InterNeg

# User Assessment of E-negotiation Support Systems: A Confirmatory Study *

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## Abstract

A study of over 2000 students and professionals who used the Inspire e-negotiation system led Vetschera, Kersten and Koeszegi (2006) to the formulation of an assessment model for Internet-based systems (AMIS). The model was used to determine factors leading to a high user acceptance of the technology exemplified by Inspire. This paper presents a follow up study that aims at the verification of AMIS and the empirical results. The focus is on the verification of the users' assessment of the system influence on their intention to use a system, their clear distinction between the two main facilities of Inspire: the communication platform and the analytical tools, and the cultural differences in the system assessment. The dataset used in this study is extracted from over 5,000 cases and additional information is included from the negotiation transcripts.

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# 1. Introduction

While the technology acceptance model (TAM) proposed by Davis (1989) is an important basis for much empirical research on the evaluation of information systems, several researchers consider it to be too general to be applied in specific contexts (Venkatesh and Davis 1996; Agarwal and Prasad 1998; Venkatesh and Davis 2000; Hong, Thong et al. 2002). Particularly, in cases involving new technology investigators are interested in an assessment model that can provide specific concepts which are useful for system design (Triandis 1980; Trice and Tracy 1988).

E-negotiation support systems (ENSs) are technologies which have the potential to impact e-business, especially in the design of e-marketplaces (Bichler 2001). They can also be used in on-line dispute resolution and arbitration (Lodder and Zeleznikow 2005) and participatory decision-making (Kersten 2003).

The target user population of ENSs, are people who may be inexperienced negotiators and inexperienced users of information and communication technologies. These users need useful, expressive, user friendly and easy-to-use systems. Otherwise, according to the cost-benefit framework (Todd and Benbasat 1999), the users would not appreciate the value of employing an ENS and either resort to alternative methods (e.g., face-to-face negotiation) or avoid participating in e-negotiations.

Gaining an understanding of the users' perceptions of the usage of the whole system is important from the point of view of system development and adaptation. New software development technologies allow for fast and efficient system modification. To make such modifications effective, knowledge of the system features that are difficult to use or may otherwise hinder the overall system usability is necessary. This requires an in-depth investigation of the usage of the whole system as well as of its individual components. Furthermore, with software being increasingly more responsive to the users' needs and to the demands of the tasks they encounter, a thorough understanding of system functioning and use is required. Such an understanding will allow software developers to prescribe specific tools to a particular context.

ENSs and other systems deployed on the web allow for their extensive testing and use in a different environment. They can be used in controlled laboratory settings as well as in the settings which are natural to their future users. The TAM model was introduced when prospective users could test software only using simple pre-defined tasks. In contrast, an ENS can be used to conduct both simple and complex negotiations over a long period of time. The latter property overcomes the limitations of laboratory experiments and the pre-internet era. Web-based experiments allow for a prolonged user exposure to a system and involvement in negotiations which are more realistic than a 2-3 hours experiment.

To address the new opportunities posed by the web-based systems, Vetschera, Kersten and Koeszegi (2006) proposed a conceptual model which allows to relate the characteristics of the systems' users, the systems, and the results of the systems' usage to the users' perceptions of the systems and processes. The model, called "assessment model for internet-based systems" (AMIS), is depicted in Figure 1.

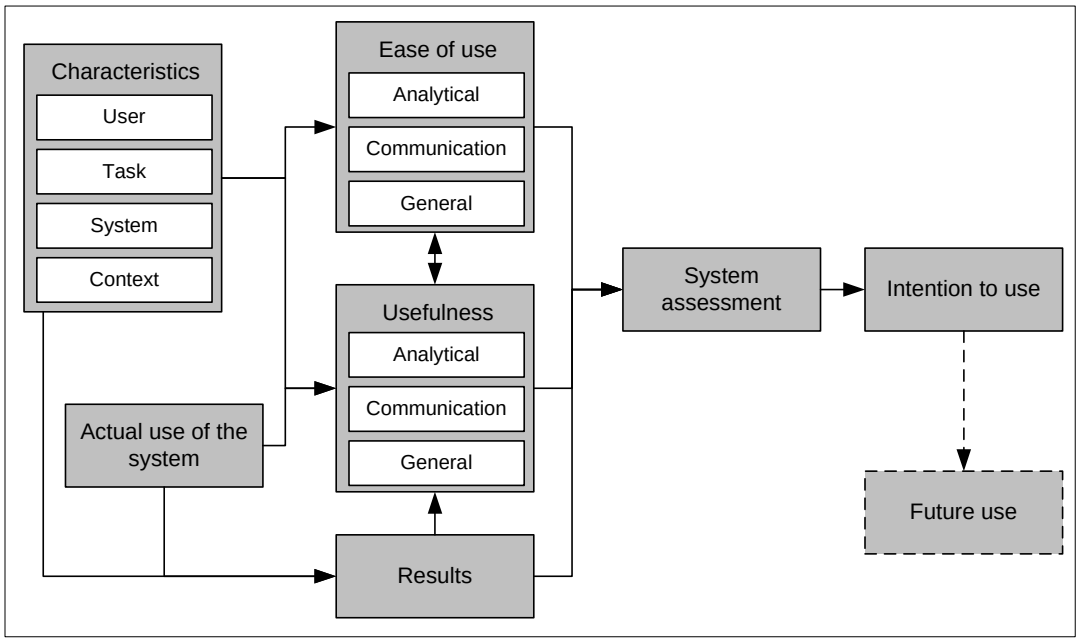


Figure 1. Conceptual view of AMIS (Vetschera, Kersten et al. 2006)

The rationale behind the modification of TAM and construction of AMIS includes the following observations:

1. Users are able to determine the system's *usefulness* rather than *perceived usefulness* because of its prolonged use for all tasks required to complete a project.

2. The emergence of standards (like web-browser based interfaces) allow for the use of one system to assess the usefulness of other systems which have the same or similar key functionalities.

3. Users control the intensity and time of the web-based systems use, making the *actual use* of a system an important behavioral variable.

4. Unlike traditional IT systems, systems deployed on the Web may be accessed not only by users from the same organization, but by a large number of users with different background, making *individual characteristics* an important part of the model.

The AMIS model extends the TAM model and some of its well-known variants (Davis 1989; Venkatesh and Davis 1996; Venkatesh and Davis 2000), by the consideration of: (1) system use, (2) specific features of the technology and (3) users' characteristics.

The TAM model mainly considers the situation before an information system is introduced in an organization; *system use* is considered to be a consequence of users' attitudes and beliefs towards usage of a system. The AMIS model is oriented towards a situation in which users have prolonged experience with the system under study and thus system use is considered an antecedent to the users' perceptions of the system, which in turn is used to predict future attitude towards the system or similar systems. Consequently, *system usage* is modeled as a numerical variable describing the extent to which the system and its various features have been used, and we also take into account the outcome

achieved from the process (Results). This multi-dimensionality of usage coincides with DeLone and McLean's argument for measuring this construct as more than just the interaction between the user and the system (1992). Some authors have even argued that usage encompasses innovation and learning (Compeau and Higgins 1995; Agarwal and Prasad 1998).

The system is not considered as a "black box", instead its key tools and features are distinguished. Correspondingly, the two main constructs of TAM, *ease of use* and *usefulness,* are decomposed into several more specific constructs relating to different features of the system, such as analytical and communication tools (Agarwal and Karahanna 2000).

The model is extended to include characteristics of users. This extension has been proposed in the literature and it has been shown that user's characteristics may have a strong impact on behavioral concepts of technology assessment (Venkatesh, Morris et al. 2003).

The purpose of this study is to confirm and possibly extend Vetschera et al.'s (2006) exploratory work. For a confirmation, the present study draws upon data from 5,027 users, including an additional 2,823 cases. These cases were obtained by using the same experimental design as in the earlier study. Our study extends the earlier work in two directions:

1. The original work on the AMIS model has helped to identify the relationships between constructs, but did not specify a causal structure. Using these results we formulate a structural equation model (SEM) which simultaneously contains all the constructs of AMIS. Thus we replace the undirected correlation analysis performed in (Vetschera, Kersten et al. 2006) by SEM.

2. The stability of the model and its parameters for two groups of users (men vs. women) is examined. We conduct a multi-group analysis to assess the similarities and dissimilarities between these groups.

Both studies use data obtained from the Inspire system. The data is collected in three stages (Kersten and Noronha 1999).

In the first stage, data is obtained from the pre-negotiation questionnaire which contains demographic data and users' expectations regarding the negotiation process and its outcomes. The questionnaire is administered after the users read the case and engaged in the preference elicitation and utility function construction but before the construction and exchange of offers and messages.

The second data collection stage is done during the negotiation when the interactions between users are recorded. Finally, in the third stage, users fill in a post-negotiation questionnaire, which contains questions about their experiences and subjective assessment of the system.

Following this introduction, a brief overview of Inspire and the results of AMIS exploratory assessment are given in Section 2. In order to use SEM, a modification of AMIS is required; the revised model and the hypotheses are given in Section 3. The results of the SEM analysis are discussed in Section 4. In this section we also discuss the results of multi-group analysis to the revised model to determine the similarities or dissimilarities between different groups of users (i.e. men vs. women). Section 5 provides a summary of the major findings and the implications of this study.

# 2. Background

## 2.1 Inspire

Inspire (http://interneg.org/inspire), is one of the earliest ENSs. The system was made available in 1995 and has been used in the training of students and professionals since 1996. The system was also used to collect data for research in bilateral multi-issue negotiations (Kersten and Noronha 1999).

Inspire users negotiate anonymously by interacting through the system; although they may reveal their identities, their counterparts cannot verify them.

Over the past nine years Inspire has been used by students and professionals in numerous fields to conduct on-line negotiations involving many scenarios. The predominant case is the Cypress-Itex negotiation; it concerns a four-issue purchasing contract between a buyer and supplier of bicycle parts. There are 180 feasible alternatives and parties need to agree on one of them. The case provides indicative preferences with respect to the negotiated issues and their values, but the parties are asked to formulate their individual preferences according to their understanding of the case. Only data collected from the negotiations using this case has been used.

The Inspire system provides a communication platform which allows for message and offers exchanges. It also has analytical tools which are used to elicit users preferences and construct multi-attribute utility functions[1] using a hybrid conjoint measurement method.. The use of utility allows for a consistent evaluation of offers throughout the negotiations and graphical representation of offers in the user's utility space (time is the second dimension). It is also used for the assessment of the agreement efficiency (if one is achieved) which is done using a post-settlement mechanism[2].

The exchange of free-text messages allows the negotiators to communicate with their counterparts. A message can be attached to an offer or it can be sent separately. The exchange of messages allows users to establish a more humanistic environment, and more importantly, it allows negotiators to apply persuasion tactics in their bargaining (Thompson and Nadler 2002). The information communicated is often based on the knowledge acquired from the analytical tools.

Another type of analytical support is the history-graph, which is based on the utility functions and provides users with a visual representation of the "negotiation dance" (Raiffa 1982). Based on the graph, negotiators can observe the deviations in the utility values of offers made and received, and thus plan their bargaining strategy.

The third analytical support takes place in the post-settlement phase. After an agreement is reached, the system determines its efficiency. If the agreement is inefficient, up to seven efficient alternatives which dominate the agreement are presented to the negotiators. From the suggestions calculated by the post-settlement mechanism, the users can proceed to negotiate for an efficient agreement.

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[1] Strictly speaking, since the users' risk attitude is not considered, the support is based on a multi-attribute value function.

[2] This feature is not investigated in the present study because the sample size of users who have reached an inefficient agreement in the post-settlement phase was too small for SEM.

## 2.2 Exploration of AMIS

The purpose of the AMIS model, proposed by Vetschera et al. (2006), was to extend the constructs introduced by TAM for web-based systems. The model was also used to determine the possible reasons for the Inspire users' very positive attitude towards negotiating through ENSs. 88.2 % of the users who filled in the post-negotiation questionnaire, would use a system similar to Inspire to practice negotiation, 81.3 % would use such a system to prepare for actual negotiations and 61.3 % of the respondents would use it to conduct actual negotiations.

In order to test AMIS and assess the behavioral value of the ENS Inspire, 1,367 out of 2,204 records were extracted from Inspire for factor analysis based on subjects who have answered both pre- and post-negotiation questionnaires. The remaining 837 participants did not answer the post-negotiation questionnaire.[3]

Part of the exploratory research on AMIS focused on the explanation of the system assessment. Using correlation analysis, the authors found that actual use of the system, which relates to system recorded values for usage, is significantly correlated to experienced usefulness of the communication and analytical tools. Usefulness and ease of use are correlated with system assessment which also is correlated with the negotiation results.

Early research on negotiation support has suggested that the combination of analytical and communication support increases the efficacy of negotiations and enables more parties to reach compromises (Lim and Benbasat 1992-93). However, there has been little knowledge available on the behavioral assessment of ENS (Lim and Yang 2004).

In contrast to the TAM model, where experienced usefulness is evaluated after a comparatively short exposure to the system, the construct 'usefulness' in AMIS is based on the user's perceptions during a fairly long period of usage (three weeks). The experienced ease of use of the analytical tools (ease of use of analytical) and the experienced ease of use of the system in general (ease of use of system) indicate the degree to which the users consider the analytical tool and system to be free of effort on their part. These constructs are significantly related to construct 'results' which was originally measured by the individual utility values for the agreements reached. The components of the factors 'ease of use' and 'usefulness' significantly impact the user's system assessment. These and other relationships between the model constructs are depicted in Figure 2.

[3] The response rate for the post-negotiation questionnaire may appear low, i.e., 63%. Because it is a voluntary questionnaire with the Inspire managers and researchers having no control over the process this response rate may be viewed as quite high.

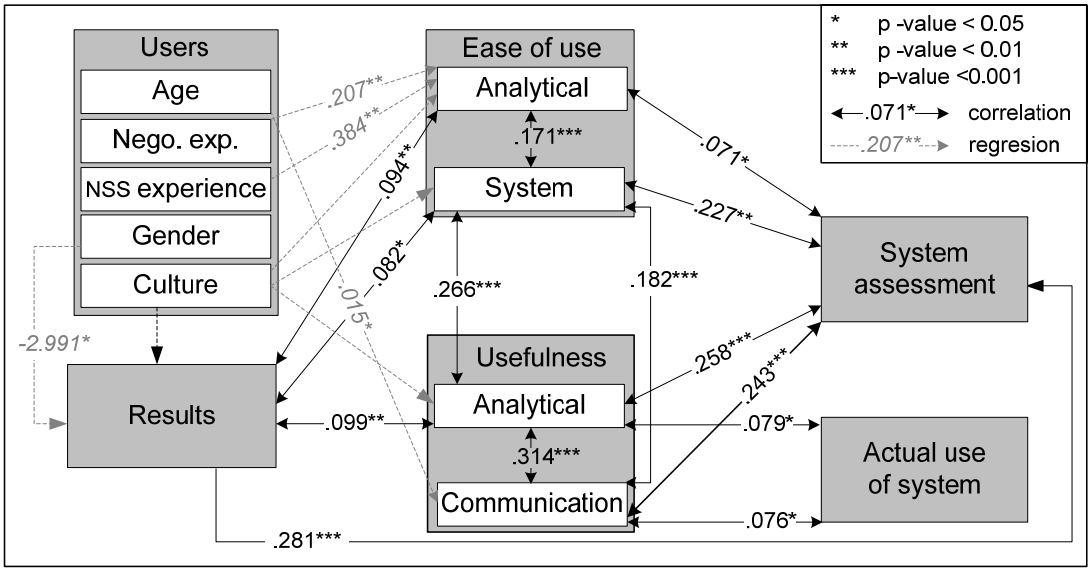


Figure 2. Exploratory research results (adapted from Vetschera, Kersten et al. 2006)

The factor 'results' of negotiations is also significantly correlated with usefulness of analytical tools and the system assessment. Furthermore, there exist significant correlations between ease of use and usefulness of the components, and the ease of use of the system in general is significantly related to usefulness of the analytical and communication tools.

The results of the exploratory research include the impact of the users' characteristics on the other constructs of the model. These characteristics are age, negotiation experience, experience with negotiation support systems, gender and culture (for which the country of residence is used as proxy). In Figure 2, the parameters for regression of ease of use, usefulness, and utility on user characteristics are shown for the results which were found significant. It should be noted that the coefficients for regression and correlation analyses cannot be compared.

The main conclusions of the exploratory analysis of the AMIS model are:

1. Cognitive constructs (ease of use and usefulness) need to be decomposed according to the different components of the system.

2. The antecedents to the cognitive constructs should include the degree of actual system usage.

3. Users' characteristics have a significant effect on ENS assessment. The factor 'ease of use' is affected by experience in conducting negotiation and/or in using software in negotiations. Culture of the negotiator affects all factors except for usefulness of communication; gender influences negotiation results.

## 2.3 AMIS confirmation

The AMIS model identified several factors which can affect negotiations. Based on the findings of the exploratory study, in the following, we propose a causal model to confirm and explain the relations among these factors. A structural equation modeling (SEM) technique is used to determine whether the

AMIS model is valid (Bollen 1989).

The use of SEM requires data for all factors incorporated in the model. Therefore, AMIS is verified for those Inspire users who have reached an agreement. Although this is a limitation, the confirmatory analysis provides means to assess explicitly the impact of the AMIS factors on each other and on the user's assessment of the negotiation system.

In this study we consider only one user characteristic, namely, gender. Other user characteristics stratify the sample into too small groups to use the cross-sectional statistical modeling technique such as SEM.

To account for the specific effect of gender on the proposed relationships in the model, the sample was divided into two groups (male and female). The relationships among the various constructs, particularly ease of use and usefulness, and the final dependent variable 'system assessment' are studied separately for each group and through multi-group analysis, using structural equation modeling.

# 3. System assessment confirmatory model

## 3.1 Dataset

In the exploratory study, a total of 2,204 records were collected from negotiations on Inspire, out of which 1,367 had completed the pre- and post-questionnaire. The exploratory factor analysis was based on these 1,367 observations for all constructs, except for results, for which 660 records were used (660 users achieved an agreement).

In the present confirmatory study, 2,823 new records were collected and added to the pre-existing dataset to form a total of 5,027. Out of 5,027 users, 2,056 answered both questionnaires, and 1,692 achieved an agreement. Because our premise is to examine the nomological network proposed in the exploratory study, we need to extract records of users who achieved an agreement and completed both questionnaires. Therefore, the sample employed in this study consists of 829 participants.

Users from 53 different countries are represented in this data set. The 10 largest groups (i.e. 50 or more users) are indicated in Table 1. Out of the sample, about 60% of the users in this dataset are male, only 16% of the sample is experienced in negotiation, and even less are familiar with ENS (10% of sample).

Table 1. Inspire users by country of residence (country born)

| Country | Percent | Country | Percent |
|---|---|---|---|
| Canada (CA) | 26.6 (12.9) | Austria (AT) | 3.2 (3.6) |
| USA (US) | 14.2 (10.2) | Russia (RU | 2.8 (2.9) |
| India (IN) | 8.8 (9.8) | Taiwan (TW) | 2.6 (2.1) |
| Germany (DE) | 7.2 (7.2) | Hong Kong (HK) | 1.6 (2.9) |
| Finland (FI) | 4.9 (5.0) | Switzerland (CH) | 1.6 (1.9) |
| Ecuador (EC) | 4.7 (4.9) | Undeclared | 10 (10) |

## 3.2 AMIS modifications

The independent variables in the AMIS model (Figure 1) describe user, task, system and context characteristics, and the actual use of the system. All characteristics, with the exception of the user, are kept constant.

### 3.2.1 Actual use, usefulness and ease of use

The construct actual use of the system is a formative one and it is calculated from the number of offers and messages sent by the negotiator during the usage of Inspire. The exploratory results of AMIS (Figure 2), show that the actual use of the system (actual use) may not necessarily be an independent construct as Vetschera et al. (2006) initially postulated (Figure 1); the usefulness of the system's analytical tools (usefulness of analytical) and the communication platform (usefulness of communication) may affect the use of the system.

Inspire users negotiate through the system for three weeks. During the negotiation they use the system to read and evaluate offers, read and write messages, make counter-offers, and review the negotiation history. These activities are undertaken a number of times, therefore one may expect that the users' willingness to continue using the system depends on their finding it easy to use and useful. This in turn suggests that ease of use and usefulness may be the model's independent variables.

The influence of perceived usefulness as it is used in the TAM model, on actual use seems questionable. This is because usefulness relates to both the process and results; it requires a perspective on the system role and it pertains to the usefulness of specific tools and features for the achievement of the user's objectives. The degree of usefulness of various features of the system and their contribution to the achievement of results can only be assessed after the negotiation has been completed. Therefore, one can argue that, when a system is used for the first time, its usefulness cannot affect its use.

But the AMIS model considers a different situation. The system was used for a longer time and for several complete and different tasks related to the negotiation, therefore its usefulness can be assessed when one or more tasks have been completed. The continuing system use is similar for these cases to future use; for example, a user who finds the system useful to construct and present an offer will continue using the system at a later time and construct and present new offers. Therefore, we assume that usefulness may influence actual use which, in our case, shares some similarity with the construct future use. This latter construct has been found to be affected by the usefulness (Parthasarathy and Bhattacherjee 1998; Karahanna and Straub 1999). [4]

A similar argument may be made with respect to the ease of use of the system and its tools. One may expect that a system which is easier to use is used more often. The influence of ease of use on future use was proposed in the original TAM model (DeLone and McLean 1992) and confirmed in several subsequent experiments (Adams, Nelson et al. 1992; Igbaria, Guimaraes et al. 1995; Parthasarathy and Bhattacherjee 1998). Ease of use at one time affects frequency and/or intensity of usage at the later times. As we noted above, in the Inspire negotiations, this usage may be viewed as actual use in the AMIS model.

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[4] Nonetheless, we analyzed the model in which the relationship between usefulness and actual use was removed. The fit of the resulting model although acceptable was not be as good as for the model with the relationship ($R^2$ for the system assessment was reduced to .57 from.62 to .57).

### 3.2.2 Results

The AMIS model postulates that the construct results impacts constructs usefulness of analytical tools and usefulness of communication (Figure 1). The exploratory results of the AMIS model show (Figure 2), that there is a significant correlation between the construct results and usefulness of analytical tools, ease of use of analytical tools and ease of use of system.

The question is whether results affect the usefulness and ease of use, or *vice versa*. Vetschera et al. (2006) considered the users' rationalization; the better the results achieved, the better are their perceptions of the system usability and ease of use. The reason is that users provided their opinions about ease of use and usefulness after they completed the negotiations. The counterargument is that the results which one may achieve from using a system depend on its features, their ease of use and their usefulness. Even though the users provide information about the system after they complete their negotiation, it is during the negotiation when they form an opinion. Therefore, we consider the possibility of the results being affected by ease of use analytical tools, ease of use of system, usefulness of analytical tools and usefulness of communication.

### 3.2.3 Ease of use and usefulness correlation

The last modification to the AMIS model involves ease of use and usefulness. The exploratory analysis shows that there is a significant correlation between these two constructs (Figure 2). For the same reasons as discussed in Section 3.2.1 we assume that usefulness depends on ease of use and not vice versa.

### 3.2.4 User characteristics and the revised model

We mentioned (Section 2.2) that due to the sample size and the SEM method used to test AMIS model, we can consider only one characteristic of the Inspire users, that is, gender. We analyze the model for each gender group separately, and then compare/contrast the results by conducting a multiple group analysis.

The revised AMIS model is illustrated in Figure 3. The changes discussed in the three preceding sections are indicated with thick arrows.

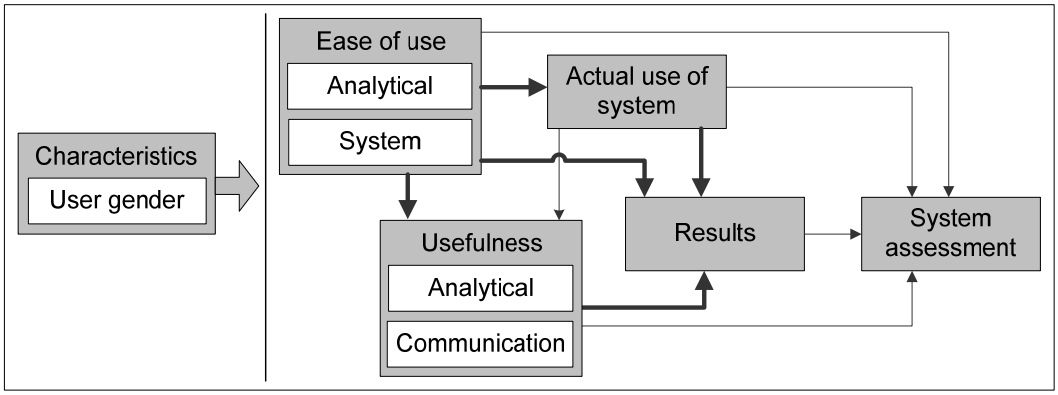


Figure 3. Proposed changes to AMIS: Conceptual view of the revised model

It should be indicated that in the following analysis, the definition of results is not identical to the one

used in exploratory analysis. Vetschera et al. (2006) considered results as a construct comprising: the achievement of an agreement, agreement efficiency and agreement utility value. They removed the first two variables from the analysis; we do the same because we consider only negotiations which ended with an agreement. We decided, however, to include the variable 'satisfaction with agreement' in the results construct because it is a subjective measure of the outcome.

## 3.3 Research model

The AMIS study and its discussion presented in Section 3.2, postulate a structural model. The structural model consists of seven constructs (underlying factors). Every construct is measured by one or more variables. The definitions for the constructs and their respective measures in this model are given in the Appendix, Tables 9 and 10.

In view of elaborating the detail relationships among the constructs and with the measures, the nomological network is depicted in Figure 4 to illustrate the manner in which system assessment is the internalization of the dynamic interplay between cognitive variables of the system and the objective variables. This extension from Figure 3 delineates the constructs (underlying factors) by circles and the observed (measured) variables by squares.

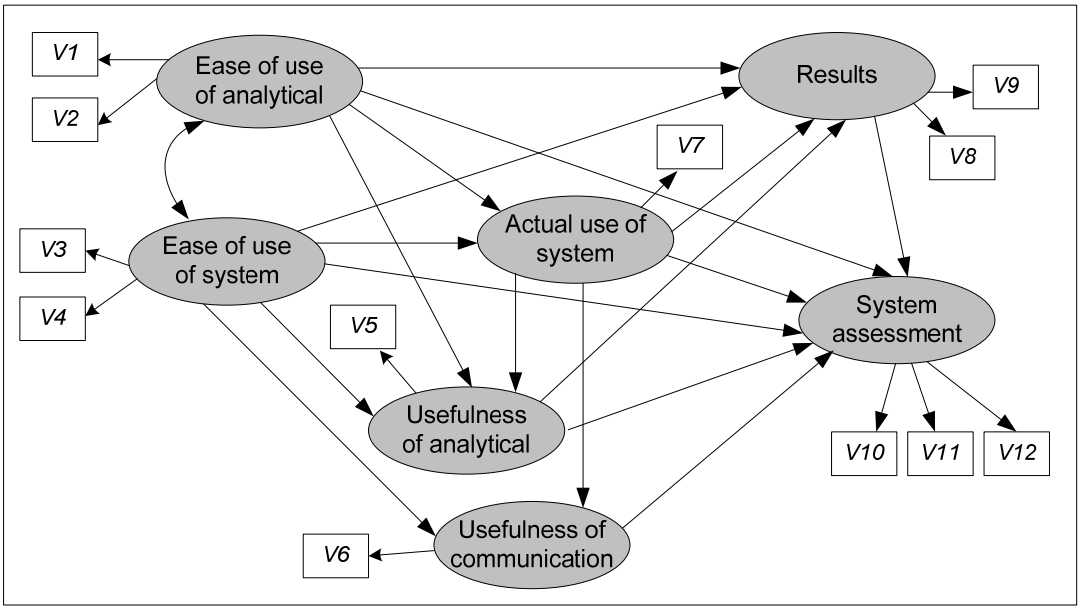


Figure 4. The postulated model

In Figure 4, the arrows from one factor to another factor or to a variable are the regression paths which correspond to "causal" relationships. These relationships may be decomposed into two groups: (1) the relations between factors with their corresponding measures (variables) which reflect the measurement model; and (2) the relation among the factors which represent the structural model. To avoid clutter, in Figure 4, arrows reflecting residual of regressions are not shown.

To verify the measurement model, confirmatory factor analyses of the nine variables reflecting the four constructs with multiple indicators (i.e. ease of use of analytical, ease of use of system, system assessment and results) were separately conducted for the male and female groups. The data, as

indicated, were records of people who negotiated via the Inspire system after the exploratory study conducted by Vetschera et al. (2006). The factor analysis results are discussed in Section 4.2; they confirm the measurement model as depicted in Figure 4.

## 3.4 Hypotheses

Vetschera et al. (2006) formulated a number of research questions which were tested. Their results are presented in Figure 2. The structural model (Figure 4) provides a basis for 14 hypotheses regarding the structural model an additional six hypotheses regarding the role of gender. They are discussed in this section.

### 3.4.1 Ease of use

The construct ease of use is measured separately for the analytical tools and for the whole system. Similar to the initial study, we were not able to measure ease of use of the communication platform because the questionnaires used were designed to assess users' experience with Inspire and not as a means of evaluating technology acceptance with instruments for different features.

Having used a modified TAM model and testing it with survey data, Chau (1996) reports that ease of use has positive impact on the system use in near future. Because other studies confirm this causal relationship (Igbaria, Guimaraes et al. 1995; Straub, Limayen et al. 1995), we hypothesize:

H1a: Ease of use of analytical tools has a positive effect on actual use of system.

H1b: Ease of use of system has a positive effect on actual use of system.

H1c: Ease of use of analytical tools has a positive effect on results.

H1d: Ease of use of system has a positive effect on results.

The effect of the system ease of use on its usefulness has been extensively studied within the TAM framework and its extensions (Davis, Bagozzi et al. 1989; Igbaria, Guimaraes et al. 1995; Todd and Benbasat 1999). The experiential construct ease of use influences usefulness, another experiential construct, in a positive way, thus we formulate:

H1e: Ease of use of analytical tools has a positive effect on usefulness of analytical tools.

H1f: Ease of use of system has a positive effect on usefulness of analytical tools.

H1g: Ease of use of system has a positive effect on usefulness of communication platform.

Jackson et al. (1997) found that the ease of use has a significant influence on attitude while usefulness does not. In contrast, Taylor and Todd (1995) found that the effect of ease of use on attitude towards a system is not significant. The users' long exposure to a system led Vetschera et al. (2006) to replace attitude towards the system with system assessment and postulate:

H1h: Ease of use of analytical tools has a positive effect on system assessment.

H1i: Ease of use of system has a positive effect on system assessment.

Based on work that evaluates ease of use of system features, we conjecture that ease of use of selected

system features is related to the overall consideration of the system ease of use (Hong, Thong et al. 2002).

H1j: Ease of use of analytical tools and ease of use of system are correlated.

### 3.4.2 Actual use

The actual use of the Inspire system is a construct measured by the number of offers with and without messages sent by the negotiators.

H2a: Actual use of the system has a positive effect on usefulness of analytical tools.

H2b: Actual use of the system has a positive effect on usefulness of communication platform.

H2c: Actual use of the system has a positive effect on results.

H2d: Actual use of the system has a positive effect on system assessment.

### 3.4.3 Usefulness

The concept of usefulness is tied to performance (Davis 1989), and in our case specifically to the analytical tool, which allows the negotiator to compare offers based on utility. From a procedural point of view the information provided by the analytical tool serves to establish the context for communication between negotiators. Since both features are used in conjunction with each other, the communication between negotiators can affect the use of the analytical tool and *vice versa*. As suggested in the exploratory study, we hypothesize:

H3a: Usefulness of analytical tools has a positive effect on results.

H3c: Usefulness of analytical tools has a positive effect on systems assessment.

H3b: Usefulness of communication platform has a positive effect on system assessment.

Most IS research examines solely the cognitive concepts that lead to adoption and usage, we extend this approach to include the stimulus that triggers human perception of systems. In essence, our model encompasses the usage of system features as the antecedents to the cognitive constructs of systems adoption in order to reinforce the notion of feedback in technology acceptance (Venkatesh and Davis 2000).

In the earlier TAM studies system usefulness was found to affect the system usage (Adams, Nelson et al. 1992; Straub, Limayen et al. 1995). As suggested in the exploratory study and also discussed in Section 2.3.1, the usefulness of various components of the system affect the actual use of the system.

### 3.4.4 Results

The construct 'results' is measured by the utility value of the achieved agreement and the user's satisfaction with it.

It affects the efficacy of the user, that is, the extent to which the individuals believe they have the capability to successfully execute the behavior (Compeau and Higgins 1995).

The attitude of the user towards using the system (i.e. *system assessment*) is influenced by the benefits that the user receives from the system, such as described by DeLone and McLean (2003) in terms of satisfaction (i.e. attitude) being impacted by net benefits.

H4a: Results has a positive effect on system assessment.

### 3.4.5 Gender

A major characteristic of the users is gender. To compare and contrast the above hypothesis for male and female users, we will first test the model separately for each group. Then we conduct a multi-group analysis under the hypotheses of identical measurement models in both male and female groups. That is, we hypothesize identical relationships between factors and their corresponding indicators for different groups. If there is a significant difference between the factor loadings of the two groups we will then focus on studying the dissimilarities. If there is no significant difference between the loadings, then we will reanalyze the data under the assumption of equal loadings and equal correlations among factors. Finally, since the main objective of our study is to understand the users' system assessment, we aim to learn the effect of the various factors on this final dependent variable in the diverse groups.

Gender is often an influential characteristic in IT assessment studies. Venkatesh et al. (2003) found that effort expectancy (i.e. ease of use) has a stronger impact on technology acceptance for women. On the other hand, for men technology acceptance is more influenced by performance expectancy (i.e. usefulness) than effort expectancy (i.e. ease of use) (Venkatesh and Davis 2000).

In this study usefulness is divided into communication and analytical tools. Based on studies which have shown women search for relationship-based outcomes and thus placing more emphasize on communication tools in negotiation (Thompson 1998), we propose:

H5a: The relationships among factors are significantly different for male and female users.

H5b: The ease of use of analytical has a significantly more positive impact on system assessment for the female group than it has for the male group.

H5c: The system ease of use for female group has a significantly more positive impact on system assessment for the female group than it has for the male group.

H5d: For the female group usefulness of communication has a significantly more positive impact on system assessment than it has for the male group.

H5e: For the male group 'results' has a significantly more positive impact on system assessment than it has for the female group.

## 4. Findings and discussion

The analysis consists of four parts. First, after examining the data for missing values and its distribution, a confirmatory factor analysis was conducted for each group separately to verify the underlying structure of the four factors which have multiple indicators (ease of use of analytic, ease of use system, system assessment and results). Then, SEM was used to test the plausibility of the model presented in Figure 4 for both male and female groups. Finally, multi-group analysis was conducted to identify the similarities and differences between the parameters of the male and female

groups (Byrne 2001).

## 4.1 Preliminary analysis

As indicated, the data were records of people who negotiated via the Inspire system after the exploratory study conducted by Vetschera et al. (2006). For this study we extracted 829 usable (not more than one missing value) records out of 5,027, based on the system's logs, as well as demographic and behavioral responses. The sample consisted of 481 males and 348 females. The low response rate is mainly due a large number of users not achieving an agreement and their decision to not answer the optional post-negotiation questionnaire.

Before conducting the required analyses, first an exploratory analysis of the data was conducted. The exploratory analysis revealed that 7 individuals in the male group and 4 in the female group did not send any message or offer to their opponents. The records of these individuals were consequently removed and the subsequent analysis was conducted on the remaining 474 observations in the male group and the 344 ones in the female group. The data was also checked for patterns of missing values which was about 1.86% of the sample and was treated using EM imputation. The items used in the study were all measured in Likert scales with five or more categories. Therefore, there was no need to use categorical analysis (Bentler 2004). It is important to note that the maximum likelihood (ML) estimates used in SEM are based on the assumption of multivariate normal distribution of the data. Although, it is unlikely that the ML estimate would be affected, non-normality of the data could lead to biased estimates of standard errors and consequently an inflated number of statistically significant parameters (Muthén and Kaplan 1985).

An examination of the distribution of the variables revealed that the data were slightly skewed and had excess kurtosis. Consequently, the analysis was conducted in EQS under elliptical distribution method. Finally, we checked cases with excess contribution to kurtosis as outliers and excluded them from the analysis. This resulted in deletion of two cases in the male group and two in the female group.

## 4.2 Confirmatory factor analysis

In order to investigate construct validity of the measurement model, confirmatory factor analyses of the nine indicators of the four constructs: ease of use of analytical, ease of use of system, system assessment and results were separately conducted for each male and female group.

The factor analysis results confirm the measurement model as depicted in Figure 4. The chi-square value (as a measure of bad fit) was not significant for both groups (p-values were 0.223 for female and 0.283 for male). All goodness of fit indices for both groups were very good. The value of CFI for male was 0.995 and for female 0.981 and the other goodness of fit indices were all more that .95 reflecting excellent fit (Bentler 2004). The factor loadings for both male and female groups are reported in Table 2. As we note from this table these loadings are very similar across the two groups.

Table 2. Confirmatory factor loadings and reliability analyses for both male and female groups

| Items | Factor loadings: male group | Factor loadings: female group | Composite reliability for combined sample | Construct |
|---|---|---|---|---|
| V1 Weight issues | 0.832 | 0.837 | 0.809 | Ease of use of analytical |
| V2 Weight options | 0.836 | 0.842 | | |
| V3 Inspire easy | 0.642 | 0.661 | 0.719 | Ease of use |

| | | | | |
|---|---|---|---|---|
| V4 Instruction easy | 0.786 | 0.820 | | of system |
| V8 Utility value | 0.409 | 0.488 | 0.542 | Results |
| V9 Satisfying agreement | 0.771 | 0.754 | | |
| V10 Performance | 0.719 | 0.697 | 0.701 | System assessment |
| V11 Expectations met | 0.567 | 0.548 | | |
| V12 Control | 0.506 | 0.488 | | |

Table 2 also provides the coefficient alpha as a measure of reliability for the composite measures of the four factors based on the entire sample. We note that the reliability coefficients, except for the factor 'results' are greater than 0.70. Therefore we may conclude that that the items are good indicators of the underlying factors and together provide a reliable measure of the corresponding factors. The correlations among the four factors are reported in Table 8 of the Appendix. These correlations may be used as a measure of convergent and discriminant validity of the factors. We note that the correlations among all factors are rather low except for the correlation between results and 'system assessment'. Table 7 also gives the correlation matrix of the variables to provide information on the convergent and discriminant validities of the items.

## 4.3 Structural equation modeling

Using EQS software (Bentler 2004), the general model depicted in Figure 4 is fitted to the data by means of the elliptical distribution method.

The chi-square values as a measure of bad fit for both groups are not significant (p-value = .2835 for male and .2223 for female) indicating that the model fits the data very well. The goodness of fit indices for both male and female are reported in Table 3 which are all very high reflecting excellent fit. (Bentler 2004).

Table 3. Fit indices for the structural factor analysis

| | **Female** | **Male** |
|---|---|---|
| BENTLER-BONETT NORMED FIT INDEX | 0.953 | 0.965 |
| BENTLER-BONETT NON-NORMED FIT INDEX | 0.987 | 0.992 |
| COMPARATIVE FIT INDEX (CFI) | 0.993 | 0.995 |
| BOLLEN (IFI) FIT INDEX | 0.993 | 0.995 |
| MCDONALD (MFI) FIT INDEX | 0.991 | 0.995 |
| LISREL GFI FIT INDEX | 0.975 | 0.981 |
| LISREL AGFI FIT INDEX | 0.950 | 0.963 |
| ROOT MEAN-SQUARE RESIDUAL (RMR) | 0.511 | 0..370 |
| STANDARDIZED RMR | 0.035 | 0.029 |
| ROOT MEAN-SQUARE ERROR OF APPROXIMATION (RMSEA) | 0.022 | 0.016 |
| 90% CONFIDENCE INTERVAL OF RMSEA | (.000, .046) | (.000, .037) |

Estimates of the structural parameters (reflecting the strength of relations among various factors) are given in Table 3 for both male and female groups.

For the dependent factor system assessment, in male group, the model is able to explain over 61.8% of its variation and in the female group over 62.7%. These percentages are quite high, particularly if we consider the nature of the measures involved in the model and the fact that most factors are measured only by two indicators.

A summary of the hypotheses tested for the general model along with the paths that are significant is reported in Tables 4 and 5, and depicted in Figure 5. Confirmed hypotheses are indicated in Figure 1 with thick black arrows, unconfirmed are indicated with narrow grey arrows. The user group for the confirmed hypotheses is indicated with F for female and M for male groups.

We note that actual use of system is neither affected by ease of use of analytical or by ease of use of system. That is, actual use acts as an independent variable as suggested by (Venkatesh and Davis 2000).

For both female and male groups ease of use of system indirectly affects system assessment through usefulness of communication (Table 4). The direct effect of this factor and the factor ease of use of analytical on system assessment is only observed in the female group. We also note that for both groups ease of use of analytical has significant effect on usefulness of analytical. However usefulness does not affect significantly system assessment in any group.

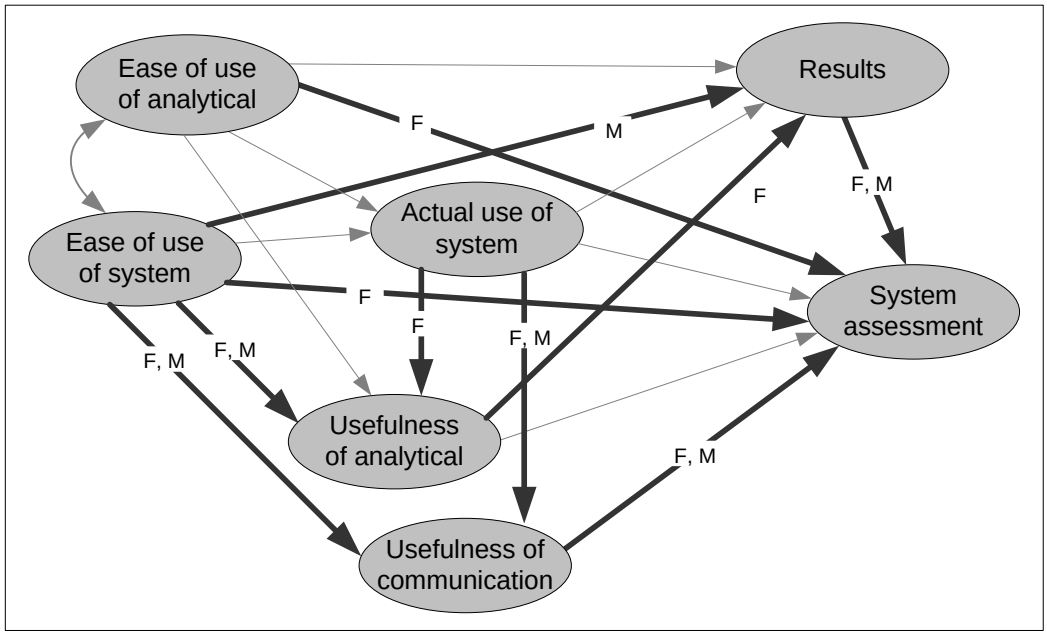


Figure 5. A graphical presentation of the significant paths in AMIS model

For the female group usefulness of analytical has a significant effect on results. However, this effect was not observed in the female group. For the male group it seems that results is effected directly by ease of use of system. These findings indicate that the system can be perceived as an amalgamation of its features, but also as an interaction between features (Hevner, March et al. 2004)**.** They also indicate differences between these two groups which, as far as we know, may not have been observed before. In particular, the impact of the usefulness of the analytical tools on the negotiation results

appears important. This is because of some researchers' critique of—as (Riley and McGonn 2002, p. 8) observed—"negotiation analysis for its stereotypically masculine characterization of negotiators as boundedly rational, utility-maximizing individuals." It appears that the usefulness of the analytical tools is considered important for the female group and affects the result they achieve. This implies that the use of utility and the achieved utility of the agreement are important for the female group.

Table 4. Hypotheses for the general model

| H | Hypothesis | Female | Male |
|---|---|---|---|
| 1a | Ease of use of analytical tools has a positive effect on actual use of system. | .272 | .087 |
| 1b | Ease of use of system has a positive effect on actual use of system. | .022 | -.029 |
| 1c | Ease of use of analytical tools has a positive effect on results. | .301 | .994 |
| 1d | Ease of use of system has a positive effect on results. | .903 | 2.374* |
| 1e | Ease of use of analytical tools has a positive effect on usefulness of analytical tools | .029 | .029 |
| 1f | Ease of use of system has a positive effect on usefulness of analytical. | .473** | .597** |
| 1g | Ease of use of system has a positive effect on usefulness of communication. | .261** | .329** |
| 1h | Ease of use of analytical tools has a positive effect on system assessment. | .200 | .058 |
| 1i | Ease of use of system has a positive effect on system assessment. | .142* | -.065 |
| 1j | Ease of use of analytical tools and ease of use of system are correlated. | .221 | .298 |
| 2a | Actual use of system has a significant impact on usefulness of analytical tools. | .067* | .035 |
| 2b | Actual use of system has a significant impact on usefulness of communication. | .078** | .054** |
| 2c | Actual use of system has a positive effect on results. | -.186 | -.052 |
| 2d | Actual use has a positive effect on system assessment. | -.018 | -.029 |
| 3a | Usefulness of analytical tools has a positive effect on results. | 2.311* | .748 |
| 3b | Usefulness of analytical tools has a positive effect on system assessment. | .012 | -.059 |
| 3c | Usefulness of communications has a positive effect on system assessment. | .194** | .086* |
| 4a | Results have a positive effect on the system assessment. | .065** | .087** |

* p-value < 0.05; ** p-value < 0.01; --- no significance

For the dependent factor system assessment, in the male group, the model is able to explain over 61.8% of its variation and in the female group over 62.7%. These percentages are quite good, particularly if we consider the nature of the measures involved in the model.

The model can account for only six to twenty three percentage of the variation of other dependent factors. This is partially due to the fact that most constructs are only measured with one to two items, which leads to a higher error in construct measurement compared to multi-item constructs (Bentler 2004). Unfortunately, some of the relevant questions were not included in the questionnaires, which was design mainly to capture a general sense of the negotiation process.

## 4.4 Multi-group analysis for users' characteristics

We used multi-group analysis to identify similarities and differences between male and female groups. This was done with multi-group analysis following the strategies outlined in Byrne (2001). That is, after the above analyses we conducted the following in order:

Step 1. Non-constrained baseline models was estimated for both groups to determine the overall fit of multi-group analysis.

Step 2. If the fit was acceptable, then measurement constraints are imposed on the models such that the factor loadings and measurement error are equal across the two groups.

Step 3. If the measurement models were found to be the same, then structural constraints are added to the models such that the regression coefficients relating factors to each others (structural coefficient) are equal across groups.

Step 4. If the structural model was similar, then the covariances (or correlations) among all factors are restricted to be equal for the two groups in addition to all other constraints.

Only after the group models have successfully passed the Steps 1 and 2 above, one can conduct step 3 to test equality of common paths for the two groups. The above strategy was adopted due to the fact that the structural models differed for male and female. That means that in this context only a partial invariance across gender is meaningful.

It should be indicated that the associated chi-square ($\chi^2$) for a fitted model along with its degree of freedom is used to test a model in which certain parameters are constrained to be equal across gender with a less restricted one in which the same parameters are free to take on any value. To assess the extent to which a new restriction in the model exhibits deterioration in the fit over its predecessor, we examine the difference in chi-square ($\Delta\ \chi^2$) between the two nested models. This difference itself has a chi-square distribution with a degree of freedom equal to the difference in t degrees of freedom ($\Delta\ f$) of the two models and can thus be tested statistically.

The main concept of AMIS is system assessment, which leads us to provide a detailed analysis of the factors influencing this construct for each group separately. The significant paths for these models are given in Table 4 and illustrated in Figure 5. Based on the above literature and these findings we conducted some multi-group analysis to test equality of effects of the paths that are significant in both groups.

The results of invariance across gender for multi-group analysis and testing the above hypothesis are summarized in Table 5.

From the first four $\chi^2$ values and their associated degrees of freedom given in table 6, we can conclude invariance of the measurement model in the two groups. We note that for the above measurement

model the factor loadings along with their corresponding measurement error and factor correlation are invariant across the two groups. Consequently we can use model 4 as a base to test the above hypothesis. The difference of the chi-square values ($\Delta \chi^2$) for the above five hypotheses are also reported in Table 5. These differences, as indicated previously, have a chi-squares distribution with one degree of freedom which are used to test the corresponding hypothesis.

Table 5. Invariance of gender

| | Model | $\chi^2$ | *d.f.* | P-Value | Model Comparison | $\Delta \chi^2$ | $\Delta$ *d.f.* |
|---|---|---|---|---|---|---|---|
| 1 | Base Model | 88.21 | 77 | .201 | --- | --- | --- |
| 2 | Invariance of all factor loadings | 88.36 | 82 | .329 | 2 vs 1 | .15 | 5 |
| 3 | Invariance of all factor loadings and measurement error | 104.89 | 90 | .134 | 3 vs 1 | 16.68 | 13 |
| 4 | Invariance of all factor loadings and measurement error and covariances (H5a) | 110.68 | 92 | .090 | 4 vs 1 | 22.47 | 15 |
| 5 | H5b | 111.70 | 93 | .091 | 5 vs 4 | 1.02 | 1 |
| 6 | H5c | 114.73 | 93 | ..063 | 6 vs 4 | 4.15 | 1 |
| 7 | H5d | 113.38 | 93 | .074 | 7 vs 4 | 3.30 | 1 |
| 8 | H5e | 110.75 | 93 | .101 | 8 vs 4 | .07 | 1 |

We note that these differences are less than 3.48 which is the critical value of chi-square with one degree of freedom. Therefore, at .05 significance level there is not sufficient evidence to conclude that there exists a gender difference for the above effects. These results are summarized in Table 6.

Table 6. Hypotheses for multi-group analysis

| | Hypothesis for multi-group comparison | Supported |
|---|---|---|
| 5a | The relationships among factors are significantly different for male and female users. | No |
| 5b | The ease of use of analytical has a significantly more positive impact on system assessment for the female group than it has for the male group. | No |
| 5c | The system ease of use for female group has a significantly more positive impact on system assessment for the female group than it has for the male group. | Yes |
| 5d | For the female group usefulness of communication has a significantly more positive impact on system assessment than it has for the male group. | No |
| 5e | For the male group 'results' has a significantly more positive impact on system assessment than it has for the female group. | Yes |

# 5. Conclusions

In line with research in technology acceptance (Hong, Thong et al. 2002), we find that for the female group, ease of use of system affects their system assessment. The explanation for the insignificant link between ease of use of analytical to system assessment is that particular perceptions on system features may not translate to an overall view of the system (Venkatesh 1999).

The lack of a relationship between usefulness of analytical and system assessment could be explained by the employment of a single item to measure this construct, which may not be sufficient to reflect the nature of this latent variable (Bollen 1989, 16-18).

In general, the findings lend support to the conclusions proposed in the previous study and by other researchers that TAM must be modified to allow for a more parsimonious model that showcases system features and user characteristics in assessing usage (Venkatesh and Davis 1996; Agarwal and Prasad 1998; Hong, Thong et al. 2002).

This study confirms the finding of the previous research. We find that:

1. System features can be decomposed into analytical and communication for richer assessment of users' intention to utilize ENSs;

2. The constructs ease of use and usefulness must also be broken down according to the features; and

3. The users' gender can influence the relationships in system assessment.

One contribution appears to be the specification of the constructs and relationships which best explain system assessment. For the general model, system assessment is determined by usefulness of communication and usefulness of analytical, as well as, the ease of use of analytical tool and ease of use of system. However, from multi-group analysis in the case where participants are females the EU of communication becomes important to the assessment of the system, and the general ease of use of the system also affects assessment of the system. Regarding the difference in significant paths, one explanation for having significant effect from ease of use to system assessment for the female group and to results for male that is female are more process oriented and male are results oriented (Ilie, Van Slyke et al. 2005).

From the perspective of ENS design, this study shows that system assessment of ENS is equally impacted by ease of use of communication and analytical tools. Nevertheless, if the system is geared towards female users, then the usefulness of the communication tool and the overall ease of use play a strong role on their system assessment.

Limitations of this study include the fact that the model is proposed for only those Inspire users who have reached an agreement. The most influential limitation in this study is the post-questionnaire used to measure the constructs. This was created to provide some information on participants and their negotiation experience and not to assess adoption of ENS, thus attributing to a low factor variance for system assessment. For future research, the experimental design of the questionnaire should consist of questions developed specifically to measure each construct. As a continuation of this project, we will also evaluate other characteristics that influence system assessment by means of multi-group analysis.

These characteristics are the user's country of residence and the effect of resulting scores for negotiators who have reached an agreement.

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Appendix

Table 7. Correlation matrix for AMIS items

| | V1 | V2 | V3 | V4 | V5 | V6 | V7 | V8 | V9 | V10 | V11 | V12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weight issues(V1) | 1.00 | | | | | | | | | | | |
| Weight options(V2) | .679 | 1.00 | | | | | | | | | | |
| Inspire easy(V3) | .127 | .150 | 1.00 | | | | | | | | | |
| Instruction easy(V4) | .214 | .188 | .562 | 1.00 | | | | | | | | |
| Analytic useful(V5) | .116 | .086 | .341 | .259 | 1.00 | | | | | | | |
| Communication useful (V6) | .092 | .073 | .165 | .135 | .264 | 1.00 | | | | | | |
| Number of offers(V7) | -.041 | -.038 | -.001 | -.110 | .072 | .136 | 1.00 | | | | | |
| Utility value(V8) | .097 | .034 | .102 | .095 | .167 | -.004 | -.038 | 1.00 | | | | |
| Satisfying agreement(V9) | .137 | .056 | .172 | .170 | .181 | .126 | -.038 | .372 | 1.00 | | | |
| Performance (V10) | .195 | .153 | .190 | .220 | .146 | .182 | -.071 | .234 | .457 | 1.00 | | |
| Expectations met(V11) | .093 | .083 | .108 | .114 | .104 | .130 | -.059 | .159 | .367 | .379 | 1.00 | |
| Control(V12) | .083 | .067 | .107 | .056 | .125 | .147 | -.015 | .127 | .300 | .375 | .339 | 1.00 |

Table 8. Correlation Matrix of Latent variables

| | Ease of use of analytical tools | Ease of use of system | Results | System assessment |
|---|---|---|---|---|
| Ease of use of analytical tools | 1.00 | | | |
| Ease of use of system | .235<br>(0.091) | 1.00 | | |
| Results | .179<br>(0.176) | .345<br>(0.328) | 1.00 | |
| System assessment | .196<br>(0.208) | .254<br>(0.235) | .764<br>(0.736) | 1.00 |

Note: The numbers in bracket are correlations for female group.

Table 9 Construct definitions for research model

| Constructs | | Definitions | Measurement variables |
|---|---|---|---|
| Actual use | | Taken from the log record of Inspire, this construct is based on number of offers sent with messages. The measure variables are treated as one item (AU) in EQS analysis | Number of offers with and without a message (V7) |
| Results | | The agreement utility obtained by the user from the negotiation | Utility value (V8)<br>Satisfying agreement (V9) |
| Ease of use | Analytical tool | Describes users' perception of the ease of use of the utility tool with respect issue and option rating. | Weight issues (V1)<br>Weight options (V2) |
| | System | Describes users' perception of the ease of use of the system and the instructions related to system use. | Inspire easy (V3)<br>Instruction easy (V4) |
| Usefulness | Analytical tool | Describes users' perception of the usefulness of the utility values. | Analytic useful (V5) |
| | Communication | Describes users' perception of the helpfulness of messages. | Communication useful (V6) |
| System assessment | | Reflects users' attitude towards the behavior of negotiating with the system. This attitude is related to the user's feelings concerning the consequence of their behavior (i.e. outcome) and the control over the process of negotiation. | Performance (V10)<br>Expectations met (V11)<br>Control (V12) |

Table 10. Items definitions for research model

| **Measurement variables** | **Scale** | **Definitions** |
|---|---|---|
| Offers with message | integer | No. of offers sent to negotiation partner containing a message |
| Offers without message | integer | No. of offers sent to negotiation partner containing no message |
| Messages | integer | No. of text message sent independent of offer |
| Utility | integer | Utility value calculated for the agreement |
| Weight issues | Likert-5 | Easy to weigh issues |
| Weight options | Likert-5 | Easy to weigh options |
| Instruction easy | Likert-7 | Easy to understand instructions |
| Inspire easy | Likert-7 | Easy to use Inspire |
| Analytic useful | Likert-7 | Found the rating displayed with offer useful |
| Communication useful | Likert-7 | Found message helpful for negotiation |
| Performance | Likert-7 | Using the system increase negotiation performance |
| Agreement satisfying | Likert-7 | Satisfaction with negotiation agreement |
| Expectations met | Likert-7 | Negotiations met expectations |
| Control | Likert-7 | Level of perceived control over the process |