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IS 및 기능관리자의 시각에서 본 시스템분석에 필요한 직무능력

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Job Skill Importance for Systems Analysts From the Viewpoint of IS and Functional Managers

Increasingly, systems analysts are expected to have behavioral and administrative skills as well as technical skills. This paper presents the results of a nationwide survey of 739 information systems (IS) managers (220 responses) and other functional managers (178) regarding the importance of various skills needed by systems analysts.

The findings indicate that IS managers and three functional area managers differ in their perceptions of the importance of skills that system analysts should possess. These differences suggest that IS managers consider the ability to work with others more important than do functional managers. In contrast, three functional manager groups seem to view technical areas more importantly and thus may have greater expectations for technical performance. Also the results indicate that a positive relationship exists between possession of the identified skills and systems effectiveness.

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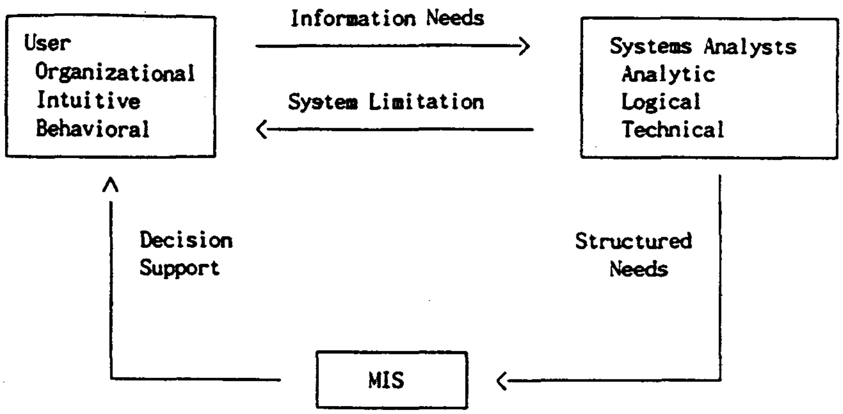
I. Research Rationale

During recent years, information systems have typically been designed by both users and systems analysts. This approach contrasts sharply with previous system developments that were solely handled by the systems analysts. Numerous research works in the field of management information systems (MIS) have indicated a positive relationship between user involvement and information systems (IS) effectiveness [Baronas and Louis, 1988; Baroudi, Olson, and Ives, 1986; McKeen, Guimaraes, and Wetherbe, 1994; Newman and Robey, 1992]. Thus, many believe that the development of useful and satisfactory information systems requires a good working relationship between users and systems analysts. That is, successful system development efforts depend to a large degree upon how well systems analysts and users work together.

Differences and conflict, however, exist between users and systems analysts [Kaiser, 1982; Newman and Robey, 1992], and have been blamed for the shortcomings of many information systems. As shown in Figure 1, users tend to have a broader organizational view and behavioral side emphasis when solving a problem. However, systems analysts tend to deal with problems in a logical framework with a technical emphasis. These differences and conflicts are caused by a set of perceptions that users have concerning systems analysts that ultimately make users dissatisfied with the systems analysts [Senn, 1978; Newman and Robey, 1992]. As Green [1989] states, conflict and the differences between the systems analysts' job skills and users' perceptions of these skills trigger serious consequences that can be very costly to organizations. These consequences, as shown in Figure 2, result in poorly developed systems and negative user satisfaction which may cause or lead to systems failure.

Past empirical research continually demonstrates that one of the major reasons for failure of most information system developments has been the lack of attention paid to organizational behavior problems in the analysis, design, and operation of systems [Kumar and Welke, 1984; Anderson, 1978; Lucas, 1976]. That is, systems analysts are no longer expected to have expertise only in technical areas such as programming or file design, but are also expected to understand and recognize the behavioral and organizational impacts of



SOURCE: Adapted from Kaiser and Bostrom, "Personality Characteristics for MIS Project Teams: An Empirical Study and Action-Research Design." MIS Quarterly, 6(4), December 1982, pp. 4.

Figure 1. MIS Project Team

Figure 2. Results of Conflict and Differences

systems development [Joshi, 1989]. These findings have focused on the need for defining the characteristics of systems analysts.

Today's prevailing thought regarding the development of information systems is that heavy user participation results in better user satisfaction. As noted by Kaiser and Bostrom [1982], a major challenge to users and analysts in implementing information technologies may be "integrating the strengths of complementary perspectives into their views." When users and analysts interact, non-technical, behavioral-oriented skills are required of the analysts. Seemingly then, the increase in user-analyst interaction will lead to an increase in the need for non-technical skills by the systems analyst. However, questions remain regarding which skills are most important for the successful systems analysts.

At least three factors support the importance of renewed surveys relating to systems analysts' job skills. First, the in-

Table 1. PREVIOUS STUDIES FOR SYSTEMS ANALYSTS' JOB SKILLS

Authors	Target	Results Ranked by Factor	Conclusion	Validity Test	Reliability Test	Systems Effectiveness Relationship
Strout, 1970	IS managers & Systems analysts	Administrative & organizational, Functional area competence, Computer & equipment competence, Personal, public competence	A	No No No		
Arvey & Hoyle, 1974	Systems analysts & Programmer/Analysts	Technical knowledge, User relations & job effort, Planning, organizing, scheduling	C	Yes	No	No
Henry et al., 1974	SAs & Users (questionnaire were distributed through IS managers	Performance skills, People skills, System skills, Organizational skills, Computer skills, Society skills, Model skills	A	Yes	No	No
Benbasat et al., 1980	IS managers & Systems analysis	People skills, Organizational skills, System skills, Society skills, Computer skills, Model skills	A	Yes	No	No
Cheney & Lyons, 1980	IS managers	System design, HW & SW, IS mgmt Quantitative mgmt, Computer processing method	B	No	No	No
Kaiser & Srinivasan 1982	Users & IS (questionnaire were distributed through IS managers)	User-Analyst communication, User need focus, System staff methodology, Development methodology, Information system potential	C	Yes	No	No
Vitalari, 1985	Systems analysts	Functional requirement of the IS Organizational structure, System error control, System documentation, User Involvement				
Green, 1989	Systems analysts End-users	Behavioral skills, Technical skills	D	Yes	Yes	No

Note: A: The usefulness of behavioral skills are more important than technical skills

B: The usefulness of technical skills are more important than behavioral skills

C: No conclusion

D: Both are important

creased involvement by a wide range of technology-wise diverse user groups in all phases of the systems development process leads to different analyst skill requirements. Second, the presumed changing role of the analyst in various phases of the systems development process tied to the number of new technology-supported analysis and design tools indicates that analyst skill requirements may indeed be different today from what they were several years ago. Finally, the age of prior research efforts coupled with their conflicting results, different survey instruments, and different target audiences means that room exists for additional study (see Table 1 for a summary of these findings).

The purpose of this research is (1) to develop a theory-based valid instrument for measuring the characteristics of the practicing systems analyst's job skills based upon various functional groups' perceptions; and (2) to examine the relationship between systems effectiveness and the set of systems analysts' job skills identified via the instrument.

II. Literature Review

In the previous literature, substantial emphasis has been given to the findings of perceived job skills of systems analysts based upon IS professionals' perceptions [Vitalari, 1985; Kaiser and Bostrom, 1982; Cheney and Lyons, 1980; Benbasat, Dexter, and Mantha, 1980]. These studies explored systems analysts' job skills requirement to build a successful system. To explore these skills, various instruments have been developed [Green, 1989; Vitalari, 1985; Kaiser and Bostrom, 1982; Kaiser and Srinivasan, 1982; Cheney and Lyons, 1980; Henry, Dickson, and LaSalle, 1974; Arvey and Hoyle, 1974; Strout, 1970].

As the first empirical finding of skill studies, Strout's 98 items are representative variables used to find skills to accomplish successful performance in systems development. Although there has been some modification of the original Strout items, numerous studies [Kaiser and Srinivasan, 1982; Benbasat, Dexter, and Mantha, 1980; Alloway, 1980; Cheney and Lyons, 1980; Arvey and Hoyle, 1974; Henry, Dickson, and LaSalle, 1974] adopted the items to identify the job skills required to accomplish successful performance in system development. For instance, Cheney and Lyons [1980] identified 26 items and Arvey and Hoyle [1974] produced 12 major dimensions of the systems analysts'

Table 2. LIST OF VARIABLES USED IN THE PERVIOUS STUDIES

Variables	Frequency & Source*
1. Having a broad view of organizational goal & objective	2(f,g)
2. Knowledge about the functional organizational structure	2(b,f)
3. Knowledge about the interdepartmental relationship	1(f)
4. Knowledge about types of human behavior occurring in the org.	3(b,f,g)
5. Skill of assessing users' needs and problem	7(a,b,c,d,e,f,g)
6. Skill communication & interaction with users	7(a,b,c,d,e,f,g)
7. Listening (paying attention to & concentrating on what is being said)	1(g)
8. Interview skill (ability to ask the right questions to obtain the information needs	2(f,g)
9. Skill of persuading others	3(b,f,g)
10. Cooperation (working with others productively)	1(g)
11. Conducting presentation to users	2(b,g)
12. Non-verbal communication skill (gestures & facial expression)	1(g)
13. Clear attitude(answer yes or no clearly)	1(g)
14. User training skill	4(a,b,f,g)
15. Skill of preparing documentation that accurately communicates	5(a,b,c,f,g)
16. Skill of providing recommendation to programmers and support staff	2(a,g)
17. Providing supervision and leadership (effectively giving rewards & punishment)	2(a,g)
18. Skill to handle conflicts about procedures	1(g)
19. Skill about planning, organizing, and scheduling of projects	3(b,f,g)
20. Skill of system problem analysis	7(a,b,c,d,e,f,g)
21. System design skill	7(a,b,c,d,e,f,g)
22. Skill about the various types of functional requirements of information systems	2(f,g)
23. File design skill	3(b,c,f)
24. Programming (coding) ability	7(a,b,c,d,e,f,g)
25. Debugging ability	3(a,b,c)
26. Hardware knowledge employed to implement information systems	5(a,b,c,e,f)
27. Error control skill within system	3(b,c,f)
28. Target functional area knowledge	3(b,f,g)

Note:
*a: Arvey and Hoyle, 1974
b: Benbasat, Dexter, and Mantha, 1980
c: Cheney and Lyons, 1980
d: Kaiser and King, 1982
e: Kaiser and Srinivasan, 1982
f: Vitalari, 1985
g: Green, 1989

job skills from the previous studies.

The most comprehensive study of job skills for systems analysts was completed by Vitalari [1985], who identified 23 specific skills categorized as organizational-specific knowledge, applications domain knowledge, functional domain knowledge, and technical skills.

Recently, Green [1989] identified with validity test 21 different behavioral and technical skills for information systems analysts. Table 2 summarizes the variables used more than twice in the systems analysts' job skills studies.

III. Proposed Descriptive Model

A number of studies in the field of IS indicate a relationship between user involvement and IS effectiveness [Baronas and Louis, 1988; Baroudi, Olson, and Ives, 1986; Cerullo, 1980; Guimaraes and Wetherbe, 1994]. However, a theoretical model to identify any relationship between the set of variables and systems effectiveness has not been reported in previous studies. Prior research works have shown only diverse skills required to accomplish successful performance in systems analysis and design without seeking any relationship with user satisfaction. They have not attempted to use those perceived job skills coupled with a performance rating of systems effectiveness. This study assumes that a system developed by a well trained and high-performance-rated systems analysts will enhance the degree of user satisfaction.

The relationship between systems analysts and users, as Lucas [1975] stated, can translate directly to the success or failure of system development projects. Because the proposed instrument for collecting the skills inventory will include users' perception, it should be possible to examine whether or not a set of valid metrics is related to system effectiveness. If so, it will be possible to train and select systems analysts so as to increase user satisfaction. Since user satisfaction has often been used as a surrogate measure for system effectiveness [Melone, 1990; Bailey and Pearson, 1983; Ives, Olson, and Baroudi, 1983; Jenkins and Richetts, 1979], its measure will benefit this research.

Figure 3 presents a descriptive model which explains the relationship between usage of the set of variables and their impact on user satisfaction. The basic idea behind the model is that users' perceptions can identify what skills are considered important for the systems analyst; employ-

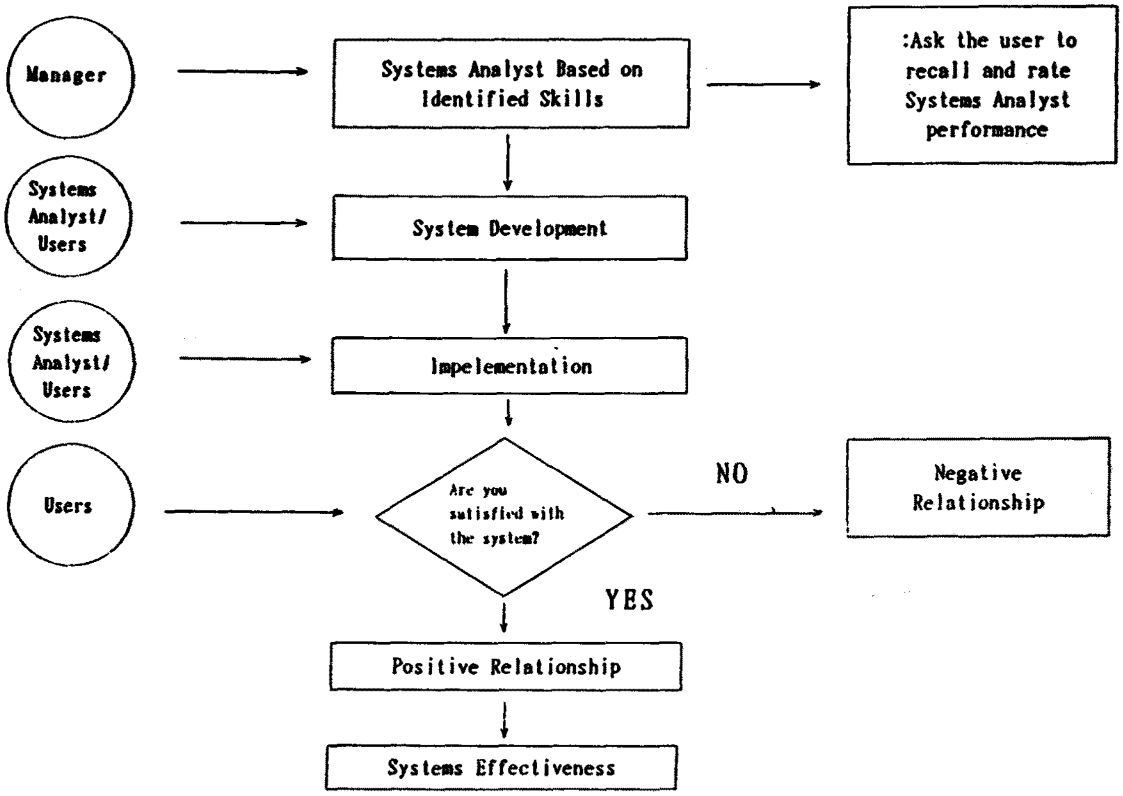


Figure 3. Proposed Descriptive Model

ing an analyst with these skills can provide the organization with a system analyst who through systems development and systems implementation is better able to satisfy the diverse needs of the user group. A satisfied user group will in turn lead to information systems that are better received by their users. If this idea is successful, it can reduce system failure rates.

Ⅳ. Research Methodology

1. Sample Subject

A mail survey was used to collect the systems analysts' job skills data. A survey–based field study of industries which had recently designed and implemented information systems was used.

The IS and three functional area manager group samples (Production/Operations, Finance/Accounting, and Marketing) were selected from Standard and Poor's Register of Corporations, Directors and

Executives, which provides an alphabetical list of over 50,000 corporations. Seven hundred thirty-nine corporations were selected by a systematic sampling method for each manager group. Only subject organizations which had an IS department were selected from every second page of the register. For the end user group, a personal letter was mailed to each of the previously selected major functional managers. The managers were asked to deliver the questionnaire to end users who were knowledgeable of the information system and had previous experience working with the systems analyst on at least one system development project.

2. Research Instrument

A review of important studies [Green, 1989; Vitalari, 1985; Kaiser and Bostrom, 1982; Cheney and Lyons, 1980; Benbasat, Dexter, and Mantha, 1980] identified 28 key items to determine the attribute of system analysts' job skills needed to be successful in system development. The researcher used the 28 items identified as the draft questionnaire variables. Five were taken from Green [1989] directly, and the remaining 23 were generated based on an extensive study of relevant literature [Green, 1989; Vitalari, 1985; Kaiser and Bostrom, 1982; Cheney and Lyons, 1980; Benbasat, Dexter, and Mantha, 1980].

An instrument can be considered as invalid on grounds of the content of the measurement item. To satisfy this need, the questionnaire was examined by systems analysts, the director of the Mississippi State University Computing Center, and three faculty members in the field of information systems at Mississippi State University. Their feedback resulted in considerable modifications to the instrument.

After conducting a pretest, the refined instrument and the questionnaire were used to collect data. Two different questionnaires were used; one for the four manager groups, and the other for end users. The manager group questionnaire contained 26 statements concerning literature derived variables which pertain to the measurement of systems analysts' job skills. A second part of the questionnaire contained 7 items to capture the demographic data.

3. Data Analysis

Analysis of the collected data was divided into three parts: (1) the psychometric test to capture systems analysts' job skills perceived to be successful in systems development, (2) the proposed hypotheses test, and (3) the proposed descriptive model test to explore whether or not the identified skills were related to systems effectiveness.

The instrument was examined for its reliability and validity. As suggested by other researchers [Nash, 1989; Nunnally, 1967], Cronbach's alpha was examined for both individual items and overall measures. Construct validity was checked by a factor analysis which determined to what extent the instrument measured the conceptual dimensions. Content validity, as Cronbach [1971] suggested, is a review process whereby experts in the field familiar with the content universe evaluate versions of the instrument before administering the questionnaire.

Analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA) were the major techniques for identification of systems analysts' job skills perceived to be successful in system development. In addition to ANOVA and MANOVA, Scheffe's contrast method was used to further investigate specific group mean differences of interest.

In addition to the above analysis, the study examined the relationship between the degree of user satisfaction and the set of skills identified via instrument. Pearson correlation analysis was used to test the proposed conceptual model.

V. Research Hypotheses

User, as seen in Figure 1, tend to have a broader organizational and behavioral emphasis when solving a problem. However, system analysts tend to deal with problems in a logical framework with a technical emphasis. These differences are caused by a set of perceptions that users have concerning systems analysts that ultimately make users dissatisfied with the systems analysts [Senn, 1978].

H1: The relative importance of each skill item will not be different among the 25 skill items and among the four different manager groups.

Few studies have empirically tested user group perceptions and there were none found that involved both information specialists and different functional user groups. Therefore, this study included both groups in hypotheses H2 through H8.

H2: The IS group and three functional manager groups do not differ in their perceptions of importance of skills that system analysts should exhibit in performing their jobs.

The four groups might have different perceptions on the systems analysts' job skills to be successful in system development. However, where the differences lie can not be determined. If hypothesis H2 is statistically significant, a test is needed to examine whether there is any difference in each factor among the four groups. If it is, then where the significant difference lies is examined through hypotheses H3 to H8.

H3: There is no difference among the four manager groups for factor 1.
H4: There is no difference among the four manager groups for factor 2.
H5: There is no difference among the four manager groups for factor 3.
H6: There is no difference among the four manager groups for factor 4.
H7: There is no difference among the four manager groups for factor 5.
H8: There is no difference among the four manager groups for factor 6.

There may be, as Green [1989] pointed out, differences among the different functional specialities. For instance, those in the finance and accounting areas may have different perceptions and expectations than those in other areas such as marketing or production. Differences may be related to training, education, and extent of required computer applications to perform the job function. If a different functional area has a different perception of a system analyst, the IS manager should prepare a different training program, or a different selection procedure on a particular project.

H9: The three major functional groups do not differ in their perceptions of the importance of skills that system analysts should exhibit in performing their jobs.

By the same token for hypotheses H3 through H8, the functional groups might have different perceptions on the systems analysts' job skills to be successful in system development. However, where the differences lie can not be determined. If hypothesis H9 is statistically significant, some tests (hypotheses 10 through 15) are needed to examine whether there is any difference in each factor among the four groups. If there is, then another examination might be needed to test where the significant difference lies.

H10: There is no difference among the three major functional groups for factor 1.

H11: There is no difference among the three major functional groups for factor 2.

H12: There is no difference among the three major functional groups for factor 3.

H13: There is no difference among the three major functional groups for factor 4.

H14: There is no difference among the three major functional groups for factor 5.

H15: There is no difference among the three major functional groups for factor 6.

Researchers in the field of MIS have indicated a relationship with user involvement and MIS effectiveness; however, identification of any linkage between the set of variables measuring systems analysts' job skills and systems effectiveness has not been reported in previous studies. Prior research works have shown only diverse skills required to accomplish successful performance in systems analysis and design without seeking any relationship with systems effectiveness. They have not attempted to use those perceived job skills coupled with a performance rating of systems effectiveness. This study assumes that a system developed by a well trained and high-performance-rated systems analysts may enhance the degree of user satisfaction. Therefore, some tests (hypotheses H16 through H19) are needed to examine whether or not the proposed descriptive model is valid.

H16: The expectations of the computer based information systems (CBIS) performance are not directly related to the level of systems effectiveness.

H17: The level of user involvement in the system development is not closely related to the systems effectiveness.

H18: The level of accurate output information is not directly related to the systems effectiveness.

H19: A system developed by a systems analyst who holds a higher weighed performance score will not obtain a higher user satisfaction rating.

Table 3. DEMOGRAPHICS OF RESPONDENTS(END-USERS)

A.	Sex	IS[a]	Group PR[b]	FI[c]	MK[d]
	Male	188(85.5)	47(33.9)	55(77.8)	45(86.5)
	Female	28(12.7)	9(16.1)	15(21.4)	7(13.5)
	Missing	4(1.8)			
	Total	220(100.0)	56(100.0)	70(100.0)	52(100.0)
B.	Organizational Home of SA				
	Part of IS	190(86.3)	43(76.8)	54(77.1)	38(73.1)
	Part of Functional	21(9.6)	6(10.7)	10(14.3)	12(23.1)
	Missing	9(4.1)	7(12.5)	6(8.6)	2(3.8)
	Total	220(100.0)	56(100.0)	70(100.0)	52(100.0)
C.	Highest Education				
	High School	40(16.2)	13(23.2)	4(5.7)	611.5)
	College	124(56.4)	28(50.0)	43(61.4)	33(63.5)
	Graduate School	54(24.5)	15(26.8)	23(32.9)	13(15.0)
	Total	220(100.0)	56(100.0)	70(100.0)	52(100.0)
D.	Age				
	Less 25	3(1.4)	3(5.4)	3(4.3)	2(3.8)
	26-30	9(4.1)	1(1.8)	7(10.0)	4(7.7)
	31-35	19(8.6)	4(7.1)	10(14.3)	12(23.1)
	36-40	34(15.5)	9(16.1)	15(21.4)	9(17.3)
	41-50	96(43.5)	15(26.8)	26(37.1)	20(38.5)
	51-55	34(15.5)	10(17.8)	4(5.6)	4(7.7)
	Over 56	22(10.0)	14(25.0)	5(7.1)	1(1.9)
	Total	220(100.0)	56(100.0)	70(100.0)	52(100.0)
E.	Years with Current Organization				
	Less 3	29(13.1)	0(0.0)	10(14.3)	5(9.6)
	3-7	45(20.5)	10(17.9)	22(31.4)	8(15.4)
	8 Over	146(66.4)	46(82.1)	38(54.3)	39(75.0)
	Total	220(100.0)	56(100.0)	70(100.0)	52(100.0)
F.	Years in Current Position				
	Less 3	46(31.0)	1(1.6)	23(32.9)	21(40.4)
	3-7	74(33.6)	32(57.1)	30(42.9)	21(40.4)
	8 Over	100(45.4)	23(41.1)	17(24.2)	10(19.2)
	Total	220(100.0)	56(100.0)	70(100.0)	52(100.0)

Note: a Information Systems Department

b Production/Operation Department

c Finance/Accounting Department

d Marketing Department

Ⅵ. Results

A total of four hundred twenty-eight (428) responses for manager groups were collected. Some responses were excluded because of mismatched department and/or unmarked questionnaires. Three hundred ninety-eight (398) of them were usable. Demographic statistics of the respondents are shown in Table 3.

Non-response bias was examined using telephone interviews with twenty subjects who did not respond. Their telephone interview responses on several questionnaire items were compared with those of the mail respondents. An F-test for each of these items resulted in no significant difference in variance between the two groups; non-respondents and respondents.

1. Construct Validity Check

Construct validity seeks to examine the factors underlying the instrument [Kerlinger, 1986]. Factor analysis was used to examine the construct validity since factor analysis describes the interrelated constructs among items.

A commonly used rule-of-thumb in factor analysis, referred to as Kaiser's criterion, states all factors should have an eigenvalue greater than or equal to one. According to Table 4, the eigenvalue of the six factors ranged from 1.11 to 7.09, all above the selected minimum requirement 1. It clearly indicated that the construct validity of the measurements was sound.

2. Predictive Validity Test

Predictive validity refers to how well the instrument's variables correlate with user satisfaction. In order to obtain such a measure, each end user rated the degree of satisfaction with the currently used information system by a single question graded on a seven-point scale. Correlation between this single measure and the composite measure, which is the weighted average of the performance scores for each systems analysts for a given user, was calculated and used to indicate the predictive validity of the instrument. The correlation coefficients were high enough and significant ($p<.000$). This is taken to be evidence of predictive validity (see Table 5).

3. Reliability Check

The reliability test generated Cronbach's coefficient alpha for 25 items to be .8850.

Table 4. FACTOR ANALYSIS STATISTICS

Factor	Eigenvalue	Percent of Variance	Cum. Percent
Factor 1	7.09	28.4	28.4
Factor 2	2.81	11.2	39.6
Factor 3	1.79	7.2	46.8
Factor 4	1.28	5.1	51.9
Factor 5	1.22	4.9	56.8
Factor 6	1.11	4.4	61.2

TABLE 5. PEARSON CORRELATION COEFFICIENTS

	SE	EXP	OUTPUT
WA	.5716**	.5969**	.5993**
	(64)	(64)	(64)

Note :

( ) :The Number of Cases

** :Significance level= .001

SE :Systems effectiveness

EXP :User expectation

OUTPUT :System output accuracy

This is quite high for this type of research [Doll, 1988; Ives, 1984; Neumann, 1980]. From the analysis, it was concluded that the measure of 25 items was very reliable and tended to be free of errors. The calculated coefficient alphas for individual items are exhibited in Table 6. The reliabilities of the 25 items varied between .8653 and .8722, far above.70, the minimum required level recommended by Brown [Nunally, 1978] for measuring perceptions. This indicated the significant reliability of the instrument.

4. Final Instrument

Based upon the above tests, the final variables for the importance of the job skills as perceived from the IS manager group are selected (see Table 6). Several factors are of interest. First, those skills exhibiting a mean rating below 5.0 on the

Table 6. RELIABILITY TEST RESULT COEFFICIENT ALPHAS FOR INDIVIDUAL ITEMS

Item(Variable name used in computer output)	Coefficient	α
1. Broad view of organizational goals & objectives	(v1)	.8718
2. Knowledge about the functional organizational structure	(v2)	.8697
3. Knowledge about the interdepartment relationship	(v3)	.8680
4. Knowledge about types of human behavior in organization	(v4)	.8691
5. User need and problem assessment skill	(v5)	.8719
6. Communication and interaction skill	(v6)	.8707
7. Listening skill	(v7)	.8722
8. Interview skill	(v8)	.8709
9. Persuasion skill	(v9)	.8692
10. Cooperation skill	(v10)	.8681
11. Presentation skill	(v11)	.8670
12. User Training skill	(v12)	.8661
13. Documentation preparation skill	(v13)	.8674
14. Recommendation to programmers & support staff (v14)	(v14)	.8656
15. Supervision and leadership skill	(v15)	.8667
16. Conflict resolution skill	(v16)	.8653
17. Planning, organizing, and scheduling skill	(v17)	.8695
18. Problem analysis skill	(v18)	38714
19. System design skill	(v19)	.8700
20. Functional requirements identification skill	(v20)	.8681
21. Data Structure design skill	(v21)	.8655
22. Programming skill (v22) .8676	(v22)	.8676
23. Debugging skill	(v23)	.8680
24. Hardware knowledge	(v24)	.8680
25. Knowledge about the target functional area	(v25)	.8676

7-point scale were programming skills (4.95), debugging skills (4.89), hardware knowledge (4.89), and supervision and leadership skills (4.78). Two comments are appropriate here. 1) the skills which can best be classified as technical (programming, debugging, and hardware knowledge) exhibit ratings lower than all but one of the other listed skills. These ratings are also lower than those received in prior studies. Thus the indication is a definite decrease in the importance that information systems managers place on the technical skills of the analyst. 2) the relative low rating of the importance of the supervision and leadership skills may be the result of two factors:the IS manager respondent considers himself the primary supervisor or leader, and/or these skills are simply not as important given the presumed increasing role of coordination and decreasing role of leading subordinates (programmers) in their work. As aside explanation for this last reason is that technology tools such as higher-level languages and workbenches render a programming job that requires less supervision than in the past.

Another view of the skill needs analysis flows from those five skills rated higher that 6.5 on the 7-point scale. In rank order, these skills are:listening skill (6.80), problem analysis skill (6.72), interview skill (6.71), user need and problem assessment skill (6.66), and communication and interaction skill (6.62). Here the skills identified are clearly oriented away from the baseline level technical skills. Note also that the skills are mainly needed in the analysis phase of systems development efforts. Seemingly, the IS managers assume technical skills are possessed at other levels of their organizations or can be gathered from outside sources.

Variables for the perceived importance of attributes of systems analyst from the three major functional groups were selected. Mean values from the functional groups range from 4.40 to 6.57 with standard deviations of .57 to 1.75. The lowest mean values are the persuasion skills, leadership skills, and knowledge about types of human behavior in organization and the highest ones are the problem analysis skill, system design skill, and user need and problem assessment skill. Functional group managers seemed to perceive that the system development related skills are more important than the user/systems analysts interaction skills.

5. Hypothesis Testing

Hypothesis 1

Hypothesis H1 deals with the four manager groups' perception of the importance of 25 skill items and determining if there is any difference in the variables.

Table 7. SIGNIFICANCE OF F-VALUE AMONG 4 MANAGERS GROUPS FOR 25 VARIABLES

Variable(Variable name used in computer output)		Sig. F-value
1. Broad view of organizational goals & objective	(v1)	.11*
2. Knowledge about the functional org'nl structure	(v2)	.110
3. Knowledge about the interdept. relationships	(v3)	.001*
4. Knowledge about types of human behavior in org.	(v4)	.014*
5. User need and problem assessment skill	(v5)	.144
6. Communication and interaction skill	(v6)	.001*
7. Listening skill	(v7)	.068*
8. Interview skill	(v8)	.000*
9. Persuasion skill	(v9)	.000*
10. Cooperation skill	(v10)	.006*
11. Presentation skill	(v11)	.002*
12. User training skill	(v12)	.174
13. Documentation preparation skill	(v13)	.177
14. Recommendation to programmers & support staff	(v14)	.611
15. Supervision and leadership skill	(v15)	.718
16. Conflict resolution skill	(v16)	.276
17. Planning, organizing, and scheduling skill	(v17)	.634
18. Problem analysis skill	(v18)	.034*
19. System design skill	(v19)	.521
20. Functional requirements identification skill	(v20)	.005*
21. Data structure design skill	(v21)	.611
22. Programming skill	(v22)	.001*
23. Debugging skill	(v23)	.000*
24. Hardware knowledge	(v24)	.002*
25. Knowledge about the target functional area	(v25)	.430

Note: * significant variables at .10 level.

TABLE 8. FACTOR MEAN SCORES AND SIGNIFICANT F-VALUE FOR IS AND FUNCTIONAL GROUPS

Factor	IS[a]	PR[b]	FI[c]	MK[d]	Sig F-Value*
Factor 1	.17	-.20	-.12	-.34	.001
Factor 2	-.26	.30	.29	.38	.000
Factor 3	.11	-.22	.14	-.29	.008
Factor 4	.08	.05	-.17	-.24	.096
Factor 5	.01	.06	-.07	-.03	.906
Factor 6	.11	.01	-.02	-.44	.006

Note: *alpha=.10

a: Information Systems Department

b: Production/Operation Department

c: Finance/Accounting Department

d: Marketing Department

ANOVA was used to test this hypothesis. As summarized in Table 7, hypothesis H1 was rejected and it can be concluded that the relative importance of the variables was different. Fourteen skill items were significantly different at a p-value of .10. The four manager groups differ statistically in their perceptions of the relative importance of the following variables:v1, v3, v4, v6, v7, v8, v9, v10, v11, v18, v20, v22, v23, v24.

Hypothesis 2

For analysis of hypothesis H2, taking each group as a treatment, MANOVA was used to check whether or not the IS group and three functional groups differed in their perceptions of the importance of skills that systems analysts should exhibit in performing their jobs. This test used factor 1 (F1), factor 2 (F2), factor 3 (F3), factor 4 (F4), factor 5 (F5), and factor 6 (F6) found in the previous validity test as dependent variables. In MANOVA, the Wilks Lambda was used to assess the statistical significance. The Wilks Lambda is .803. An F-statistic associated with this value of Wilks' Lambda is 4.94. Significance of this F value is .000. Since the p-value does not exceed .10, we can conclude that the mean vectors of the four groups are not equal. That is, the four groups have different perceptions on the importance of systems analysts' job skills. However, where the differences lies remains in question.

Hypotheses 3 through 8

Since hypothesis H2 was statistically significant, an examination to determine any differences in each factor among the four groups was appropriate. An ANOVA was used to examine the above hypotheses. The average perceived scores from the four different group managers on factor 1 to factor 6 are presented in Table 8 with the significant F-value. Since the p-values for factors 1, 2, 3, 4, and 6 do not exceed the .10, the null hypotheses H3, H4, H5, H6, and H8 were rejected and a conclusion that the four groups' perceptions are different on the set of dependent measures can be reached. However, the p-values for factor 5 exceeded the .10. Therefore, the null hypothesis H7 can not be rejected.

Although the F-test in ANOVA allows rejection of null hypotheses H3, H4, H5, H6, and H8 that the four independent sample means are all equal, it does not pinpoint where the significant differences lie. Even though there are many procedures available for further investigation of spe-

Table 9.a SCHEFFE'S CONTRAST VALUE OF FACTOR ONE FOR IS AND FUNCTIONAL GROUPS

Mean	Group	MK	PR	FI	IS
-.34	MK				
-.20	PR				
-.12	FI				
.17	IS	*	*	*	

Table 9.b SCHEFFE'S CONTRAST VALUE OF FACTOR TWO FOR IS AND FUNCTIONAL GROUPS

Mean	Group	IS	PR	FI	MK
-.26	IS				
.30	FI	*			
.30	PR	*			
.38	MK	*			

Table 9.c SCHEFFE'S CONTRAST VALUE OF FACTOR THREE FOR IS AND FUNCTIONAL GROUPS

Mean	Group	MK	PR	IS	FI
-.20	MK				
-.22	PR				
.11	IS	*	*		
.14	FI				

Table 9.d SCHEFFE'S CONTRAST VALUE OF FACTOR THREE FOR IS AND FUNCTIONAL GROUPS

Mean	Group	MK	FI	PR	IS
-.44	MK				
-.02	FI	*			
.01	PR	*			
.11	IS	*			

Note : * indicates the significant difference between 2 groups
MK: Marketing Department
FI: Finance/Accounting Department
PR: Production/Operations Department
IS: Information Systems Department

cific group mean differences of interest, Scheffe's contrast method was used as one procedure generalized to ANOVA. For hypothesis H3, the Scheffe contrast is significant and the asterisks indicate that the mean for IS managers is significantly different from the means for PR, FI, and MK managers (Table 9.a). For hypothesis H4, the Scheffe contrast is also significant and the asterisks indicate that the means for PR, FI, and MK managers are significantly different from the mean of IS managers (Table 9.b). The Scheffe contrast is also significant for hypothesis H5 at the .10 level for ranges and the asterisks indicate that the mean for IS managers are significantly different from the means of MK and PR managers (Table 9.c). For hypothesis H8, the Scheffe contrast is significant and the asterisks indicate that the means for IS, PR, and FI managers are significantly different from the mean of MK managers (Table 9.d). However, the Scheffe contrast is not significant for Hypothesis H6.

Hypothesis 9

For the analysis of hypothesis H9, taking each group as a treatment, MANOVA was used to check whether or not the three functional groups differ in their perceptions of the importance of skills that systems analysts should exhibit in performing their jobs. This test used the six factors (F1, F2, F3, F4, F5, F6) found in the previous validity test as dependent variables. In MANOVA, the Wilks Lambda was used to assess the statistical significance. The Wilks Lambda is .891. An F-statistic associated with this value of Wilks' Lambda is 1.68. Significance of the F-value is .07. Since the p-value does not exceed .10, hypothesis H9 can be rejected at the .10 level of significance and a conclusion can be reached that the mean vectors of the three groups are not equal. That is, the three groups might have different perceptions on the systems analysts' job skill to be successful in system development. However, where the difference lies still remains in question.

Hypotheses 10 through 15

Since hypothesis H9g was statistically significant, an examination to determine any differences in each factor among the three functional groups was appropriate.

An ANOVA was used to examine the above hypotheses. Average perceived scores from the three functional manager on factor 1 to factor 6 are presented in Table 10 with the significant F-values.

Since the p-values for factor 3 and factor 6 do not exceed the .10, null hypotheses H12 and H15 can be rejected and leads to the conclusion that the three groups' perceptions are different on the set of dependent measures. However, the p-values for factor 1, factor 2, factor 4, and factor 5 exceeded .10, so null hypotheses H10, H11, H13, and H14 can not be rejected.

Although the ANOVA F-test allowed rejection of null hypotheses H12 and H15 that the three independent sample means are equal, it did not pinpoint where the significant difference lies. Scheffe's contrast method, as described previously, was used as one procedure generalized to ANOVA for further investigation of specific group mean differences of interest. For hypothesis H12, the Scheffe contrast was significant and the asterisk indicates that the means for FI managers are significantly different from the means of MK and FI managers (Table 11.a). The Scheffe contrast is also significant for hypothesis H15 at the .10 level for ranges and the asterisks indicate that the means for FI and PR managers are significantly different from the mean of MK managers (Table 11.b).

Hypothesis 16 through 18

These hypotheses are concerned with the proposed conceptual model which is used to test the performance and systems effectiveness relationship.

To conduct these tests, the Pearson correlation coefficient between systems effectiveness and user involvement, accurate output, and expectation items were examined from the SPSS-X output. As shown in Table 12, coefficients were .7304, .7549, .7304 respectively, and indicate that the above three hypotheses were rejected statistically at .000 level of significance based upon the .40 minimum coefficient recommended by Guilford. It was indicated that three was a general association between variables.

Hypothesis 19

To conduct this hypothesis test, correlation analysis was used. First, the composite score of the systems analyst's performance based upon the end users recall was computed. The composite measure is the weighted average of the performance scores for each systems analyst, called WAj, for a given user.

Second, the Pearson Correlation Analysis was used to test if any relationship between systems effectiveness and WA exists. The relationship of both sides was as-

Table 11.a SCHEFFE'S CONTRAST VALUE OF FACTOR THREE FOR FUNCTIONAL GROUPS

Mean	Group	MK[a]	PR[b]	FI[c]
-.29	MK			
-.23	PR			
.14	FI			

Note: * indicates the significant difference between 2 groups

a: Marketing Department

b: Production/Operations Department

c: Finance/Accounting Department

Table 11.b SCHEFFE'S CONTRAST VALUE OF FACTOR SIX FOR FUNCTIONAL GROUPS

Mean	Group	MK[a]	FI[b]	PR[c]
-.44	MK			
-.02	FI	*		
.10	PR	*		

Note: * indicates the significant difference between 2 groups

a: Marketing Department

b: Finance/Accounting Department

c: Production/Operations Department

Table 12. PEARSON CORRELATION COEFFICIENT

	EXP	INVOL	OUTPUT
SE	.7304	.7201	.7549
	(64)	(64)	(64)
	P=.000	P=.000	P=.000

Note: ( ): The Number of Cases

SE: Systems effectiveness

EXP: User expectation

INVOL: User involvement

OUTPUT: System output accuracy

sessed primarily by means of the Pearson Correlation Coefficient. Relatively high correlation, for instance, the .40 minimum coefficient recommended by Guilford, is usually a sign that both sides have a relatively high correlation. As shown in Table 5, coefficients were high enough to conclude that components of the proposed model can be used to enhance systems effectiveness. Coefficients were significant at the .000 level.

Ⅶ. Findings

The construct and predictive validity of the instrument along with its reliability analysis supported the fact that the 25 items used in the questionnaire were reliable, individually and collectively, and valid for the instrument development process stage. Table 13 summarizes the results of the item analysis. The top 5 categories for the systems analysts' job skills in rank order are listening skill (v7), problem analysis skill (v18), interview skill (v8), user need and problem assessment skill (v5), and communication and interaction skill (v6) from the IS managers' point of view. This rank order contrasts with user need and problem analysis skill (v5), communication and interaction skill (v6), listening skill (v7), interview skill (v8), problem analysis skill (v18), and system design skill (v19) identified from the three major functional managers' point of view. The fact that the top 5 of the 25 possible skills were the same, even with a different order, is of value to this research project. These ranking, under closer inspection, have some important similarities when compared to the findings of earlier studies of systems analysts' job skills. In the skill studies reviewed earlier, behavioral skills were ranked as the most useful from the IS professionals' perspectives. As seen in Table 14, a somewhat similar view is indicated in this study. The top five ratings in the IS groups' perceptions from both studies are related to details concerning aspects of user/systems analyst interaction skills during systems design and analysis. This result indicates that the two studies are very similar.

In order to examine related items in homogeneous groupings, the 25 items were composed into meaningful factors. As a result of construct validity and reliability analysis, the 25 items had been factored into six categories labeled with meaningful titles as: F1 (user/systems analyst interaction skills), F2 (system development skills), F3 (training skills), F4(orga-

Table 13. RESULTS OF ITEM ANALYSIS

Rank	IS[a]	PR[b]	FI[c]	MK[d]
1.	Listening	Listening	Listening	Listening
2.	Problem analysis	System design	User need and problem assessment	Problem analysis
3.	Interview	Communication and interaction	Problem analysis	User need and and problem analysis
4.	User need and problem assessment	Problem analysis	System design	System design
5.	Communication and interaction	User need and problem analysis	Interview	Interview

Note:

a: Information Systems Department

b: Production/Operations Department

c: Finance/Accounting Department

d: Marketing Department

TABLE 14. COMPARISON OF FINDINGS: GREEN'S STUDY VS. CURRENT STUDY

Rank	Green(1989)		Current Study	
	User	System Analysts	Functional Managers	IS Managers
1.	Directing	Directing	User need and Problem Assessment	Listening
2.	Speaking	Speaking	Communication and interactive	Problem analysis
3.	Training	Diplomacy	Listening	Interview
4.	Programming	Training	Interview	User need and Problem assessment
5.	Diplomacy	Politics	Problem analysis	Communication and interactive

Table 15. RESULTS OF FACTOR ANALYSIS

Rank	IS[a]	PR[b]	FI[c]	MK[d]
1.	User/systems analyst interaction skills (F1)	System development related skills (F2)	System development related skills (F2)	System development related skills (F2)
2.	Requirements identification skills (F6)	User/systems analyst/IS interaction skills (F5)	Training skills (F3)	User/systems analyst/ IS personal interaction skills (F5)
3.	Training skills (F3)	Organization skills (F4)	Requirements identification skills (F6)	Organization skills (F4)

Note:

a: Information Systems Department

b: Production/Operations Department

c: Finance/Accounting Department

d: Marketing Department

nizational skills), F5 (user/systems analyst/IS personal interaction skills), and F6 (functional requirement identification skill). Table 15 summarizes the result of the factor analysis from the IS manager and the three major functional manager groups. The top 3factors imply that IS managers are more concerned about user/ systems analyst interaction skills, training skills, and functional requirement identification skills than they are about organizational or technical issues. A possible explanation is that IS managers believe that user/systems analyst interaction skills during system design and analysis should be the most desirable skills for systems analysts even though some level of other skills must be present. This means that a minimum level of technical skills, such as programming and hardware skills are assumed to exist and not necessarily be the most important skills for systems analysts.

Factor scores for managers from the three functional areas and end users suggest that systems analysts should have greater technical performance skills. One reason for this result is that functional managers might not understand the typical ladder-rank job path of IS departments. That is, programming and debugging skills are parts of the baseline skills for lower level IS development personnel such as programmers. Another reason is that those managers may be biased in their expectations of systems analysts job skills since managers might see systems analysts in a technical support role.

IS managers and the three functional area managers differ in their perceptions of the importance of skills that system analysts should possess. The results indicate that the four manager groups differ statistically in their perceptions of the relative importance of factors: F1, F2, F3, F4 and F6. For the first three factors (F1, F2, and F3), the perceptions of the IS managers are significantly different from the perceptions of the three functional groups. For the last factor, functional requirement identification skill, the mean for IS, PR, and FI managers are significantly different from the mean of MK managers. By the nature of the function, marketing professionals may lean more toward communication and persuasion skills as a major aspect of their business. The two factors of organizational skills (F4) and user/systems analysts/IS personal interaction skills (F5) did not show any significant differences. In summary, a significant difference in perceptions exists between IS managers and the major functional groups for factors: 1, 2, and 3.

The three functional manager groups differ statistically in their perceptions of the relative importance of factors, training skills (F3) and functional requirement identification skill (F6). However, there was no differences among F1, F2, F4 and F5. For the third factor, the perceptions of the FI managers are significantly different from the perceptions from the MK managers. For the sixth factor, the statistical test proved that the means for PR and FI managers are significantly different from the mean of MK managers. In summary, a significant difference in perceptions exists between MK managers and two major functional managers (PR and FI) for factors: 3 and 6. Again, the personal contact orientation of marketing professionals might explain these differences.

From the results of hypotheses H16, H17, and H18, the following conclusions can be drawn: (1) Higher user expectation can be regarded as a factor which impacts systems effectiveness, (2) A positive relationship exists between user involvement and systems effectiveness, and (3) System output quality is also related to the measure of systems effectiveness. In summary, user expectation, user involvement, and system output are identified as significant factors in determining systems effectiveness.

The proposed instrument for identifying the systems analysts' job skills deemed desirable to accomplish successful systems development was tested for both IS managers' perception and the three functional area managers' perceptions. Furthermore, the proposed model has been validated from the last hypothesis test. Therefore, a conclusion may be drawn that a positive relationship exists between possession of the identified skills and systems effectiveness.

Ⅷ. Conclusion

The purpose of this study has attempted to extend existing research by exploring two aspects: (1) determination of systems analysts job skill importance based upon both IS manager and functional manager perceptions, and (2) examination of the linkage between systems effectiveness and the set of job skills identified via the instrument.

First, systems analysts' job skills items regarding system development were identified and ranked based upon both IS manager and functional manager perceptions. The identified job skills items can be used to enhance existing systems analysts' training programs, aptitude assessment examinations, and job selection processes. Some of these identified job skills items are more important than others depending on functional area of manager. The ranking of systems analysts' job skills were based upon both IS manager perceptions and functional manager points of view, and end user assessments. Further, the three functional manager groups and the non-manager end users reported similar perceptions. Therefore, these perceived skills should be used to improve the match between the expectations of users and systems analysts, thereby reducing conflict that often arises during system development activities.

IS managers and the three groups of functional managers feel differently about factors. These differences suggest that IS managers consider the ability to work with others more important than do functional managers. In contrast, users/managers groups have different skill expectations of system analysts than do IS managers. The three functional manager groups seem to view technical areas more importantly and thus may have greater expectations for technical performance.

Second, this study was to examine the proposed model. The results indicate that a positive relationship between possession of skills and their impact on systems effectiveness does, in fact exist. Obtaining a systems analyst with the identified skills should allow the organization to satisfy the diverse needs of the user group and lead to more effective information systems. A qualified systems analysts should generate information systems that are better received by the target user groups.

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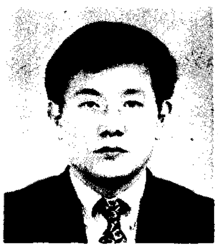
◇ 저자소개 ◇

공동저자 정종덕은 외국어대 법학과를 졸업하고 Southeastern Louisiana University에서 경영학석사학위를 취득후 Mississippi State University에서 경영정보학 전공으로 박사학위를 취득후 University of Wisconson, Eau Clare에서 조교수로 4년간 강의하였으며 현재 한국통신기술(주) 정보시스템 개발실 경영전산부장으로 재직중. 주요관심분야는 전문가 시스템, 재무정보시 스템, 시스템분석 및 설계이다.



공동저자 윤종훈은 인디애나주립대에서 경영학학사 학위를 취득후 미시시피 주립대에서 경영학석사 및 경영정보학 전공으로 박사학위를 취득하였다. 현 재 동국대학교 회계학과 조교수로 재직중. 현재 주요 연구분야는 회계정보 시스템의 설계, 정보기술의 전략적 활용, 정보자원관리, 그리고 Business Process Reengineering이다.