# The Relationships among Performance of Accounting Information Systems, Influence Factors, and Evolution Level of Information Systems

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ABSTRACT: In previous implementation studies, the relationships between influence factors and information systems (IS) performance under the level of IS evolution were not empirically examined. The studies did not consider the evolution level of IS in examining influence factors of IS performance. They have tried to identify critical influence factors without considering the state of the IS and the IS department, that is, the levels of IS evolution.

The objectives of this study are to examine the direct relationships between influence factors and performance of accounting information systems (AIS), and to identify the moderating effect of evolution level of IS on the relationships. In this study, the direct relationships and the moderating effect of evolution level of IS were hypothesized.

The results of the empirical test suggested that there are significant positive correlations between the performance of an AIS and the influence factors such as user involvement, capability of IS personnel and organization size. It was also proved that the relationships between performance of AIS and influence factors are significantly influenced by the evolution level of IS. Hence, for the success of AIS, each influence factor should be considered differently in the degree of importance according to the level of IS evolution.

KEY WORDS AND PHRASES: accounting information systems, evolution level of information systems, user satisfaction with accounting information systems.

MANY STUDIES HAVE TRIED TO IDENTIFY THE FACTORS or the courses of action that positively contribute to system performance or the probability of successful implementation. Factors that influence the performance of information systems (IS) are user involvement in development (e.g., [10, 35, 42, 64]), top management support (e.g., [6, 12, 13]), user training and education (e.g., [9, 12, 42]), context of IS group (e.g., [8, 19, 33, 52, 56]), and other organizational contexts such as size, task characteristics, and the like (e.g., [20, 22, 25, 57, 60, 69]).

Some studies have found the direct effects of these influence factors on the successful implementation and performance of IS. The results of many other studies, however, have been inconclusive and contradictory (e.g., [12, 19, 25, 31, 52, 56]).

In terms of organization size, Gremillion [25] has suggested no relationship between IS use and organizational size as measured by geographic area, staff and budget levels, and so on. However, Yap [69] empirically suggested a positive relation between IS use and organization size measured by annual turnover. The results of the two studies were contradictory. Raymond [57] explained these conflicting results through system sophistication. He reported that the effect of organization size on IS usage is mediated by the system sophistication. Generally, system sophistication increases as the evolution level of IS becomes higher [1].

In terms of user involvement, Olson and Ives [52] found an inconclusive relationship between user involvement and IS success. However, in the studies of Kim and Lee [35], and Tait and Vessey [64], the moderating effect of task or system complexity on the relationship between user involvement and IS success was suggested. Task or system complexity as a moderating variable is related to the evolution level of IS [1, 21, 48].

In other studies [12, 19, 56, 60], the impacts of influence factors on IS success were empirically tested and the results were conflicting. Delone [12] found no relation between user training and IS success, but Sanders and Courtney [60] suggested a significant positive relationship. Raymond [56] empirically suggested a significant positive relationship between IS department rank and IS success. However, in the study of Franz and Robey [19], no relationship was found.

On the whole, the reason for these inconclusive and contradictory results is related to the direct link between influence factors and IS performance. Some implementation factor researchers have ignored the intermediate level or the moderating effects of variables [22].

The evolution level of IS is also an influence factor, and many researchers have empirically tested the impact of evolution level on the performance of IS (e.g., [8, 40, 42, 56]). However, their results were inconclusive.

Cheney and Dickson [8] have found that IS performance is influenced by the evolution level of IS. However, Raymond [56] and Montazemi [42] have suggested no relationship between IS performance and IS maturity as measured by the duration of IS operation. Mahmood and Becker [40] also have found that the individual IS maturity variables were weakly related to user satisfaction variables.

In the study of Raymond [56], it was suggested that IS maturity is significantly associated with all the other influence factors. He proposed that IS maturity may have an influence on the performance of IS through its association with other influence factors.

Nolan [46, 49] suggested that critical management problems or critical success factors are different according to the degree of evolution. He also represented that, in the earlier evolution stage, fund support, lax control, and technical capability of IS personnel are more important, and in the later stage, independence of IS department, steering committees, user involvement and recognition are more critical. Hence, according to the level of IS evolution, the influence factors, such as user involvement, user training and education, top management support and steering committees are considered differently in the degree of importance and each influence factor has a different impact on the performance of IS.

In previous implementation research, the relationships between influence factors and evolution level of IS were not considered, and the relationships between influence factors and IS performance under the level of IS evolution were not empirically examined. The research did not consider the evolution level of IS in examining influence factors of IS performance. The research has tried to identify critical influence factors without considering the states of the IS and the IS department, that is, the levels of IS evolution.

The performance of IS directly or indirectly depends on the state of the IS and the IS department. Hence, influence factors for the increase of IS performance should be examined, considering the states of the IS and the IS department.

This paper represents an exploratory effort to empirically test the relationships among performance of accounting information systems (AIS), influence factors, and evolution level of IS in Korean business firms. Thus, the objectives of this research are: to examine the direct relationships between influence factors and AIS performance; to identify the relationships between influence factors and AIS performance under the level of IS evolution; and to suggest some managerial implications of these findings for the successful implementation of AIS.

## Factors Influencing AIS Performance

THE RESEARCH APPROACH THAT EXAMINES THE INFLUENCE FACTORS on the performance of IS is implementation factor research [7]. Implementation factor research suggests various influence factors including user involvement, top management support, user training and education, and context of IS group.

User variables, such as user cognitive style, attitude, and prior expectations, have an influence on the performance of IS. Zmud [72] and Rahman and Mccosh [55] empirically tested the impact of the decision style and the personality of user on IS use and satisfaction. Shewe [61] and Robey [58] also empirically tested the relationships among user belief, user attitude and IS use, and they represented positive relationships between user attitude and IS use.

Many researchers have examined the influence of organizational context and structure variables on IS performance (e.g., [8, 9, 19, 42, 60]). Sanders and Courtney [60] and Cheney et al. [9] examined the impact of organizational environment, structure, and task environment on the performance of IS. They suggested significant relationships between the performance of IS and the organizational variables, such as task characteristics, standardization and authority [60]. In other studies (e.g., [8, 56]), the influences of IS department variables on IS performance were empirically suggested.

Ein-dor and Segev [17] suggested that there is a positive relationship between organization size and IS performance, and Gremillion [25] and Raymond [57] empirically tested it. Other studies suggested and empirically tested the relationship between the formalization of IS development and the IS success (e.g., [37, 65]). Lee and Kim [37] found a significant positive relationship.

However, in implementation factor researches, critical influence factors were studied and examined without considering the level of IS evolution. Most studies have tried to find direct relationships between influence factors and IS performance.

In this study, user participation in development, user training and education, top management support, steering committees, formalization of IS development, location of IS department, technical capability of IS personnel, and organization size, which have been investigated critically in previous implementation factor researches [9, 13, 19, 26, 37, 42, 43, 57], were also included as main influence factors.

## The Effect of IS Evolution Level on the Relationships

NOLAN [49] AND DRURY [15] PROPOSED THAT IS evolution stages can be grouped together into two broad categories. Stages 1, 2, and 3 belong to one category (prior stage), and stages 4, 5, and 6 belong to the other (posterior stage).

In the prior stage, for the adoption and expansion of IS, organizational slack in IS activities should be permitted. Sufficient fund support, lax control, early training, education, and documentation of IS are more important in the prior stage. The IS documentation is necessary for the learning and knowledge acquisition in the early stage of IS development [49].

In the posterior stage, the roles of steering committees, independence of the IS department, and user involvement are more critical for the successful implementation of IS [49]. Ein-dor and Segev [18] and Mahmood and Becker [40] also suggested that, as the IS becomes more mature, independence of the IS department and user participation are more important for the success of IS.

As the IS evolves into the posterior stage, the developed systems are more sophisticated, and the number of related user departments increases [1, 49]. Hence, the organizational and user requirements also increase. User participation in the development permits the system to be constructed so as to provide the best fit between the IS characteristics and the requirements of organization or user [27]. User participation can improve system design quality by constructing the system's fit to the various needs of the organization [64]. Mahmood and Becker [40] represented that user involvement increases the performance of IS as the IS matures. Therefore, it is likely that the influence of user participation on the performance of IS will be greater in the posterior stage.

Cerullo [6] reported that top management support involves the following functions: setting goals and appraising objectives, evaluating project proposals, defining information and processing requirements, and reviewing programs and plans for the information system effort. Doll [13] also suggested that top management support ensures offering funds, setting policies and goals, system development planning, and deciding development priorities. Of these functions, particularly, fund support and goal setting are important [13].

In the prior stage, sufficient fund support is required for the adoption and the expansion of IS. However, in the posterior stage, it is more critical to set system objectives and goals that are fitted to the organizational goals [48, 49]. Hence, top management support has an equal influence on the performance of IS in both stages, prior and posterior.

Many researchers have suggested that user training and education have an impact on system performance (e.g., [42, 43, 70]). Though user training and education are necessary in both stages, they are more necessary for user acceptance and understanding in the initial stage when the application systems are first introduced [5, 49]. Nolan [49] also suggested that early training and education are inevitable. Hence, it is likely that the influence of user training and education on system performance will be greater in the prior stage.

The steering committees have five essential functions: setting the direction of IS activities, resource rationing, structuring the IS department, staffing of IS personnel, and advising and auditing of IS activities [34, 50]. Doll [13] suggested that the committees in successful firms are more active in discussing policy issues related to IS development, more apt to discuss how IS can contribute to organizational objectives, and how the systems development process can be managed. Several other researchers also reported similar functions of steering committees, such as defining objectives of IS, resolving conflicts concerning user needs, discussing problems arising from IS development and operation, approving data-processing capital expenditures, and reviewing documentation for IS [16, 17, 54].

However, the above functions are required more in the later evolution stage when the information systems are decentralized and the strategic thrusts of organization increase [48, 50]. Nolan [50] also proposed that the role of steering committees is more important in the posterior stage for efficient resource allocation. Hence, the influence of steering committees on the performance of IS will be greater in the posterior stage.

Technical capability of IS personnel has a major influence on the information requirements analysis and the design of IS. For example, competent system analysts have a positive effect on the information requirement assessments [29, 41]. Bruwer [4] also suggested that the performance of IS is related to the technical quality or the design quality of the system, which is the responsibility of system personnel.

Benbasat et al. [3] classified technical capabilities into two categories, specialist skill and generalist skill. In the prior stage, specialist skill is required. However, in the posterior stage, generalist skill is more necessary [3]. Specialist skill includes system design techniques related to the system, computer, and model, and generalist skill means system analysis techniques related to the organization, human, and society. Therefore, technical capability of IS personnel has equal influence on the performance of IS in both stages.

In the initial stage, the IS unit locates itself within other departments. However, as the IS matures, the IS unit eventually becomes autonomous [17, 21].

The location of an IS unit within a specific department inhibits and delays application outside the department. Hence, as the IS unit expands, the IS unit should become independent for companywide coordination and information processing. Therefore, the influence of IS unit location on the performance of IS will be greater in the posterior stage.

Formalization of IS development means the extent to which the task in the process of system development is systematically documented and actively conforms to the documents [37].

The formalization of system development influences the successful implementation of IS [37, 45, 65]. Lee and Kim [37] empirically tested the claim that in the initial stage of IS evolution the formalization of system development has a greater influence on the performance of IS, since in the initial stage learning and experience of system personnel would be lower. Nolan [49] also suggested that, in the prior stage, documentation and programming of system development processes are more critical for successful implementation. Hence, it is likely that the influence of formalization on the performance of IS will be greater in the prior stage.

Many researchers have proposed that organization size has an influence on system performance [17, 57]. They also suggested that the reason why system implementation is successful in large organizations is the sufficient funding or resource support of the larger organization. Other researchers proposed and empirically tested the relationship between organization size and system performance [19, 56]. However, Lehman [38] and Raymond [57] empirically suggested the relationships among organization size, system sophistication, and system performance, and the significant indirect effect of organization size through its association with system sophistication.

Although sufficient resources are needed in the expansion stage, the required funds increase dramatically in the posterior stage when the database and the telecommunication systems are introduced [49]. Hence, the influence of organization size on system performance will be greater in the posterior stage when the system sophistication and the needed resources radically increase.

So far, previous research has been reviewed. Based on the prior studies, it is suggested that influence factors have different impacts on the performance of IS according to the level of IS evolution. The research model in this study is represented in figure 1.

## Hypotheses

THE HYPOTHESES IN THIS STUDY DESCRIBE THE DIRECT RELATIONSHIPS of the influence factors and AIS performance, and the relationships between influence factors and AIS performance under the level of IS evolution.

Many studies have suggested and empirically tested that top management support has a positive effect on the performance of IS through diverse activities [6, 12, 13]. Hirschheim [28] suggested that participatory system design improves system quality

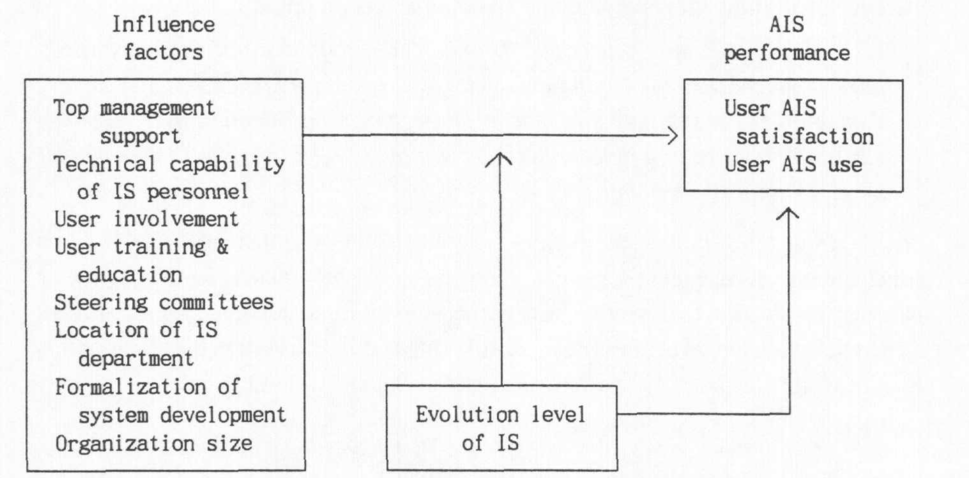


*Figure 1.* Research Model

and can lead to increased user satisfaction and fewer systems change requests. Several other researchers also reported that user participation influences the design and performance of IS [42, 64].

Technical capability of IS personnel has an influence on the design quality and the performance of IS [4, 29]. Montazemi [42] empirically suggested the positive relationship between the presence of IS personnel and user satisfaction.

The relationship between the formalization of system development and IS success was proposed and empirically tested [37, 65]. Lee and Kim [37] empirically suggested a significant positive relationship. Many researchers have proposed that organization size is positively related to the success of IS, since the funds or the resource support is more sufficient in larger organization [17, 57].

Based on the above arguments, hypothesis 1 is presented.

> *H1: There are positive relationships between influence factors such as top management support, user involvement, technical capability of IS personnel, formalization of system development and organization size, and the performance of AIS.*

With user training and education, users can acquire the ability to identify their information requirements and the advantages and the limitations of IS, and this ability can lead to increased performance [42]. Other researchers have proposed positive relationships among user training, user attitude, and success of IS [9, 60].

Steering committees have an influence on the performance of IS through the essential functions [50, 54]. Ein-dor and Segev [17] and Drury [16] also suggested that key functions of steering committees have an effect on the performance of IS. Many studies have proposed that the location of the IS department or IS manager is positively related to IS success [9, 19]. Raymond [56] also empirically found a positive relation between the location of IS department and the success of IS.

On the basis of the previous findings, hypothesis 2 is proposed:

*H2: In an organization where user training, education and steering committees are introduced, and the location of the IS department is independent, the performance of AIS is greater than that of an organization in which user training, education, and steering committees are not introduced, and the IS department locates within another department.*

As the IS matures, system complexity or sophistication also increases [1, 49]. User participation in development is required more as the system becomes more complex or sophisticated [2, 35, 64]. Therefore, user participation is more important for the success of IS as the evolution level of IS rises [18, 40]. This study hypothesizes the relationships among user involvement, AIS performance, and evolution level of IS:

*H3: The influence of user involvement on AIS performance tends to be positively greater in the posterior evolution stage of IS.*

Top management support involves various fuctions, such as offering funds, setting policies and goals, system development planning, and the like [6, 13]. In the prior evolution stage of IS, the function of fund support is more necessary. In the posterior stage, however, setting system objectives and goals is more critical [48, 49]. In both evolution stages, top management support is needed for the success of IS.

*H4: Top management support has equal influence on the AIS performance in both stages, prior and posterior.*

User training and education improve users' computer ability [47], and change users' attitudes toward the IS services and staff [70]. In the initial evolution stage, when users resist and have doubts about computerization, user training and education are more necessary [5, 49].

*H5: The influence of user training and education on AIS performance tends to be positively greater in the prior evolution stage of IS.*

In the posterior evolution stage, when the information systems are decentralized and the strategic thrusts of IS increase, the roles of steering committees, such as defining objectives of IS, resolving conflicts about user needs, and approving resource allocation, are inevitable [48, 50]. Hence, the functions of steering committees are more critical in the posterior stage [50].

*H6: The influence of steering committees on AIS performance tends to be positively greater in the posterior evolution stage of IS.*

The location of the IS unit within a specific department restricts the roles of IS to the activities of that department. In the posterior stage, when the information systems become expanded and the companywide use of IS is required, the IS department should become autonomous [21]. The location of IS unit is more important in the posterior stage.

*H7: The influence of the location of the IS department on the AIS performance tends to be positively greater in the posterior evolution stage of IS.*

Technical capabilities of IS personnel are grouped into two categories, such as specialist skill and generalist skill [3]. Nelson [46] also suggested similar categories. Specialist skill is needed in the prior stage, and generalist skill is required more in the posterior stage [3]. Hence, technical capabilities of IS personnel are important in both evolution stages.

*H8: Technical capability of IS personnel has equal influence on AIS performance in both stages, prior and posterior.*

In the initial evolution stage, the learning and experience of IS personnel and users would be lower. Therefore, the formalization of system development is more necessary in the prior stage [37, 49].

*Hypothesis 9: The influence of the formalization of system development on AIS performance tends to be positively greater in the prior evolution stage of IS.*

Large organization size means sufficient funds or resource support [17, 25, 57]. In the posterior stage, IS sophistication and necessary resources increase dramatically [49]. Therefore, the influence of organization size will be greater in the posterior stage.

*H10: The influence of organization size on AIS performance tends to be positively greater in the posterior evolution stage of IS.*

## Research Method

### Sampling

THE DATA USED IN THIS STUDY WERE DRAWN FROM A SURVEY of the current status of management information systems (MIS) development and management in Korean business firms. One hundred organizations were randomly selected from a population of about 417 firms with a mainframe computer. Among these, 78 responded to the request for information and were finally included in the study.

The study covered 450 users of accounting information systems in 107 subunits, such as departments of general accounting, finance, tax and cost accounting, which mainly use the accounting information systems. Therefore, the unit of analysis was the subunit within the organization. In a sample department, the main subsystem of AIS was surveyed.

Data were gathered by the interviews based on structured questionnaires. Two kinds of questionnaires were prepared for the study, one for measuring the overall environment of organizational information systems, another for measuring users' perception with relation to both the influence factor and the AIS. Questionnaires of the first type were distributed to the managers of IS departments. Those of the second type were delivered to the users, and the respondents were spread from lower to upper levels in their

Table 1. Sample Characteristics

| | Type of industry | | | | | |
|---|---|---|---|---|---|---|
| | Manufact-uring | Construction/ engineering | Retail/ wholesale | Financing/ insurance | Others | Total |
| No. of firms | 46 | 6 | 9 | 16 | 1 | 78 |

| | Type of subsystem | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cost ac-count-ing | Subsid-iary ledger | General ledger | Fund mgt. | Budget-ing | Tax mgt. | Per-form-ance mgt. | Invest-ment mgt. | Lease ac-count-ing | Total |
| No. of sub-systems | 12 | 28 | 23 | 16 | 14 | 10 | 1 | 2 | 1 | 107 |

subunit's formal hierarchy. Table 1 summarizes the sample characteristics according to the industrial type of the firm and the type of the subsystem.

## Measurements

### User Participation in the AIS Development Process

User participation is defined simply as involvement in the system development process by a member or members of the target user group [52]. In this study, the degree of participation in the overall AIS implementation process by the user group was measured on a seven-point Likert-type scale [35].

### User Training and Education

User training and education were measured by asking whether the training and education system exists and if the user was substantially educated through the system. Of the 107 subsystems, 76 subsystems belonged to an organization with a training and education system and educated users substantially, 18 did not belong to such an organization, and the rest did not answer.

### Top Management Support

Top management support is defined as the understanding of the computer system and the degree of interest, support, and recognition about information systems or computerization [35, 37]. In this study, top management support was measured by an instrument originating partly from Vanlommel and Debrabander [67], but modified for this study [35]. It was measured on seven-point Likert-type scales.

### Capability of Information System Personnel

Capability of information system personnel can be measured by average education/experience levels of IS group members [30]. In this study, information system group members were classified into one of five categories according to level of experience, such as less than one year, one year to three years, three to five years, five to seven years, and more than seven years. These categories were given the weights 1, 3, 5, 7, and 9, respectively, and the number of personnel belonging to each category was multiplied by the weight for the category. By summing up the scores and dividing by the total number of information system personnel, the average level of experience or capability of information system personnel was obtained.

### The Existence of Steering Committee

The existence of a steering committee was measured by asking whether one exists or not. Of the 107 subsystems, 36 belonged to organizations that had a steering committee, 68 did not belong to such an organization, and the rest did not answer.

### The Location of IS Department

The location of the IS unit was measured by asking whether the IS unit is independent or located within other departments. Of the 107 subsystems, 60 subsystems belonged to an organization in which the IS unit is independent, 46 did not belong to such an organization, and the rest did not answer.

### Formalization of System Development

The instrument for the formalization of system development consists of five items that measure the current status of the project control procedure, including progress reports for a project submitted to the manager of the IS department, project documentation in a standardized format, detailed person-hour recording by each project, cost allocation to individual project, and computer-based information system for project control [37]. Degree of formalization for each dimension was measured on a seven-point scale.

### Organization Size

Organization size can be measured by the sales volume or premium income and the number of employees [18, 26, 57]. Number of employees is the most common size criterion used by researchers [12, 56]. In this study, the organization size was measured by the number of employees.

### The Evolution Level of IS

Even though empirical support for Nolan's stage model was mixed and somewhat discouraging [15, 39], it was used to measure evolution or maturity level of IS. Mahmood and Becker [40] proposed that as an organization moves from stage 1 to stage 6, it becomes more mature. In other words, organizations displaying characteristics of later stages were considered to be more mature than organizations showing characteristics of former stages. Hence, in this study, Nolan's stage model was used to measure maturity level or evolution level of IS.

Gregoire and Lustman [24], however, suggested the inappropriateness of some benchmarks for measuring evolution level. Inadequate benchmarks are expenditure and technology benchmark. Expenditure benchmark is most inadequate because data-processing expenses are budgeted according to the traditions and the rules of organization. Finance-related variables should not be used as a stage assessment tool [24]. In this study, expenditure benchmark was excluded, and the remaining five benchmarks were used. Each benchmark was measured on a six-point ordinal scale.

#### Performance of AIS

Surrogate measures of performance have been utilized in many studies, and they can be divided largely into four types, attitudinal or user satisfaction, system use, decisional performance, and organizational performance [68].

In this study, user AIS satisfaction and system use are considered surrogate measures for the performance of AIS, and an underlying reasoning of measuring user AIS satisfaction and system use as surrogates is that direct relationships among information system quality, the user information system satisfaction, the use of IS, and decisional or organizational effectiveness are assumed to exist [4, 10, 14, 32].

Goodhue [23] has argued that user information system satisfaction is divided into two constructs: one is information system satisfaction brought about by the correspondence between the information system's intrinsic benefits and the needs of the user, and the other is information system satisfactoriness resulting from the correspondence between the job requirements and system functionality. This study utilized a measure of information system satisfactoriness. The measure of user AIS satisfaction was based on a set of ten questionnaire items that were constructed through reviewing and integrating the previous related studies [13, 37, 59], and measured on a seven-point Likert-type scale.

The degree of system usage may not be an appropriate performance measure if system use is mandatory [35]. In this perspective, system use was measured by consideration of both the frequency and the willingness of use. Each was measured on a single-item seven-point Likert-type scale. Then, with multiplication of the frequency by the degree of willingness, the scores ranging from 1, for "much less frequent use" and "completely mandatory use," to 49, "very frequent use" and "completely voluntary use" were obtained. The scale is normalized by a square root.

## Results

### Reliability and Validity Tests

#### Reliability Test

ITEM ANALYSES WERE PERFORMED WITH CRONBACH ALPHA COEFFICIENTS for all multi-item scale measures. Table 2 shows the results of the Cronbach alpha test.

Table 2. Cronbach Alpha Coefficients

| Variable | Before deletion | | After deletion | |
|---|---|---|---|---|
| | Number of items | Alpha coefficient | Number of items | Alpha coefficient |
| User AIS satisfaction | 10 | 0.9105 | 9 | 0.9167 |
| Top management support | 5 | 0.8203 | | |
| Evolution level of IS | 5 | 0.7723 | | |
| User involvement | 2 | 0.6654 | | |
| Formalization of system development | 5 | 0.7814 | 3 | 0.8073 |

Except for the alpha value of user involvement, the alpha coefficients were above 0.77. The alpha value of user involvement was 0.6654. If the alpha coefficient is above 0.7, the reliability of the multi-item scale is satisfactory [51].

The alpha value depends on the number of items in the scale. The value of alpha increases as the number of items increases. Therefore, the satisfactory level of alpha can be lowered as the number of questionnaire items decrease [66, 71]. For measuring user involvement, only two questionnaire items were used. Because of the small number of items, the standard level of alpha for the user involvement could be lowered, and it may be about 0.6 (see [66]). In this study, user involvement was used with caution.

Because of the high coefficient values of reliability, except for user involvement, we were encouraged to utilize composite measures obtained by computing the arithmetic means of individual item scores in further analyses.

## Validity Test

The questionnaire items for measuring user AIS satisfaction, top management support, and the evolution level of IS have been used in previous empirical works [13, 35, 37, 40]. However, in this study, the construct validities of these items were questionable. So, to confirm the theoretical groupings of items for measuring the above variables, data from the questionnaire were factor-analyzed.

In this study, for measuring five different constructs, 24 questionnaire items were used. The number of factors to extract can be given, based on the number of constructs to measure [36]. Twenty-four items are expected to break out into five factors. Principal component factor analysis using VARIMAX rotation was performed, given the number of factors to extract. The result is presented in Table 3.

Using the 0.40 criterion for a significant item loading on a factor, the result shows that all items within each index are represented by a single factor, and the items of each factor do not confound with the items in other factors. A single scale for the research variable was constructed by averaging a respondent's scores over the items measuring each variable.

Table 3. Factor Loadings of Research Variables (Number of Factors to Extract, 5, is given; Varimax Rotation)

| Variable items | Factor 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **User AIS satisfaction** | | | | | |
| 1 | 0.7809 | | | | |
| 2 | 0.7459 | | | | |
| 3 | 0.7215 | | | | |
| 4 | 0.8507 | | | | |
| 5 | 0.7797 | | | | |
| 6 | 0.7996 | | | | |
| 7 | 0.7070 | | | | |
| 8 | 0.7968 | | | | |
| 9 | 0.7599 | | | | |
| **Top management support** | | | | | |
| 1 | | 0.6962 | | | |
| 2 | | 0.6871 | | | |
| 3 | | 0.8858 | | | |
| 4 | | 0.7356 | | | |
| 5 | | 0.7847 | | | |
| **Evolution level of IS** | | | | | |
| 1 | | | 0.5725 | | |
| 2 | | | 0.6215 | | |
| 3 | | | 0.8188 | | |
| 4 | | | 0.7442 | | |
| 5 | | 0.4341 | 0.6010 | | |
| **User involvement** | | | | | |
| 1 | | | | | 0.7253 |
| 2 | | | | | 0.7883 |
| **Formalization of system development** | | | | | |
| 1 | | | | 0.8362 | |
| 2 | | | | 0.8652 | |
| 3 | | | 0.4490 | 0.6560 | |
| Percentage of variance | 24.2 | 20.2 | 8.7 | 6.2 | 5.2 |
| Eigenvalue | 5.8 | 4.83 | 2.08 | 1.48 | 1.24 |

* Factor loadings below 0.4 were not presented.

The values of mean and standard deviation for the research variables were calculated and are summarized in Table 4.

## Relationships between Influence Factors and AIS Performance

Pearson correlation analysis was used to assess the relationships among critical variables. Table 5 presents the correlation matrix for the research variables. There were statistically significant positive relationships between user participation and user

Table 4. Summary Statistics of Research Variables

| Variables | Mean | Median | Standard deviation |
|---|---|---|---|
| Top management support | 4.95 | 5.00 | 0.99 |
| Capability of IS personnel | 4.91 | 4.80 | 1.02 |
| User involvement | 4.83 | 4.89 | 1.14 |
| Formalization of system development | 3.54 | 3.33 | 1.67 |
| Organization size | 3,766 | 1,722 | 5,922 |
| Evolution level of IS | 4.00 | 3.99 | 0.93 |
| User AIS satisfaction | 4.08 | 4.06 | 0.93 |
| System usage | 5.10 | 4.97 | 1.14 |

Table 5. Pearson Correlation Coefficients ($N = 101$)

| | Influence factors | | | | | |
|---|---|---|---|---|---|---|
| Performance | Top management support | Capability of IS personnel | User involvement | Formalization of system development | Organization size | Evolution level of IS |
| User satisfaction | 0.008 | 0.044 | 0.354*** | 0.024 | 0.268*** | 0.033 |
| System usage | 0.046 | 0.125* | 0.368*** | 0.033 | 0.074 | 0.127* |

* $p \leq 0.1$; *** $p \leq 0.01$.

satisfaction and system usage. Hence, if user involvement in development increases, performance of the AIS also increases.

Significant positive correlations were also observed among capability of IS personnel, evolution level of IS, and system usage. Thus, when the technical capability of IS personnel is high and the evolution level of IS is mature, the performance of AIS increases. Organization size was positively related to user satisfaction. Hence, in large organizations, the performance of AIS tends to be high.

Thus, hypothesis 1, which relates influence factors—such as top management support, user involvement, capability of IS personnel, formalization of system development, and organization size—to the performance of AIS, was partially supported by the results. Some partial support was also found for hypothesis 2, which relates the remaining influence factors to AIS performance (see Table 5).

In Table 6, the differences of performance are presented according to the introduction of steering committees and user training and education, and the location of the IS department.

As to the steering committees, system usage was higher in organizations that have no steering committees. Hence, the result was inversely related. When user training and education were considered, the system usage was greater in organizations that have systems of user training and education. Hence, the performance of AIS can be increased with user training and education.

Table 6. Results of *T*-Test and Mann-Whitney Test

| | Influence factors | | |
|---|---|---|---|
| Performance | Steering committee | Location of IS unit | User training and education |
| System usage | Mean<br>Exist: 4.83 ($n = 36$)<br>Not exist: 5.23 ($n = 68$)<br>$t = -1.83$** | Mean<br>Independent: 5.11 ($n = 60$)<br>Dependent: 5.09 ($n = 46$)<br>$t = 1.2$ | Mean rank<br>Exist: 49.7 ($n = 76$)<br>Not exist: 37.9 ($n = 18$)<br>U = 512.5** |
| User satisfaction | Mean<br>Exist: 2.92 ($n = 36$)<br>Not exist: 2.99 ($n = 68$)<br>$t = 0.42$ | Mean<br>Independent: 2.97 ($n = 60$)<br>Dependent: 2.87 ($n = 46$)<br>$t = -0.61$ | Mean rank<br>Exist: 50.7 ($n = 76$)<br>Not exist: 46.7 ($n = 18$)<br>U = 625.5 |

** $p \leq 0.05$.

There was no difference of performance in the location of the IS department.

## Relationships under the Level of IS Evolution

There are two basic analysis methods to empirically test the effect of the evolution level of IS on the relationships between influence factors and AIS performance: subgroup analysis and moderated regression analysis (MRA) [62]. MRA is differentiated from subgroup analysis because MRA maintains the integrity of a sample [62].

In applying MRA in terms of one predictor variable, three regression equations were formulated as follows:

(1) $y = b_0 + b_1 \cdot x;$
(2) $y = b_0 + b_1 \cdot x + b_2 \cdot z;$
(3) $y = b_0 + b_1 \cdot x + b_2 \cdot z + b_3 \cdot x \cdot z;$

where $y$ = AIS performance (AIS satisfaction or AIS usage); $b$ = regression coefficients; $x$ = influence factor (predictor variable); $z$ = level of IS evolution; and $x \cdot z$ = interaction of $x$ and $z$.

Following Sharma et al. [62], three regression analyses were performed in number order. If equations 2 and 3 are not significantly different (i.e., $b_3 = 0$; $b_2 \neq 0$), $z$ is an independent predictor variable. For $z$ to be a pure moderator, equations 1 and 2 should not be different but should be different from equation 3 (i.e., $b_2 = 0$; $b_3 \neq 0$). For $z$ to be classified as a quasi-moderator, equations 1, 2, and 3 should be different from each other (i.e., $b_2 \neq 0$; $b_3 \neq 0$) [62].

The eight influence factors were tested separately with the evolution level of IS. In the regression analyses, user training and education, steering committees, and location

Table 7. Results of Regression Analyses for AIS Satisfaction

| Independent variable | Standardized β | $F$ | Change in $R^2$ | $p$ |
|---|---|---|---|---|
| (1) Top management support | –0.005 | 0.003 | 0.00 | 0.95 |
| level of IS evolution | –0.032 | 0.048 | 0.00 | 0.76 |
| (2) Capability of IS personnel | 0.044 | 0.192 | 0.002 | 0.66 |
| level of IS evolution | –0.045 | 0.189 | 0.002 | 0.66 |
| (3) User involvement | 0.329 | 12.62 | 0.108 | 0.00 |
| level of IS evolution | 0.026 | 6.29 | 0.00 | 0.77 |
| (4) User training and education | 0.094 | 0.83 | 0.008 | 0.36 |
| level of IS evolution | –0.065 | 0.59 | 0.004 | 0.54 |
| (5) Steering committees (SC) | –0.163 | 2.85 | 0.027 | 0.09 |
| level of IS evolution | 0.066 | 1.64 | 0.004 | 0.50 |
| SC × level of IS evolution | –2.218 | 2.35 | 0.033 | 0.05 |
| (6) Location of IS unit | 0.059 | 0.37 | 0.003 | 0.54 |
| level of IS evolution | –0.042 | 0.27 | 0.002 | 0.67 |
| (7) Formalization of system development | 0.028 | 0.079 | 0.000 | 0.77 |
| level of IS evolution | –0.048 | 0.141 | 0.003 | 0.65 |
| (8) Organization size | 0.264 | 7.82 | 0.07 | 0.00 |
| level of IS evolution | –0.064 | 4.12 | 0.004 | 0.50 |

* Nonsignificant interaction term was not presented.

of the IS unit were entered in the equation as dummy vaiables because they were measured on a nominal scale. The results of three regression analyses in each influence factor are presented in Tables 7 and 8. The standardized β, $F$ value, change in $R^2$ and $p$ value for the evolution level of IS in the table were reported from equation 2 regression analysis. The standardized β, change in $R^2$, and $p$ value for the interaction term were reported from equation 3 regression analysis.

Most interaction terms, except for steering committees, were not significant. In steering committees, the level of IS evolution was not related to the performance of AIS (i.e., $b_2 = 0$), and the interaction term was significant (i.e., $b_3 \neq 0$). Hence, in this case, the level of IS evolution was a pure moderator.

However, the results of MRA were not satisfactory. In MRA, the level of IS evolution was a continuous variable, and therefore the number of groups was equal to the number of subjects. The differences in the relationships betweeen influence factors and AIS performance according to the level of IS evolution may not be significant because of too many groups, that is, levels of IS evolution.

If the result of MRA is unsatisfactory and the variable is theoretically serving as a moderator, the next analysis technique, subgroup analysis, can be used [62].

In the sample firms, the evolution level of IS, which was measured by Nolan's stage model, was calculated. The thirteen subsystems belonged to the organization of which the evolution level was stage 1 (initiation) or stage 2 (expansion). There were 39 subsystems in the stage ranging from 3 (formalization) to 4 (integration), and 33 subsystems existed in the stage from 4 to 5 (data administration). In the stage from 5 to 6 (maturity), there were 21 subsystems.

Table 8. Results of Regression Analyses for AIS Use

| Independent variable | Standard-ized β | $F$ | Change in $R^2$ | $p$ |
|---|---|---|---|---|
| (1) Top management support | 0.044 | 0.20 | 0.002 | 0.65 |
| level of IS evolution | 0.106 | 0.62 | 0.01 | 0.31 |
| (2) Capability of IS personnel | 0.129 | 1.34 | 0.01 | 0.10 |
| level of IS evolution | 0.095 | 1.11 | 0.012 | 0.34 |
| (3) User involvement (UI) | 0.361 | 15.61 | 0.13 | 0.00 |
| level of IS evolution | 0.176 | 9.84 | 0.03 | 0.05 |
| UI × level of IS evolution | –0.399 | 6.69 | 0.00 | 0.48 |
| (4) User training and education | 0.19 | 3.46 | 0.03 | 0.06 |
| level of IS evolution | 0.106 | 2.24 | 0.01 | 0.31 |
| (5) Steering committees (SC) | 0.012 | 0.02 | 0.00 | 0.89 |
| level of IS evolution | 0.111 | 0.63 | 0.01 | 0.27 |
| SC × level of IS evolution | 2.78 | 2.37 | 0.05 | 0.01 |
| (6) Location of IS unit (LISU) | 0.012 | 0.01 | 0.00 | 0.90 |
| level of IS evolution | 0.11 | 0.62 | 0.01 | 0.27 |
| LISU × level of IS evolution | –0.78 | 1.33 | 0.03 | 0.11 |
| (7) Formalization of system development | 0.024 | 0.06 | 0.00 | 0.81 |
| level of IS evolution | 0.117 | 0.64 | 0.01 | 0.27 |
| (8) Organization size | 0.076 | 0.61 | 0.00 | 0.43 |
| level of IS evolution | 0.101 | 0.83 | 0.01 | 0.30 |

* Nonsignificant interaction term was not presented.

For the subgroup analysis, the observations of evolution level were divided into two groups using the median value (4.00) as the dividing point. The group below the median value (stage 4) is the prior stage, and the group above the median value, which includes stage 4, is the posterior stage. In each group, correlation analysis and a $T$-test or Mann-Whitney test were performed. The results are presented in Tables 9 and 10.

In Table 9, top management support was negatively related to the performance of AIS in the prior stage. Hence, performance decreases with top management support, it does not increase. In the posterior stage, however, top management support was positively related to user satisfaction, and hence, performance increases with top management support.

In terms of the technical capability of IS personnel, significant positive correlations between user satisfaction and system usage and the capability of IS personnel were observed only in the prior stage.

When user involvement is considered, it was positively related to user satisfaction and system usage in both stages. Hence, the performance of AIS increases with high user participation. Fisher $Z$ statistics were used to determine whether the correlation coefficients of both groups represent populations having different true correlations with respect to the evolution level [44]. The standard $Z$ for user satisfaction was 0.46, and for system usage it was 1.67. The standard $Z$ for system usage was significant at the 5 percent level. Hence, the association of user participation with system usage was positively greater in the posterior stage.

Formalization of system development was positively related to user satisfaction and system usage in the prior stage, and a positive correlation was also oberved between

Table 9. Correlation Coefficients in Both Stages (Pearson Correlation)

| Performance | Influence factor: Top management support | Capability of IS personnel | User involvement | Formalization of system development | Organization size |
|---|---|---|---|---|---|
| Prior stage ($N = 50$) | | | | | |
| User satisfaction | –0.221** | 0.125* | 0.344*** | 0.126* | 0.164* |
| System usage | –0.123* | 0.227** | 0.335*** | 0.199** | 0.051 |
| Posterior stage ($N = 51$) | | | | | |
| User satisfaction | 0.158* | –0.029 | 0.380*** | 0.052 | 0.434*** |
| System usage | 0.102 | –0.022 | 0.471*** | 0.146* | 0.194** |

* $p \leq 0.1$; ** $p \leq 0.05$; *** $p \leq 0.01$.

formalization and system usage in the posterior stage. Hence, with formalization of system development, performance of AIS can increase. The Fisher $Z$ test was performed, and the standard $Z$ for user satisfaction was 0.756, and for system usage it was 0.618. The coefficients of standard $Z$ were not significant. However, in user satisfaction, the relationship was significant in the prior stage and was not significant in the posterior stage. Therefore, it is assumed that the association of formalization with AIS performance was greater in the prior stage.

Organization size had a significant positive relationship with user satisfaction in the prior stage; positive correlations were also observed between organization size and user satisfaction and system usage in the posterior stage. Thus, in large organizations, performance of AIS can increase. The coefficients of standard $Z$ were 2.985 for user satisfaction and 1.527 for system usage. They were significant at the 1 percent and 10 percent level, respectively. Hence, it is suggested that the influence of organization size on AIS performance was greater in the posterior stage.

In Table 10, the difference of performance is presented according to the presence of steering committees in the prior stage. However, the results were the reverse: AIS performance was greater in the organizations with no steering committees. In the posterior stage, there was no difference in AIS performance.

Location of the IS unit did not influence the performance of AIS in either stage.

In the prior stage, system usage was higher in organizations that have user training and education. In the posterior stage, there was no difference. It is, therefore, assumed that the influence of user training and education on the performance of AIS was greater in the prior stage.

Based upon the research findings, it is concluded that hypotheses 1, 2, 3, 5, 9, and 10 were partially supported, and hypotheses 4, 6, 7, and 8 were rejected.

Table 10. Differences of Performance in Both Stages (Mann-Whitney Test)

| | Steering committee | Location of IS unit | User training and education |
|---|---|---|---|
| Prior stage ($N = 52$) | | | |
| System usage | Mean rank<br>Exist :19.1 ($n = 14$)<br>Not exist: 29.2<br>($n = 38$)<br>$U = 163$** | Mean rank<br>Independent: 28.9<br>(n = 27)<br>Dependent: 23.9<br>($n = 25$)<br>$U = 273$ | Mean rank<br>Exist: 25.7 (n = 34)<br>Not exist: 17.4<br>($n = 12$)<br>$U = 130.5$** |
| User satisfaction | Exist: 24.1 ($n = 14$)<br>Not exist: 32.9<br>($n = 38$)<br>$U = 176$** | Independent: 27.7<br>(n = 27)<br>Dependent: 25.4<br>($n = 25$)<br>$U = 307.5$ | Exist: 25.4 (n = 34)<br>Not exist: 22.8<br>($n = 12$)<br>$U = 181$ |
| Posterior stage ($N = 54$) | | | |
| System usage | Mean rank<br>Exist: 23.9 ($n = 22$)<br>Not exist: 28.4<br>($n = 30$)<br>$U = 274.5$ | Mean rank<br>Independent: 25.6<br>(n = 33)<br>Dependent: 30.6<br>($n = 21$)<br>$U = 282$ | Mean rank<br>Exist: 24.7 (n = 42)<br>Not exist: 23.3<br>($n = 6$)<br>$U = 119$ |
| User satisfaction | Exist: 28.4 ($n = 22$)<br>Not 24.0 ($n = 30$)<br>$U = 274$ | Independent: 28.4<br>(n = 33)<br>Dependent: 26.1<br>($n = 21$)<br>$U = 317$ | Exist: 25.3 (n = 42)<br>Not exist: 24.4 ($n = 6$)<br>$U = 121$ |

** $p \leq 0.05$.

## Conclusion and Discussion

THIS STUDY PROVED EMPIRICALLY THAT THERE ARE SIGNIFICANT positive relationships between the performance of AIS and the influence factors, such as user participation, capability of IS personnel, organization size, and the provision of user training and education.

The moderating effect of the level of IS evolution on the relationships between influence factors and AIS performance was also empirically proved. It was found that user training and education and formalization of system development have more of an effect on performance in the prior stage, while user involvement and organization size are positively greater in the posterior stage.

Some results, however, were different from previous studies. In the subgroup analysis, top management support was negatively related to AIS performance in the prior stage, and positively related in the posterior stage. The result of the prior stage was contrary to previous general results [12, 13, 60].

To examine the reason for negative correlation in the prior stage, Pearson correlation analysis was performed. Between each questionnaire item of top management support and the performance of AIS, there was a significant negative correlation between top management's knowledge of computerization and AIS performance (for user satisfaction and system usage, the correlation coefficients are –0.26 and –0.20, $p = 0.05$). A significant negative relation was also observed between top management's evaluation of IS performance and user satisfaction (the correlation coefficient is –0.12, $p = 0.1$). Another negative correlation between top management's concern with IS usage and performance was also found (for user satisfaction and system usage, the correlation coefficients are –0.06 and –0.02).

From the additional correlation analysis, one can infer the reason for negative relation. In the prior stage, top management's high knowledge about computerization and concern about IS usage may require a level of system usage that cannot be attained in the initial computerization. Hence, this high level of system usage or compulsory system use by top management's active involvement in the prior stage, when user resistance and suspicion are common, may decrease AIS performance.

Only in the prior stage was the capability of IS personnel positively related to performance. Computerization in Korean firms started in the 1980s. Because of this short history, it is assumed that though the IS evolution level may be mature, the capability of IS personnel has not yet developed from specialist skills into generalist skills.

In the prior stage, the performance of AIS was decreased by the introduction of steering committees. Nolan [50] suggested that the roles of steering committees that are inconsistent with the evolution level of IS have the opposite impact on IS performance. Therefore, the functions of steering committees, in some sample firms, had a negative impact on performance in the prior stage, and in the posterior stage steering committees were neither advantageous nor disadvantageous.

Many studies have empirically suggested that the location of IS unit or IS unit rank has a positive influence on the performance of IS [9, 17, 18, 56]. Particularly, the rank of the IS supervisor is positively related to IS success [9, 53]. However, this study presented no relationship between the location of the IS unit and the performance of AIS. Therefore, the present study performed additional analysis.

The rank of the IS supervisor was examined in the sample firms. In 43 firms that have independent IS units, 8 are supervised by a chief, 24 by a manager, and 10 by a director. In 35 firms with dependent IS units, 10 of the units are supervised by a chief, 21 by a manager, and 4 by a director. There were a few differences in the rank of IS supervisor between the independent and the dependent IS units.

IS performance declines with a lower rank of the executive responsible [9, 53]. Hence, in this study, it is assumed that nonsignificant differences of performance according to the location of IS unit are caused by similarities in the rank of IS supervisor between the independent and the dependent IS units.

The empirical results of this study suggest some managerial implications of influence factors. First, in the prior stage, when users resist computerization, top management support might have a negative influence on successful implementation.

As Benbasat et al.[3] have suggested, specialist skills are needed in the prior stage, while generalist skills are required in the posterior stage. Hence, as the IS matures, IS personnel should have various career path opportunities to acquire generalist skills. Shore [63] proposed that the structure of the IS unit should change from the triangular oganization to the pentagonal to provide the appropriate career path opportunities to IS personnel. Therefore, learning generalist skills is related to structural changes of the IS unit.

Although user participation in development is important, user training and education are more important in the prior stage. With user training, users can clarify their information requirements, and they can understand and evaluate the system's advantages and limitations. In the posterior stage, user involvement in each stage of development should be realized to increase AIS performance.

Formalization of system development, which means the extent to which the development task is completely documented and conforms to the documents, is required more in the prior stage. In the posterior stage, the IS department gains experience in system development methodology, and, moreover, users experienced in developing or operating computerized IS are hired [37]. For this reason, the importance of formalization decreases in the posterior stage.

Steering committees should be introduced in the posterior stage to set system objectives or policies, and to adjust various user requirements and problems in system development. As the IS matures, the number of systems and the application areas dramatically increase; to adjust concomitant problems, steering committees should be introduced.

This study suggested that organization size has more influence on the performance of AIS in the posterior stage. Considering that organization size is positively related to the ability of funds support, top management's active fund support in the posterior stage might increase AIS performance.

The hypotheses in this study are only partially supported. This partial support is likely due to the limitations of the study. The limitations and future research efforts are suggested as follows.

First, in this study, the evolution level of IS was measured by Nolan's [49] stage model. However, there are some problems in the benchmark variables, such as technology and application portfolio benchmarks [24]. Hence, the accuracy of measurement is questioned. For future study, an accurate conceptual and measurement tool for evolution level should be developed.

Second, the focus of this study was confined to AIS. Hence, the results might be peculiar to AIS. There are various types of information systems, according to organizational function and activity [11]. If the focus is changed, results may differ. Future research should investigate different information systems.

Third, there are other influence factors, such as user attitude, user experience and schooling, and computer hardware. This study considered only eight influence factors. Other influence factors need to be considered in future studies.

Fourth, capability of IS personnel was measured by level of experience; therefore, specialist skill and generalist skill were not classified. For a more concrete and more accurate measure, a better definition and measurement tool should be developed.

Finally, in the analysis of the results, the relationships among influence factors were ignored. This is a limitation of this study. For more concrete results, in future research the relationships among influence factors should be considered in the correlation analysis. A little questionable reliability of user involvement is another limitation.

## REFERENCES


1. Amstutz, A.E. The evolution of management information systems. *European Business, 8* (July 1968), 24–33.

2. Anderson, E.E. Managerial considerations in participative design of MIS/ DSS. *Information and Management, 9*, 4 (1985), 201–207.

3. Benbasat, I.; Dexter, A.S.; and Mantha, R.W. Impact of organizational maturity on information system skill needs. *MIS Quarterly, 4*, 1 (March 1980), 21–34.

4. Bruwer, P.J.S. A descriptive model of success for computer based information systems. *Information and Management, 7*, 2 (1984), 63–67.

5. Cash, J.I., and McLeod, P.L. Managing the introduction of information systems technology in strategically dependent companies. *Journal of Management Information Systems, 1*, 4 (Spring 1985), 5–23.

6. Cerullo, M.J. Information systems success factors. *Journal of Systems Management, 31*, 12 (December 1980), 10–19.

7. Cerveny, R.P., and Sanders, G.L. Implementation and structural variables. *Information and Management, 11*, 4 (1986), 191–198.

8. Cheney, P.H., and Dickson, G.W. Organizational characteristics and information systems: an exploratory investigation. *Academy of Management Journal, 25*, 1 (1982), 170–184.

9. Cheney, P.H.; Mann, R.I.; and Amoroso, D.L. Organizational factors affecting the success of end user computing. *Journal of Management Information Systems, 3*, 1 (Summer 1986), 65–79.

10. Conarth, D.W., and Mignen, O.P. What is being done to measure user satisfaction with EDP/MIS? *Information and Management, 19*, 1 (1990), 7–19.

11. Davis, G.B., and Olson, M.H. *Management Information Systems*. New York: McGraw-Hill, 1985.

12. Delone, W.H. Determinants of success for computer usage in small business. *MIS Quarterly, 12*, 1 (March 1988), 51–61.

13. Doll, W.J. Avenues for top management involvement in successful MIS development. *MIS Quarterly, 9*, 1 (March 1985), 17–35.

14. Doll, W.J., and Torkzadeh, G. The management of end-user computing satisfaction. *MIS Quarterly, 12*, 2 (June 1988), 259–274.

15. Drury, D.H. An empirical assessment of the stages of DP growth. *MIS Quarterly, 7*, 2 (June 1983), 59–70.

16. Drury, D.H. A survey of data processing steering committees. *Information and Management, 9*, 1 (1985), 1–7.

17. Ein-Dor, P., and Segev, E. Organizational context and the success of management information systems. *Management Science, 24*, 10 (June 1978), 1064–1077.

18. Ein-Dor, P., and Segev, E. Information systems: emergence of a new organizational function. *Information and Management, 5*, 5 (1982), 279–286.

19. Franz, C.R., and Robey, D. Organizational context, user involvement and the usefulness of information systems. *Decision Sciences, 17* (1986), 329–356.

20. Ghani, J.A. Task uncertainty and the use of computer technology. *Information and Management, 22*, 2 (1992), 69–76.

21. Gibson, C.F., and Nolan, R.L. Managing the four stages of EDP growth. *Harvard Business Review, 52*, 1 (January–February 1974), 76–88.

22. Ginzberg, M.J. An organizational contingencies view of accounting and information system implementation. *Accounting, Organization and Society, 5*, 4 (1980), 369–382.

23. Goodhue, D. I/S attitudes: toward theoretical and definitional clarity. *Data Base* (Fall–Winter 1988), 6–15.

24. Gregoire, I.F., and Lustman, F. The stage hypothesis revisited. *Information and Management, 24*, 5 (1993), 237–245.
25. Gremillion, L.L. Organization size and information system use: an empirical study. *Journal of Management Information Systems, 1*, 2 (Fall 1984), 4–17.
26. Harris, S.E., and Katz, J.L. Firm size and the information technology investment intensity of life insurers. *MIS Quarterly, 15*, 3 (September 1991), 333–352.
27. Hirschheim, R.A. Assessing participative systems design: some conclusions from an exploratory study. *Information and Management, 6*, 6 (1983), 317–327.
28. Hirschheim, R.A. User experience with and assessment of participative systems design. *MIS Quarterly, 9*, 4 (December 1985), 295–309.
29. Huff, S.L., and Munro, M.C. Information technology assessment and adoption: a field study. *MIS Quarterly, 9*, 4 (December 1985), 327–340.
30. Ives, B.; Hamilton, S.; and Davis, G.B. A framework for research in computer based management information systems. *Management Science, 26*, 9 (1980), 910–934.
31. Ives, B., and Olson, M.H. User involvement and MIS success: a review of research. *Management Science, 30*, 5 (1984), 586–603.
32. Ives, B.; Olson, M.H.; and Baroudi, J. The measurement of user information satisfaction. *Communications of the ACM, 26*, 10 (October 1983), 785–793.
33. Joshi, K. A causal path model of the overall user attitudes toward the MIS function. *Information and Management, 22*, 2 (1992), 77–88.
34. Kahn, E.H. Organization and management of information systems functions. *Information and Management, 21*, 2 (1991), 73–85.
35. Kim, E.H., and Lee, J.J. An exploratory contingency model of user participation and MIS use. *Information and Management, 11*, 2 (1986), 87–97.
36. Kim, J.O., and Muller, C.W. *Factor Analysis; Statistical Methods and Practical Issues*. Sage University Paper 14, Sage Publications, 1981.
37. Lee, J.J., and S.H., Kim. The relationship between procedural formalization in MIS development and MIS success. *Information and Management, 22*, 2 (1992), 89–111.
38. Lehman, J.A. Organizational size and information system sophistication. *Journal of Management Information Systems, 2*, 3 (Winter 1986), 78–86.
39. Lucas, H.C., and Sutton, J.A. The stage hypothesis and S-curve: some contradictory evidence. *Communications of the ACM, 20*, 4 (April 1977), 254–259.
40. Mahmood, M.A., and Becker, J.D. Effect of organizational maturity on end-users' satisfaction with information systems. *Journal of Management Information Systems, 2*, 3 (Winter 1986), 37–64.
41. McFarlan, F.W., and McKenney, J.L. The information archipelago governing the new world. *Harvard Business Review, 61*, 4 (1983), 91–99.
42. Montazemi, A.R. Factors affecting information satisfaction in the context of the small business environment. *MIS Quarterly, 12*, 2 (June 1988), 239–256.
43. Mykytyn, P.P. An empirical investigation of DSS usage and the user's perception of DSS training. *Information and Management, 14*, 1 (1988), 9–17.
44. Nachmias, C., and Nachmias, D. *Research Methods in the Social Science*. New York: St. Martin's Press, 1981.
45. Neal, R.D., and Rander, M. The relationship between formal procedures for pursuing OR/MS activities and OR/MS group success. *Operations Research, 21*, 2 (1973), 451–474.
46. Nelson, R.R. Educational needs as perceived by IS and end-user personnel: a survey of knowledge and skill requirement. *MIS Quarterly, 15*, 4 (December 1991), 503–525.
47. Nelson, R.R., and Cheney, P.H. Training end users: an exploratory study. *MIS Quarterly, 11*, 4 (December 1987), 547–559.
48. Nolan, R.L. Managing the computer resource: a stage hypothesis. *Communications of the ACM, 16*, 7 (July 1973), 399–405.
49. Nolan, R.L. Managing the crisis in data processing. *Harvard Business Review, 57*, 2 (March–April 1979), 115–126.
50. Nolan, R.L. Managing information systems by committee. *Harvard Business Review, 60*, 4 (July–August 1982), 72–79.
51. Nunally, J. *Psychometric Theory*. New York: McGraw-Hill, 1978.
52. Olson, M.H., and Ives, B. User involvement in system design: an empirical test of alternative approaches. *Information and Management, 4*, 4 (1981), 183–195.

53. Raghunathan, T.S. Impact of the CEO's participation on information systems steering committees. *Journal of Management Information Systems, 8*, 4 (Spring 1992), 83–96.

54. Raghunathan, B., and Raghunathan, T.S. MIS steering committees: their effect on information systems planning. *Journal of Information Systems, 3*, 2 (Spring, 1989), 104–116.

55. Rahman, M., and Mccosh, A. M. The influence of organizational and personal factors on the use of accounting information: an empirical study. *Accounting, Organization and Society, 1*, 4 (1976), 339–355.

56. Raymond, L. Organizational characteristics and MIS success in the context of small business. *MIS Quarterly, 9*, 1 (March 1985), 37–52.

57. Raymond, L. Organization context and information systems success: a contingency approach. *Journal of Management Information Systems, 6*, 4 (Spring 1990), 5–20.

58. Robey, D. User attitude and management information system use. *Academy of Management Journal, 22*, 3 (1979), 527–538.

59. Sanders, G.L., MIS/DSS success measure. *Systems, Objectives and Solutions, 4* (1984).

60. Sanders, G.L., and Courtney, J.F. A field study of organizational factors influencing DSS success. *MIS Quarterly, 9*, 1 (March 1985), 77–92.

61. Schewe, C.D. The management information system user: an exploratory behavioral analysis. *Academy of Management Journal, 19*, 4 (1976), 577–590.

62. Sharma, S.; Durand, R.M.; and Gur-Arie, O. Identification and analysis of moderator variables. *Journal of Marketing Research, 18* (August 1981), 291–300.

63. Shore, E.B. Reshaping the IS organization. *MIS Quarterly, 7*, 4 (December 1983), 11–17.

64. Tait, P., and Vessey, I. The effect of user involvement on system success: a contingency approach. *MIS Quarterly, 12*, 1 (March 1988), 91–108.

65. Thayer, R.H.; Pyster, A.B.; and Wood, R.C. Major issues in software engineering project management. *IEEE Transactions on Software Engineering, SE–7*, 4 (1981), 333–342.

66. Van De Ven, A.H., and Ferry, D.L. *Measuring and Assessing Organizations*. New York: Wiley-Interscience, 1980.

67. Vanlommel, E., and Debrabander, B. The organization of EDP activities and computer use. *Journal of Business, 48*, 3 (1975), 391–410.

68. Wan, T.B., and Wah, L.T. Validation of a user satisfaction instrument for office automation success. *Information and Management, 18*, 4 (1990), 203- 208.

69. Yap, C.S. Distinguishing characteristics of organizations using computers. *Information and Management, 18*, 2 (1990), 97–107.

70. Yaverbaum, G.J., and Nosek, J. Effects of information system education and training on user satisfaction. *Information and Management, 22*, 4 (1992), 217–225.

71. Zeller, R.A., and Carmines, E.G. *Reliability and Validity Assessment.* Sage University Paper 17, Sage Publications, 1981.

72. Zmud, R.W. Individual differences and MIS success. *Management Science, 25*, 10 (1979), 966–979.