and System Support Quality

| Item | Source | | |
|---|---|---|---|
| **Information Quality** | | | |
| Accuracy | Bailey and Pearson 1983<br>Baroudi and Orlikowski 1988 | DeLone and McLean 1992<br>Doll and Torkzadeh 1988 | Goodhue and Thompson 1995<br>Ives et al. 1983 |
| Availability | Miller and Doyle 1987 | | |
| Reliability | Bailey and Pearson 1983<br>Baroudi and Orlikowski 1988 | DeLone and McLean 1992<br>Ives et al. 1983 | Saarinen 1996 |
| Updatedness | Bailey and Pearson 1983<br>DeLone and McLean 1992 | Ives et al. 1983<br>Miller and Doyle 1987 | |
| Relevance | Bailey and Pearson 1983<br>Baroudi and Orlikowski 1988 | DeLone and McLean 1992<br>Ives et al. 1983 | Miller and Doyle 1987<br>Saarinen 1996 |
| Timeliness | Bailey and Pearson 1983<br>DeLone and McLean 1992 | Doll and Torkzadeh 1988<br>Goodhue and Thompson 1995 | Ives et al. 1983 |
| Completeness | Bailey and Pearson 1983<br>Baroudi and Orlikowski 1988 | Doll and Torkzadeh 1988<br>Ives et al. 1983 | Miller and Doyle 1987<br>Saarinen 1996 |
| Presentation | DeLone and McLean 1992 | Doll and Torkzadeh 1988 | Saarinen 1996 |
| Accessibility | Doll and Torkzadeh 1988<br>Goodhue and Thompson 1995 | Ives et al. 1983<br>Miller and Doyle 1987 | |
| **System Quality** | | | |
| Response Time | Bailey and Pearson 1983 | DeLone and McLean 1992 | |
| Reliability | Bailey and Pearson 1983 | DeLone and McLean 1992 | |
| Functionality | DeLone and McLean 1992 | Miller and Doyle 1987 | |
| Flexibility | Bailey and Pearson 1983 | DeLone and McLean 1992 | Ives et al. 1983 |
| User Friendliness | DeLone and McLean 1992 | Doll and Torkzadeh 1988 | Ives et al. 1983 |
| Ease of Integration | Bailey and Pearson 1983<br>DeLone and McLean 1992 | Goodhue and Thompson 1995<br>Ives et al. 1983 | |
| **System Support Quality** | | | |
| Promptness | Bailey and Pearson 1983 | Kettinger and Lee 1994 | Miller and Doyle 1987 |
| Reliability | Kettinger and Lee 1994 | Pitt et al. 1995 | |
| Responsiveness | Bailey and Pearson 1983 | Kettinger and Lee 1994 | |
| Technical Competence | Bailey and Pearson 1983 | Ives et al. 1983 | Miller and Doyle 1987 |
| Attitude | Bailey and Pearson 1983<br>Baroudi and Orlikowski 1988 | Doll et al. 1995<br>Ives et al. 1983 | Miller and Doyle 1987 |
| Keeps Accurate Records | Focus group | | |
| Provision of Training Course | Bailey and Pearson 1983<br>Baroudi and Orlikowski 1988 | Ives et al. 1983<br>Miller and Doyle 1987 | |

| Item | Source | |
|---|---|---|
| **Equitable Needs Fulfillment Inputs** | | |
| Time required to learn to use the system | Joshi 1989, 1990 | Regan and O'Connor 1994 |
| Intellectual skills required to learn to use the system and interpret the information generated | Regan and O'Connor 1994<br>Rosenberg 1997 | Zuboff 1988 |
| Work pressure and stress | Alter 1999 | Rosenberg 1997 |
| Physical strain | Eason 1988<br>Regan and O'Connor 1994 | Rosenberg 1997 |
| Gradual reduction in the recognition of user's non-IT experiences/skills | Boddy et al. 2002 | Regan and O'Connor 1994 |
| **Work Performance Fulfillment (Benefit)** | | |
| Helps me to work more efficiently and effectively | O'Brien 2004 | Laudon and Laudon 2000 |
| Helps me to improve service quality | Laudon and Laudon 2000 | Regan and O'Connor 1994 |
| **Relatedness Fulfillment (Benefit)** | | |
| Higher recognition/better relationships and communications with colleagues | Alter 1999 | |
| More power and control over colleagues | Alter 1999 | Eason 1988 |
| **Self-Development Fulfillment (Benefit)** | | |
| Job security | Regan and O'Connor 1994 | Rosenberg 1997 |
| Career advancement/meeting new challenges | Eason 1988 | |
| **End User IS Satisfaction** | | |
| Contented | Oliver 1997 | Spreng et al. 1996 |
| Pleased | Oliver 1997 | Spreng et al. 1996 |
| Delighted | Oliver 1997 | Spreng et al. 1996 |
| Relieved | Oliver 1997 | |
| Very satisfied | Kim et al. 1998<br>Oliver 1997 | Spreng et al. 1996 |

# Appendix C

## Summary of Items Added to or Removed from the Pretest

| Construct/Item | Result | Reasons |
|---|---|---|
| **IS Performance Support Services** | | |
| Ability of support staff to keep accurate records | Added | As the information systems of most airline and hotel companies contain databases that store valuable customer data, the ability of IS staff to keep accurate records of customers is one of the important criteria for evaluating the performance of IS support services. |
| **Equitable Work Performance Fulfillment** | | |
| Compare the input of "time required to learn to use the system" against the benefit of "improved service quality" | Removed | Most of the respondents agreed that the primary objective and benefit of using an information system in an organization is to enhance work performance through the improvement of operational efficiency and functional effectiveness. However, they believed that service quality in a hotel can only be improved by employees, and hence it is not necessarily a direct benefit brought about by an information system. |
| Compare the input of"intellectual skills required to learn to use the system and interpret the information generated" against the benefit of "improved service quality" | Removed | |
| Compare the input of "work pressure and stress" against the benefit of "improved service quality" | Removed | |
| Compare the input of "physical strain" against the benefit of "improved service quality" | Removed | |
| **Equitable Relatedness Fulfillment** | | |
| Compare the input of "physical strain" against the benefit of obtaining "higher recognition/better relationships and communications with colleagues" | Removed | The respondents did not feel that physical strain was a major input/cost that they had to bear in achieving better relationships or more control over colleagues through IS usage, even though the use of the IS for the improvement of work efficiency means that a system will be used for a longer period during the operation. |
| Compare the input of "physical strain" against the benefit of obtaining "more power and control over colleagues" | Removed | |
| Compare the input of "intellectual skills required to learn to use the system and interpret the information generated" against the benefit of obtaining "higher recognition/better relationships and communications with colleagues" | Removed | The respondents believed that those who aim to achieve higher recognition and better relationships with their colleagues by their proficiency in IT knowledge are likely to be relatively skillful in using the system, and the skill required to learn the system would hardly be a major cost to them. |
| Compare the input of "intellectual skills required to learn to use the system and interpret the information generated" against the benefit of obtaining "more power and control over colleagues" | Removed | |
| Compare the input of "gradual reduction in the recognition of user's non-IT experiences/skills physical strain" against the benefit of obtaining "higher recognition/better relationships and communications with colleagues" | Removed | The respondents believed that those who aim to achieve higher recognition and better relationships with their colleagues by their proficiency in IT knowledge would be unlikely to think that the non-recognition of their non-IT skills is a major concern. |
| Compare the input of "gradual reduction in recognition of user's non-IT experiences/skills" against the benefit of obtaining "more power and control over colleagues" | Removed | |

| Construct/Item | Result | Reasons |
|---|---|---|
| **Equitable Self-Development Fulfillment** | | |
| Compare the input of "physical strain" against the benefit of obtaining "job security" | Removed | The respondents did not feel that physical strain was a major input/cost that they had to bear in achieving job security or career advancement through IS usage. |
| Compare the input of "physical strain" against the benefit of obtaining "career advancement/meeting new challenges" | Removed | |
| Compare the input of "time required to learn to use the system" against the benefit of obtaining "job security" | Removed | The respondents believed that those who are looking for more challenges and career advancements would normally not regard spending more time playing with a system to be a cost or sacrifice. |
| Compare the input of "time required to learn to use the system" against the benefit of "career advancement/ meeting new challenges" | Removed | |

# Appendix D

## Summary of Factor Analysis Results from the Pilot Test

| Construct/ Subconstruct | Number of Items | Reliability Coefficient | Eigenvalue | Variance Explained | KMO† | Bartlett's Test |
|---|---|---|---|---|---|---|
| Information quality | 9 | 0.948 | 6.388 | 70.978 | 0.939 | 0.000 |
| System quality | 6 | 0.922 | 4.347 | 72.445 | 0.889 | 0.000 |
| System support service quality | 6 (after 1 item dropped | 0.917 | 4.649 | 66.408 | 0.871 | 0.000 |
| Information quality expectation | 9 | 0.951 | 6.505 | 72.274 | 0.908 | 0.000 |
| System quality expectation | 5 (after 1 item dropped) | 0.960 | 4.584 | 76.404 | 0.867 | 0.000 |
| System support service quality expectation | 7 | 0.943 | 5.679 | 89.290 | 0.940 | 0.000 |
| Equitable work performance fulfillment | 5 | 0.841 | 3.190 | 63.799 | 0.861 | 0.000 |
| Equitable relatedness fulfillment | 4 | 0.943 | 3.420 | 85.501 | 0.851 | 0.000 |
| Equitable self-development fulfillment | 6 | 0.883 | 4.010 | 66.833 | 0.765 | 0.000 |
| EUS | 4 (after 1 item dropped) | 0.961 | 3.872 | 77.448 | 0.868 | 0.000 |

†KMO: Kaiser-Meyer-Olkin measure of sampling adequacy

# Appendix E

## Finalized Items in the Instruments

### *Measurement of Expected and Actual Information Systems Performance*

| | Information Quality | Very Low ← | | | Neutral | | | → Very High |
|---|---|---|---|---|---|---|---|---|
| 1a | The quality of information *accuracy* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 1b | The quality of information *accuracy* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 2a | The quality of information *availability* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 2b | The quality of information *availability* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 3a | The quality of information *reliability* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 3b | The quality of information *reliability* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 4a | The quality of information *updatedness* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 4b | The quality of information *updatedness* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 5a | The quality of information *relevance* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 5b | The quality of information *relevance* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 6a | The quality of information *timeliness* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 6b | The quality of information *timeliness* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 7a | The quality of information *completeness* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 7n | The quality of information *completeness* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 8a | The quality of information *presentation* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 8b | The quality of information *presentation* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 9a | The quality of information *accessibility* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 9b | The quality of information *accessibility* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | **System Quality** | Very Low ← | | | Neutral | | | → Very High |
| 10a | The quality of system *response time* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 10b | The quality of system *response time* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 11a | The quality of system *reliability* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 11b | The quality of system *reliability* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 12a | The quality of system *functionality* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 12b | The quality of system *functionality* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 13a | The quality of system *flexibility* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 13b | The quality of system *flexibility* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 14a | The quality of system *user friendliness* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 14b | The quality of system *user friendliness* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 15a | The quality of system *ease of integration with other systems* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 15b | The quality of system *ease of integration with other systems* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

| | System Support Service Quality | Very Low ← | | | Neutral | | → Very High | |
|---|---|---|---|---|---|---|---|---|
| 16a | The quality of the *promptness of the support service* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 16b | The quality of the *promptness of the support service* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 17a | The quality of the *reliability of the support service* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 17b | The quality of the *reliability of the support service* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 18a | The quality of the *responsiveness of the support service* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 18b | The quality of the *responsiveness of the support service* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 19a | The *technical competence of the of the support service people* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 19b | The *technical competence of the support service people* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 20a | The *attitude of the support service people* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 20b | The *attitude of the support service people* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 21a | The *ability of the support service people to keep accurate records* that I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 21b | The *ability of the support service people to keep accurate records* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 22a | The *provision of training courses* I **originally expected** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 22b | The *provision of training courses* I **experienced** was | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

## *Measurement of Equitable Needs Fulfillment*

| | | Equitable Work Performance Fulfillment | Benefits are much less than input ← | | | Fair | | → Benefits are much more than input | |
|---|---|---|---|---|---|---|---|---|---|
| Benefits/ Outcome | | The information systems help me to work more efficiently and/or effectively (e.g., higher productivity; better decision-making). | | | | | | | |
| Inputs/ Costs | 23 | Amount of time required of me to learn to use the software/ system at work. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | 24 | Level of intellectual skills required of me to learn to use the software/system or interpret the information it generates. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | 25 | Level of work pressure and stress I face (e.g., updating IT skills, information and work overload, and electronic monitoring). | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | 26 | Amount of physical strain I suffer (e.g., eye strain, pain in the neck/back/wrist/hand/shoulder/legs). | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | 27 | Gradually reducing the recognition of my non-IT experiences/skills/control at work. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | | **Equitable Self-Development Fulfillment** | Benefits are much less than input ← | | | Fair | | → Benefits are much more than input | |
| Benefits/ Outcomes | | Knowing how to use the information systems effectively allows me to have more changes to secure my job. | | | | | | | |
| Inputs/ Costs | 28 | Level of intellectual skills required of me to learn to use the software/system or interpret the information it generates. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | 29 | Level of work pressure and stress I face (e.g., updating IT skills, information and work overload, and electronic monitoring). | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | 30 | Gradually reducing the recognition of my non-IT experiences/skills/control at work. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

| | | Equitable Self-Development Fulfillment | Benefits are much less than input ← Fair → Benefits are much more than input | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Benefits/ Outcomes | | Knowing how to use the information systems effectively provides me with the opportunity to advance my career and/or to meet new challenges at work. | | | | | | | |
| Inputs/ Costs | 31 | Level of intellectual skills required of me to learn to use the software/system or interpret the information it generates. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | 32 | Level of work pressure and stress I face (e.g., updating IT skills, information and work overload, and electronic monitoring). | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | 33 | Gradually reducing the recognition of my non-IT experiences/skills/control at work. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | | **Equitable Relatedness Fulfillment** | Benefits are much less than input ← Fair → Benefits are much more than input | | | | | | |
| Benefits/ Outcomes | | Knowing how to use the information systems effectively enables me to get more recognition and/or establish better relationships/communications with colleagues and customers at work. | | | | | | | |
| Inputs/ Costs | 34 | Amount of time required of me to learn to use the software/ system at work. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | 35 | Level of work pressure and stress I face (e.g., updating IT skills, information and work overload, and electronic monitoring). | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| Benefits/ Outcome | | Knowing how to use the information systems effectively enables me to have more power and control over colleagues at work. | | | | | | | |
| Inputs/ Costs | 36 | Amount of time required of me to learn to use the software/ system at work. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| | 37 | Level of work pressure and stress I face (e.g., updating IT skills, information and work overload, and electronic monitoring). | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |

## *Measurement of Overall User Satisfaction*

| | Overall Information System Satisfaction | Strongly Disagree ← Neutral → Strongly Agree | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 38 | I am very ***contented*** with the information system. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 39 | I am very ***pleased*** with the information system. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 40 | I feel ***delighted*** with the information system. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |
| 41 | Overall, I am very ***satisfied*** with the information system. | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ |