ELSEVIER

Information & Management 32 (1997) 15–28

INFORMATION & MANAGEMENT

Research

Perceived importance of information system success factors: A meta analysis of group differences

Eldon Y. Li*

College of Business, California Polytechnic State University, San Luis Obispo, CA 93407, USA

Abstract

Factors influencing the success or failure of an information system (IS) have been discussed frequently in the literature. This study identifies several additional factors and proposes that the existing ones be classified into eight different dimensions. These encompass, not only the system aspect, but also the human aspect of IS success (ISS). The study further uses data from past ISS studies and also those collected from a field survey to analyze the differences in the perceived importance of ISS factors between four groups of subjects from North America, namely, the user staff, the IS staff, and the managers of the two groups. It reveals that the rank orders of ISS factors between IS staff and IS managers and between user staff and user managers are not significantly different. However, the rank orders between IS personnel and user personnel are significantly different. Based on these, the top and the least important ISS factors are identified. The findings have several implications for IS management practice. © 1997 Elsevier Science B.V.

Keywords: Information system (IS); Importance ratings; IS success factors; IS personnel; IS users; IS planning; Priority assignment

1. Introduction

For the past two decades, many researchers have been attempting to identify factors that make an information system (IS) successful. Among the various studies, the one reported by Bailey and Pearson [1] has received the most attention. This study identified 39 distinct factors that influence a user's IS satisfaction and proposed an instrument to measure them. Due to its richness and validity, the instrument has been adapted by many academicians and practitioners for IS satisfaction studies [2, 4, 8, 9, 10, 11, 13, 17, 19]. Recently, DeLone and McLean [5] surveyed 180 articles attempting to measure IS success (ISS) and proposed that the existing measures be classified into six major dimensions: (1) system quality: the measures of the IS itself, (2) information quality: the measures of the IS output, (3) information use: recipient consumption of the IS output, (4) user satisfaction: recipient response to the use of the IS output, (5) individual impact: the effect of information on the behavior of the recipient, and (6) organizational impact: the effect of information on organizational performance.

However, these six dimensions seem to encompass only the system aspect of ISS and overlook the human one. This deficiency may be supplemented by the factors proposed by Bailey and Pearson which cover both aspects. The 39 factors are numbered

*Corresponding author. E-mail: eli@tuba.calpoly.edu.

PII S-0378-7206(97)00005-0

Table 1
Dimensions and factors of information system success covered by Bailey and Pearson's ISS instrument

Description of factor	Description of factor
System quality:	*Individual impact:*
13. response/turnaround time	29. User's expectation of computer-based support
15. Convenience of access	36. Job effects of computer-based support
23. Features of computer language used	31. Perceived utility
25. Realization of user requirements	
26. Correction of errors	*Service quality:*
27. Security of data and models	7. Technical competence of the CBIS staff
28. Documentation of systems and procedures	8. Attitude of the CBIS staff
38. Flexibility of the systems	9. Scheduling of CBIS products and services
39. Integration of the systems	10. Time required for systems development
	11. Processing of requests for system changes
Information quality:	12. Vendor's maintenance support
16. Accuracy of output	14. Means of input/output with CBIS center
17. Timeliness of output	30. User's understanding of the systems
18. Precision of output	35. Training provided to users
19. Reliability of output	
20. Currency of output	*Conflict resolution:*
21. Completeness of output	2. Competition between CBIS and non-CBIS units
22. Format of output	3. Allocation priorities for CBIS resources
	5. Relationship between users and the CBIS staff
Information use:	6. Communications between users and the CBIS staff
24. Volume of output	34. Personal control over the CBIS
	37. Organizational position of the CBIS unit
User satisfaction:	
1. Top management involvement	
4. Chargeback method of payment for services	
32. User's confidence in the systems	
33. User's participation	

and listed in the Appendix A, in the same sequence as they appear in the original study. They encompass the first five dimensions proposed by DeLone and McLean, overlooking the organizational impact dimension. In addition, they include the human aspect of IS success, such as the quality of IS services and the resolution of conflict between the user and IS department. The quality of IS services includes: the improvement of user's system knowledge (Items 30 and 35 in the Appendix A), the attitude and competency of IS staff (Items 7 and 8), and the efficiency of services (Items 9–12, and 14). The resolution of conflict includes: the competition between users and IS department for corporate resources (Item 2), the allocation of information resources to user departments (Item 3), the communications and relationship of users and IS department (Items 5 and 6), the personal control over computer-based IS (Item 34), and the organizational position of the IS department (Item 37). Therefore, these two dimensions (service quality and conflict resolution) should be added. Table 1 lists the factors of Bailey and Pearson under the corresponding ISS dimensions identified by DeLone and McLean and this study. The list reconfirms that the 39-item instrument of Bailey and Pearson measures a wide spectrum of IS quality. The only weakness is that it leaves out the 'organizational-impact' dimension. This is probably because the questionnaire was designed to be filled out by all levels of users; many of them are only concerned about the impact of IS on their individual performance, rather than on the performance of the organization as a whole. Therefore, the factors measuring organizational impact of information systems were omitted in the original questionnaire. This study adds factors that should correct this deficiency.

Table 2
The seven additional factors of IS success

Item ID	Description of factor
40.	*Conflict resolution* *User's attitude toward using the CBIS:* The willingness and commitment of the user to achieve organizational goals by utilizing the CBIS capability.
	Information quality
41.	*Clarity of output:* The degree to which output information is meaningful and unambiguous.
42.	*Instructiveness of output:* The capacity of output information to indicate possible corrected actions when problem occurs.
	User satisfaction
43.	*Support of productivity tools:* The quality and the quantity of available computer hardware and software as well as peripheral devices which support organization's functions.
	Organizational Impact
44.	*Productivity improved by the CBIS:* The ability of computer-based information systems to help user's organization produce more or better quality output per dollar of resource input.
45.	*Efficiency of the systems:* The ability of computer-based information systems to help the user's organization obtain the greatest possible return from the resources consumed.
46.	*Effectiveness of the systems:* The capacity of computer-based information systems to assist user's organization in identifying what should be done to better resolve problems.

2. Additional IS success factors

Despite its acclaimed validity and frequent applications, the 39-item instrument of Bailey and Pearson overlooked several IS functional characteristics that have been considered by other researchers. These include: user's attitude toward using the computer-based information system, (CBIS) [6], the clarity of output information, the instructiveness of output information [18], the support of productivity tools [12], the overall contribution of CBIS to the organizational goals [3], the efficiency of the systems, and the effectiveness of the systems [9]. Table 2 shows the description of each additional factor and the dimension to which each corresponds. The number of ISS factors is therefore increased to 46. These factors cover all the eight dimensions. Note that the fifth additional factor is operationalized through the productivity improved by the CBIS in user's organization (Item 44).

3. The importance of ISS factors

In order to identify the relative importance among the ISS factors, Pearson [16] asked 32 middle-manager users in eight different U.S. organizations to evaluate the importance level of the 39 factors. The five most important factors based on the average ratings were: (1) accuracy of output, (2) reliability of output, (3) timeliness of output, (4) realization of user requirements, and (5) user's confidence in the systems. Similarly, Montazemi [13] surveyed 86 end-users and 67 IS staff in 83 small Canadian firms to rate the importance level of 35 Pearson's ISS factors. The five most important factors of the users were: (1) accuracy of output, (2) top management involvement, 3) user's confidence in the systems, (4) timeliness of output, and (5) reliability of output. In contrast, the five most important of the IS staff were: (1) top management involvement, (2) user's confidence in the systems, (3) accuracy of output, (4) timeliness of output, and (5) documentation of systems and procedures. Recently, Conrath and Mignen [4] asked the IS managers in 42 Canadian corporations to evaluate 16 Pearson's ISS factors, along with 17 other user satisfaction factors. The top five of these were: (1) user's expectation of computer-based support, (2) user's participation, (3) job effect of computer-based support, (4) realization of user requirements, and (5) communications between users and EDP staff. No other study has published any importance ratings of

ISS factors. Since the last study used a 4-point Likert-type scale while the first two studies used a common 7-point scale, we shall use the data from the first two studies as well as those collected by this study to conduct a meta analysis. The purposes of this study are: (1) to survey a group of IS managers and report the perceived importance of ISS factors, (2) to compare the importance ratings from the IS managers with those of the end-user, the IS staff, and the user managers reported by the other studies, and (3) to explore the relative importance of the seven additional ISS factors proposed here.

4. Research method

4.1. Subjects

To begin the study, 608 members of a national IS professional association in the US were randomly selected, each representing a different company. The subjects were solicited to participate and 160 of them agreed to do so. Among these volunteers, 135 (84%) indicated that they are supervising some IS personnel: this latter group was selected as the set of subjects. Subsequently, a questionnaire containing 46 ISS factors was sent twice to these managers. Of the 135 questionnaires mailed, 115 (85% of 135) were completed and returned. However, six of the returned questionnaires were found to have too many missing values to be included, leaving only 109 usable respondents who came from a wide variety of industries including banking, electronic data processing (EDP) services, education, government, insurance, manufacturing, medical, printing, retailing, utilities, and wholesaling, etc. Based on several demographic distributions, the representativeness of the sample appears to be adequate. Table 3 exhibits the characteristics of the respondents. The distribution of these characteristics is so diverse that it allows us to use the sample means as the estimated average importance ratings of the entire population.

4.2. Questionnaire

For the purpose of comparison, this study adapted all 46 ISS factors. Each surveyed subject was asked to evaluate the importance of each ISS factor based on a 7-point Likert-type scale ranging from −3 ('extremely unimportant') to +3 ('extremely important'). Such a plus–minus coding method allows the positive scores to indicate the levels of importance, and the negative scores to indicate the levels of unimportance. In order to reduce the completion time, the 7-point Likert-type scale similar to Tan and Lo [19] was used instead of the bipolar semantic differential subscale employed by Bailey and Pearson. Table 4 shows the frequency distribution of the importance ratings of the 46 ISS factors.

4.3. Analysis

Before we began the analysis, the non-response bias was first examined. A series of chi-square tests were performed between the two samples obtained from the two waves of mailing: 60 respondents were from the first wave of mailing and 49 were from the second one. The results showed no significant difference in any response between the two samples, indicating there was no significant non-response bias. The summary statistics and the frequency distribution of the important ratings perceived by the IS managers were then compared with those perceived by the user and IS staff as well as the user managers as reported by Montazemi and Pearson. The ratings from these different groups were subjected to Wilcoxon's signed ranks test to determine if they were significantly different. Since no significant difference was found, both staff and manager groups were combined and treated as a group, called 'the personnel group.' Furthermore, the rank orders of the factors were derived and the importance ratings of the seven factors were analyzed based on the ratings of the other 39 factors.

5. Results

5.1. Average importance ratings

The top five important factors as perceived by the IS managers are: accuracy of output, reliability of output, relationship between users and the CBIS staff, user's confidence in the systems, and timeliness of output. The five least important factors in sequence are: the chargeback method, volume of output, competition between CBIS and non-CBIS units, features of com-

Table 3
Characteristics of the respondents

Characteristic	Number of respondents	Percent
Annual company sales		
Less than $25 million	27	25
$25 million to less than $100 million)	21	19
$100 million to less than $200 million)	22	20
$200 million to less than $500 million)	21	19
$500 million or more	18	17
Number of company employees:		
100 or less	18	17
101 to 500	39	36
501 to 1,000	18	17
1,001 to 5,000	23	21
Over 5,000	11	10
Ratio of CBIS budget to company sales:		
Less than 1%	29	27
1% to less than 2%	32	29
2% to less than 3%	17	16
3% to less than 10%	27	25
10% or more	4	4
Number of CBIS employees:		
10 or less	40	37
11 to 50	47	43
51 to 200	14	13
Over 200	8	7
Years of company's CBIS experience:		
Less than 5 years	21	19
5 to less than 10 years	26	24
10 to less than 15 years	27	25
15 to less than 20 years	13	12
20 years or more	22	20
Levels of CBIS management:		
Top level	70	64
Middle level	20	18
Operating level	19	17
Years of tenure with the company:		
7 months to less than a year	4	4
1 to less than 2 years	14	13
2 to less than 5 years	33	30
5 to less than 10 years	30	28
10 to less than 20 years	22	20
20 years or more	6	6

puter language used, and job effects of computer-based support, or organizational position of the CBIS unit. The only factor with negative importance rating is the chargeback method: the only factor which has an unusual number of 'extremely unimportant' rating.

In order to investigate if the ratings in this study are different from those of the other subject groups, the average importance ratings of the 39 factors from the other two studies are included in Table 5. The ratings of IS managers and IS staff were subjected to Wilcoxon's [20] signed ranks test to see if they were significantly different. Similar tests were conducted for the pair of ratings from user managers and user staff. Both null hypotheses were not rejected, indicating that each pair of ratings should be from the same distribution and may be combined as one group. Subsequently, the first pair of columns showing IS personnel's ratings were pooled by multiplying an average importance rating with its sample size and summing the two products. A pooled average was then computed by

Table 4
Statistics of importance ratings from IS managers (N=109)

Item No.	Description of Item	Mean	Standard Deviation	Frequency of Importance Ratings [a]						
				−3	−2	−1	0	1	2	3
1	Top management involvement	1.96	1.11	0	1	4	5	20	37	42
2	Competition between CBIS and non-CBIS units	0.29	1.65	8	8	16	25	27	14	11
3	Allocation priorities for CBIS resources	1.55	1.13	1	0	4	14	23	48	19
4	Chargeback method of payment for services	−0.46	2.02	25	17	13	15	15	15	9
5	**Relationship between users and the CBIS staff**	**2.56** [b]	0.83	1	0	1	0	3	32	72
6	Communications between users and the CBIS staff	2.24	0.93	1	0	0	3	13	42	50
7	Technical competence of the CBIS staff	2.04	1.06	1	1	1	5	13	49	39
8	Attitude of the CBIS staff	2.04	1.17	1	1	3	6	11	42	45
9	Scheduling of CBIS products and services	1.42	1.16	0	1	6	15	31	36	20
10	Time required for systems development	1.57	1.13	1	1	2	11	33	38	23
11	Processing of requests for system changes	2.06	0.97	0	2	1	3	13	53	37
12	Vendor's maintenance support	2.00	1.28	2	3	1	3	14	41	45
13	Response/turnaround time	1.95	0.95	0	1	1	5	20	50	32
14	Means of input/output with CBIS center	1.58	1.22	1	0	6	13	23	40	26
15	Convenience of access	1.81	1.12	1	2	0	8	21	48	29
16	**Accuracy of output**	**2.70**	0.87	0	1	3	0	1	14	90
17	**Timeliness of output**	**2.32**	0.91	1	0	0	3	9	41	55
18	Precision of output	2.07	1.16	1	1	2	5z	17	35	50
19	**Reliability of output**	**2.61**	0.81	1	0	0	1	4	26	77
20	Currency of output	2.05	1.07	1	0	1	8	14	42	43
21	Completeness of output	2.03	1.07	0	1	3	4	20	37	44
22	Format of output	1.30	1.12	0	1	9	11	35	41	12
23	Features of computer language used	0.67	1.85	7	11	13	13	22	22	21
24	Volume of output	0.17	1.56	8	10	13	29	27	17	5
25	Realization of user requirements	2.08	0.89	0	0	2	3	18	47	39
26	Correction of errors	2.00	1.07	0	0	5	3	23	34	44
27	Security of data and models	1.94	1.38	0	1	9	11	9	24	55
28	Documentation of systems and procedures	1.55	1.42	1	4	6	11	20	35	32
29	User's expectation of computer-based support	1.81	1.00	0	0	2	12	19	48	28
30	User's understanding of the systems	1.51	1.26	2	1	7	3	35	39	22
31	Perceived utility (worth vs. cost)	1.48	1.22	1	2	3	15	26	41	21
32	**User's confidence in the systems**	**2.45**	0.84	1	0	1	0	4	42	61
33	User's participation	1.81	1.27	2	0	6	4	21	40	36
34	Personal control over the CBIS	1.20	1.15	1	2	4	16	43	30	13
35	Training provided to users	1.64	1.13	0	1	7	7	22	50	22
36	Job effects of computer-based support	1.14	1.24	0	3	9	16	38	28	15
37	Organizational position of the CBIS unit	1.14	1.48	2	4	13	10	28	33	19
38	Flexibility of the systems	2.07	0.91	0	0	3	1	20	46	39
39	Integration of the systems	1.73	1.20	0	2	6	8	17	47	29
40	User's attitude toward the CBIS	1.93	1.06	0	0	5	7	14	48	35
41	Clarity of output	2.06	1.00	1	0	0	7	15	46	40
42	Instructiveness of output	1.66	1.05	0	0	2	15	27	39	26
43	Support of productivity tools	1.92	1.07	0	1	3	5	24	38	38
44	Productivity improved by the CBIS	1.93	1.17	0	2	4	5	19	38	41
45	Efficiency of the systems	1.80	1.23	0	2	5	8	21	35	38
46	Effectiveness of the systems	2.01	1.12	0	0	5	7	16	35	46

[a] All importance ratings are measured on a 7-point Likert-type scale ranging from -3 (Extremely unimportant) to +3 (Extremely important).
[b] Bold typeface denotes the average rating is among the top 5 ratings.

Table 5
Comparison of average importance ratings for the 39 ISS factors

Item No.	Description of item	IS personnel's avg. importance ratings		User personnel's avg. importance ratings		Pooled average importance ratings [a]	
		staff [b] (N=37)	Mgr. [c] (N=109)	Staff [d] (N=40)	Mgr. [e] (N=29)	IS Per. (N=146)	User Per. (N=69)
1	**Top management involvement**	**2.35**	1.96	**2.50**	1.38	2.06	2.03
2	Competition between CBIS and non-CBIS units	=	0.29	=	0.31	0.29	0.31
3	Allocation priorities for CBIS resources	0.97	1.55	1.50	1.59	1.40	1.54
4	Chargeback method of payment for services	=	−0.46	=	0.14	−0.46	0.14
5	**Relationship between users and the CBIS staff**	1.76	**2.56**	1.68	2.07	**2.36**	1.84
6	Communications between users and the CBIS staff	1.70	2.24	1.88	2.17	2.10	2.00
7	Technical competence of the CBIS staff	1.89	2.04	1.88	2.07	2.00	1.96
8	Attitude of the CBIS staff	=	2.04	=	2.14	2.04	2.14
9	Scheduling of CBIS products and services	0.97	1.42	1.50	2.07	1.31	1.74
10	Time required for systems development	1.62	1.57	1.65	2.00	1.58	1.80
11	Processing of requests for system changes	1.51	2.06	1.57	1.97	1.92	1.74
12	Vendor's maintenance support	2.00	2.00	2.25	1.24	2.00	1.83
13	Response/turnaround time	1.68	1.95	1.93	2.03	1.88	1.97
14	Means of input/output with CBIS center	1.46	1.58	1.98	1.72	1.55	1.87
15	Convenience of access	1.51	1.81	2.08	1.66	1.73	1.90
16	**Accuracy of output**	**2.27**	**2.70**	**2.60**	**2.59**	**2.59**	**2.60**
17	**Timeliness of output**	**2.14**	**2.32**	**2.30**	**2.38**	**2.28**	**2.33**
18	Precision of output	1.03	2.07	1.72	1.79	1.81	1.75
19	**Reliability of output**	1.92	**2.61**	**2.28**	**2.48**	**2.43**	**2.36**
20	Currency of output	1.81	2.05	2.15	1.97	1.99	2.07
21	Completeness of output	1.68	2.03	2.15	2.03	1.94	2.10
22	Format of output	1.89	1.30	2.25	1.86	1.45	2.09
23	Features of computer language used	1.59	0.67	1.78	0.93	0.90	1.42
24	Volume of output	1.32	0.17	1.78	1.34	0.46	1.60
25	**Realization of user requirements**	2.05	2.08	2.20	**2.38**	2.07	**2.28**
26	Correction of errors	1.59	2.00	1.93	2.14	1.90	2.02
27	Security of data and models	1.62	1.94	1.98	1.62	1.86	1.83
28	**Documentation of systems and procedures**	**2.14**	1.55	2.15	1.79	1.70	2.00
29	User's expectation of computer-based support	1.70	1.81	1.85	1.90	1.78	1.87
30	User's understanding of the systems	1.59	1.51	2.08	1.38	1.53	1.79
31	Perceived utility (worth vs. cost)	1.87	1.48	2.20	1.93	1.58	2.09
32	**User's confidence in the systems**	**2.30**	**2.45**	**2.33**	**2.28**	**2.41**	**2.31**
33	User's participation	1.97	1.81	2.00	1.69	1.85	1.87
34	Personal control over the CBIS	1.46	1.20	1.60	1.38	1.27	1.51
35	Training provided to users	1.78	1.64	2.08	1.21	1.68	1.71
36	Job effects of computer-based support	1.48	1.14	1.92	2.03	1.22	1.97
37	Organizational position of the CBIS unit	=	1.14	=	1.03	1.14	1.03
38	Flexibility of the systems	1.89	2.07	2.22	1.97	2.03	2.11
39	Integration of the systems	1.62	1.73	1.68	1.55	1.70	1.63

[a] The pooled average is computed by multiplying each average importance rating with its sample size, summing the two products, and then dividing the sum with the combined sample size.
[b] The ratings are from the IS staff in Montazemi's [13, p. 248] study using 35 ISS items.
[c] The ratings are from the IS managers in this study using 39 of the 46 ISS items.
[d] The ratings of are from the user staff in Montazemi's [13, p. 248] study using 35 ISS items.
[e] The ratings are from the middle managers of IS users in Pearson's [16, p. 174] study using 39 ISS items.
= This item was not used in the study.

Table 6
Comparison of the rank orders of importance ratings for the 39 ISS factors

Item No.	Description of Item	IS Personnel's Average Importance Rating Orders			User Personnel's Avg. Importance Rating Orders			Pooled Average Importance Rating Orders [a]			
		Staff [b] (N=37)	Mgr. [c] (N=109)	Diff. [d]	Staff [e] (N=40)	Mgr. [f] (N=29)	Diff.	IS Per. (N=146)	User Per. (N=69)	Avg. [g] (N=215)	Diff.
16	**Accuracy of output**	**3**	**1**	2	**1**	**1**	0 *	**1**	**1**	1	0 *
19	**Reliability of output**	9	**2**	7	**5**	**2**	3	**2**	**2**	2	0 *
17	**Timeliness of output**	**4.5**	**5**	0.5 *	**4**	**3.5**	0.5 *	**5**	**3**	4	2
32	**User's confidence in the systems**	**2**	**4**	2	**3**	**5**	2 *	**3**	**4**	3.5	1 *
25	**Realization of user requirements**	6	7	1 *	9.5	**3.5**	6	7	**5**	6	2
8	Attitude of the CBIS staff	=	12.5	=	=	7.5	=	9	6	7.5	3
38	Flexibility of the systems	11	8.5	2.5	8	17	9	10	7	8.5	3
21	Completeness of output	19.5	14	5.5	12	13	1 *	14	8	11	6
31	Perceived utility (worth vs. cost)	13	30	17 #	9.5	19	9.5	27	9	18	18 #
22	Format of output	11	32	21 #	6.5	21	14.5 #	30	10	20	20 #
20	Currency of output	14	11	3	12	17	5	13	11	12	2
1	**Top management involvement**	**1**	17	16 #	**2**	30.5	28.5 #	8	12	10	4
26	Correction of errors	25	15.5	9.5	20.5	7.5	13	16	13	14.5	3
28	**Documentation of systems and procedures**	**4.5**	27.5	23 #	12	22.5	10.5	24	14	19	10
6	Commu. between users and the CBIS staff	17.5	6	11.5	23.5	6	17.5 #	6	15	10.5	9
13	Response/Turnaround time	19.5	18	1.5	20.5	13	7.5	17	16	16.5	1 *
36	Job effects of computer-based support	29	34.5	5.5	22	13	9	34	17	25.5	17 #
7	Technical competence of the CBIS staff	11	12.5	1.5	23.5	10	13.5 #	11	18	14.5	7
15	Convenience of access	27.5	21	6.5	15	26	11	22	19	20.5	3
29	User's expect. of computer-based support	17.5	21	3.5	25	20	5	21	20	20.5	1 *
14	Means of input/output with CBIS center	30.5	25	5.5	18.5	24	5.5	28	21	24.5	7
33	User's participation	8	21	13	17	25	8	19	22	20.5	3
5	**Relation between users and the IS staff**	16	**3**	13	29.5	10	19.5 #	**4**	23	13.5	19 #
27	Security of data and models	22	19	3	18.5	27	8.5	18	24	21	6
12	Vendor's maintenance support	7	15.5	8.5	6.5	34	27.5 #	12	25	18.5	13
10	Time required for systems development	22	26	4	31	15	16 #	26	26	26	0 *
30	User's understanding of the systems	25	29	4	15	30.5	15.5 #	29	27	28	2
18	Precision of output	33	8.5	24.5 #	28	22.5	5.5	20	28	24	8
11	Processing of requests for system changes	27.5	10	17.5 #	33	17	16 #	15	29	22	14 #
9	Scheduling of CBIS products and services	34.5	31	3.5	34.5	10	24.5 #	32	30	31	2
35	Training provided to users	15	24	9	15	35	20 #	25	31	28	6
39	Integration of the systems	22	23	1 *	29.5	29	0.5 *	23	32	27.5	9
24	Volume of output	32	38	6	26.5	33	6.5	37	33	35	4
3	Allocation priorities for CBIS resources	34.5	27.5	7	34.5	28	6.5	31	34	32.5	3
34	Personal control over the CBIS	30.5	33	2.5	32	32	0 *	33	35	34	2
23	Features of computer language used	25	36	11	26.5	37	10.5	36	36	36	0 *

Table 6
(Continued)

Item No.	Description of Item	IS Personnel's Average Importance Rating Orders			User Personnel's Avg. Importance Rating Orders			Pooled Average Importance Rating Orders [a]			
		Staff [b] (N=37)	Mgr. [c] (N=109)	Diff. [d]	Staff [e] (N=40)	Mgr. [f] (N=29)	Diff.	IS Per. (N=146)	User Per. (N=69)	Avg. [g] (N=215)	Diff.
37	Organizational position of the CBIS unit	=	34.5	=	=	36	=	35	37	36	2
2	Competition between IS and non-IS units	=	37	=	=	38	=	38	38	38	0 *
4	Chargeback method for services	=	39	=	=	39	=	39	39	39	0 *

[a] The items in this table are arranged in descending order of the average importance ratings of pooled user personnel. When a tie exists, the ranges of the importance ratings are evaluated. The smaller the order number, the more important the ISS factor.
[b] The order is derived from Montazemi's [13, p. 248] study based on the average importance ratings from IS staff. When a tie is encountered, the average rank is used.
[c] The order is derived from this study based on the average importance ratings from IS managers. When a tie is encountered, the average rank is used.
[d] "Diff." denotes the absolute difference between the two columns to the left of this column.
[e] The order is derived from Montazemi's [13, p. 248] study based on the average importance ratings from user staff. When a tie is encountered, the average rank is used.
[f] The order is derived from Pearson's [16, p. 174] study based on the average importance ratings from user managers. When a tie is encountered, the average rank is used.
[g] "Avg." denotes the average of the two pooled average importance rating orders, one from the pooled IS personnel and the other from the pooled user personnel.
=: The data of this item are not available.
* Diff. $\leq$ 1.9 (5% of the maximum possible difference of 38), indicating the rank orders are consistent between the two ISS factors.
# Diff. $\leq$ 13.3 (35% of the maximum possible difference of 38), indicating the rank orders are opposite between the two ISS factors.

dividing the sum with the combined sample size. Similarly, a pooled average importance rating was derived for the user personnel using the other pair of columns. The outcome of this pooling process is shown in the right-most two columns. These columns were subjected to a similar signed ranks test and the null hypothesis was rejected ($p = 0.0039$), indicating they are significantly different and cannot be pooled. To reveal the differences in the ratings between the two samples of IS personnel and the two samples of user personnel, the same signed ranks test was applied to each pair of IS and non-IS groups. Significant differences were found between user staff and IS staff ($p < 0.0001$), and between user staff and IS managers ($p = 0.029$). No significant differences were found between user managers and IS staff or managers at $p < 0.05$.

5.2. *Rank order of importance ratings*

To identify the most and the least important ISS factors perceived by the sampled IS personnel and user personnel, the average importance ratings were then rank ordered within each column. The results are shown in Table 6. While the maximum difference in rank orders between IS staff and IS managers is 24.5, the one between user staff and user managers is 28.5 and the other between the pooled IS personnel and the pooled user personnel is 20. The three pairs of rank orders were subjected to Wilcoxon's signed ranks test and no significant difference was found at $p < 0.05$. To disclose the differences in the rank orders between the two samples of IS personnel and the two samples of user personnel, the same signed ranks test was applied to each pair of IS and non-IS groups. None of the four null hypotheses were rejected at $p < 0.05$, indicating the differences in rank orders between IS personnel and user staff or managers were not significant. The rank orders of the two pooled average importance ratings (see the right-most columns) indicate that several ISS factors are rank-ordered identically ('Diff.'=0) by the two groups of subjects and that the five most and the five least important ISS factors perceived by the pooled user personnel were rated as

among the seven most and the seven least important factors by the pooled IS personnel. The five least important factors now include: (1) chargeback method, (2) competition between CBIS and non-CBIS units, (3) organizational position of the CBIS unit, (4) features of computer language used, and (5) personal control over the CBIS. Note that Montazemi did not use Items 2, 4, 8, and 37, therefore the rank orders of these four ISS factors were determined primarily by the ratings from IS managers and user managers. The factors that have identical rank orders of the pooled average importance ratings (see the right-most "Diff." column) include: 'accuracy of output,' 'reliability of output,' 'time required for systems development,' 'features of computer language used,' 'competition between CBIS and non-CBIS units,' and 'chargeback method of payment for services.'

A scrutiny of the results reveals that the five most and five least important ISS factors as perceived by IS managers are mostly consistent with those perceived by user managers. However, there are two exceptions: (1) 'relationship' and 'communications' between users and the CBIS staff were perceived by IS managers to be more important than 'realization of user requirements' while user managers perceive otherwise, and (2) 'training provided to users' was perceived by user managers to be less important than 'volume of output' and 'job effects of computer-based support' while IS managers perceive on the contrary. Ironically, 'relationship between users and the CBIS staff' was rated as the 3rd most important ISS factor by IS managers, yet it was rated as the 16th by the IS staff and the 23rd by the pooled user personnel. Such difference in order is indicative of potential differences in the underlying ISS evaluation process between IS managers and the other members of the IS community.

6. Conclusions and implications

This study is the first to analyze the differences in the perceived importance of ISS factors between and within IS and user personnel. Through the analysis of the new data and previous studies, several conclusions can be drawn.

First, the seven new ISS factors proposed by this study appear to be moderately very important. They should be included in the instrument measuring the level of IS success. These factors along with the 39 factors of Bailey and Pearson can cover all eight ISS dimensions identified in this study.

Second, despite the different ages of data, the importance ratings between IS managers and IS staff appear to show no significant differences. The same conclusion applied to the importance ratings between user managers and user staff. Similarly, IS managers and user managers appear to have no significant differences. However, given the same age of data, IS staff and user staff appear to have significant differences in their importance ratings. IS management should closely monitor the factors regarded as important by each group of personnel, especially user staff. They should also allocate IS resources to maintain or improve the level of satisfaction.

Third, the top five important ISS factors indicated by the IS managers in this study are: (1) accuracy of output, (2) reliability of output, (3) relationship between users and the CBIS staff, (4) user's confidence in the systems, and (5) timeliness of output. This list is fairly consistent with the other three groups of subjects, namely, IS staff, user staff, and user managers. The major difference lies in the factor of 'top management involvement.' The staff personnel regard it as the most important ISS factor while the managerial personnel think it is somewhat to moderately important. This implies that top management should show enthusiasm and support to the IS community and to exploit IS capability for their managerial process. Only through this effort could the staff personnel be encouraged enough to utilize more of the IS functions. This in turn, may increase the use of IS in their daily work and improve the chance of IS success.

Fourth, both user managers and IS managers regard the chargeback method and the competition between CBIS and non-CBIS units as the two least important factors. Although these two factors appear to be unimportant to the level of ISS, they are indispensable because excessive chargeback may affect user's attitude toward using the CBIS [14, 15] and drive the users away from the IS services. Furthermore, unfair competition may affect the organizational equity of resources allocation [7] and endanger the relationship and communications between users and the CBIS staff.

Fifth, user personnel and IS personnel, as a whole, appear to have opposite rank orders for several ISS factors. Users and their managers seem to be con-

cerned more with the ends of IS services (such as 'perceived utility,' 'format of output,' and 'job effects of computer-based support') than IS personnel. In contrast, IS managers and staff appear to be concerned more with the means of IS services (such as 'relationship between users and the CBIS staff' and 'processing of requests for system changes') than user personnel. To attain total IS success, IS management should realize and cope with such differences. They should focus more on the ends and less on the means of IS services during resources planning and strategies formulation for the information systems.

It is important to realize that the ratings of the perceived importance of an individual ISS factor are usually different from one person to another, because each has a different level of measurement standard and personal degree of emphasis. The rank ordering process is one way to eliminate such individual differences. It generates the rank orders that show relative levels of importance. IS management should use only the rank orders of ISS factors to identify the relative importance of an ISS factor among the others. The rank orders obtained from the user personnel in this study appear to be significantly different from those obtained from the IS personnel. Such difference indicates the underlying ISS evaluation process between IS personnel (especially IS managers) and user personnel may be somewhat different. IS management should periodically conduct a survey of the importance of ISS factors as perceived by the user and IS personnel, so as to resolve the differences in rank orders of importance between the two groups.

7. Recommended practice for ISS evaluation

The ISS evaluation process in a firm should collect the importance and satisfaction ratings of the 46 ISS factors from each and every functional area, and from both user and IS personnel. The questionnaires should have two separate sections: one for the importance ratings and the other for the satisfaction ratings. While the latter allows an ISS assessor to identify specific dissatisfied ISS factors and convey them to IS management, the former allows IS management to prioritize corrective actions and to allocate IS resources. For example, assume that there are two dissatisfied ISS factors, ISS-1 and ISS-2, and ISS-1 are rated more important than ISS-2. In this case and given that other things are equal, actions should be taken and IS resources should be directed to bring up the level of satisfaction with factor ISS-1 first, and then ISS-2. Similarly, given two ISS factors with equal importance and negative satisfaction, the factor that is less satisfactory should receive higher priority and more resources.

In order to obtain 'true' responses, the evaluation should be conducted by an independent ISS assessor and the participants must remain anonymous except the identity of their functional areas. By knowing each participant's functional area, IS management could easily derive the level of satisfaction with any specific functional IS and focus their attention on it accordingly. Moreover, the participants should know as little as possible about how IS management use the ISS ratings to manage their IS projects and resources, otherwise, the participants might begin to manipulate the ISS ratings to gain immediate attention from IS management. To preclude this from happening, a detailed audit and verification of the dissatisfied ISS factor should be established.

As suggested earlier, the ISS ratings should be collected periodically from each and every functional area in the firm. Such information would permit IS management to monitor the overall (company-wide) IS quality without overlooking the quality of each functional IS. It allows IS management to compare the qualities between different functional information systems and to oversee the progress of improving a functional or company-wide IS. Furthermore, it provides IS management with a pattern of longitudinal changes in the perception of IS success within each functional area. Such information is vital to IS management in shaping the future of information systems within the firm.

In all, the application of the IS success instrument in a firm has several implications for the IS management and development processes. Every new IS manager should be trained to interpret the results of the survey and develop strategies to cope with the ratings from the users. Moreover, every new IS personnel should be well versed with these ratings, to the extent that each one can, not only utilize the satisfaction ratings to identify specific problem areas, but also analyze the importance ratings to prioritize IS development or maintenance activities.

Appendix A. Factors of information system success

A.1 Factors from Bailey and Pearson [1]

1. *Top management involvement*: The positive or negative degree of internal enthusiasm, support, or participation of any management level above the user's own level toward computer-based information systems or services or toward the CBIS staff which supports them.

2. *Competition between CBIS and non-CBIS units*: The contention between the CBIS unit and the non-CBIS units competing for organizational resources or for responsibility for success or failure of computer-based information systems or services of interest to both parties.

3. *Allocation priorities for CBIS resources*: Policies and procedures which establish precedence for the allocation of CBIS resources and services between different organizational units and their requests.

4. *Chargeback method of payment for services*: The schedule of charges and the procedures for assessing users on a pro rata basis for the CBIS resources and services that they utilize.

5. *Relationship between users and the CBIS staff*: The manner and methods of interaction, conduct, and association between the user and the CBIS staff.

6. *Communications between users and the CBIS staff*: The manner and methods of information exchange between the user and the CBIS staff.

7. *Technical competence of the CBIS staff*: The computer technology skills and expertise exhibited by the CBIS staff.

8. *Attitude of the CBIS staff*: The willingness and commitment of the CBIS staff to subjugate external, professional goals in favor of organizationally directed goals and tasks.

9. *Scheduling of CBIS products and services*: The CBIS center time table for production of IS outputs and for provision of computer-based services.

10. *Time required for systems development*: The elapsed time between the user's request for new applications and the design, development, and/or implementation of the application systems by the CBIS staff.

11. *Processing of requests for system changes*: The manner, method, and required time with which the CBIS staff responds to user requests for changes in existing computer-based information systems or services.

12. *Vendor's maintenance support*: The type and quality of the service rendered by a vendor, either directly or indirectly, to the user to maintain the hardware or software required by that organizational status.

13. *Response/Turnaround time*: The elapsed time between a user-initiated request for service or action and a reply to that request. Response time generally refers to the elapsed time for terminal type request or entry. Turnaround time generally refers to the elapsed time for execution of a program submitted or requested by a user and the return of the output to that user.

14. *Means of input/output with CBIS center*: The method and medium by which a user inputs data and receives output from the CBIS center.

15. *Convenience of access*: The ease or difficulty with which the user may act to utilize the capability of the computer system.

16. *Accuracy of output*: The extent to which the output information is sufficiently correct to satisfy its intended use.

17. *Timeliness of output*: The availability of the printout information at a time suitable for its use.

18. *Precision of output*: The variability of the output information from that which it purports to measure.

19. *Reliability of output*: The consistency and reliability of the output information.

20. *Currency of output*: The age of the output information.

21. *Completeness of output*: The comprehensiveness of the output information content.

22. *Format of output*: The material design of the layout and display of the output contents.

23. *Features of computer language used*: The set of vocabulary, syntax, and grammatical rules used to interact with the computer systems.

24. *Volume of output*: The amount of information conveyed to a user from computer-based systems. This is expressed not only by the number of reports or outputs but also by the voluminousness of the output contents.

25. *Realization of user requirements*: The degree of congruence between what the user wants or requires and what is provided by the information products and services.

26. *Correction of errors*: The methods and policies governing correction and return of system outputs that are incorrect.

27. *Security of data and models*: The safeguarding of data and models from misappropriation or unauthorized alterations or loss.

28. *Documentation of systems and procedures*: The recorded description of an IS. This includes formal instructions for the utilization of the system.

29. *User's expectation of computer-based support*: The set of attributes or features of the computer-based information products or services that a user considers reasonable and due from the support rendered by the computer-based information systems within his organization.

30. *User's understanding of the systems*: The degree of comprehension that a user possesses about the computer-based information systems of services that are provided.

31. *Perceived utility*: The judgment about the relative balance between the cost and the considered usefulness of the computer-based information products or services that are provided. The costs include any costs related to providing the resource, for example, money, time, manpower, and opportunity. The usefulness includes any benefits that the user believes to be derived from the support.

32. *User's confidence in the systems*: The user's feelings of assurance or certainty about the systems provided.

33. *User's participation*: The degree of involvement and commitment which the user shares with the CBIS staff and others toward the functioning of the computer-based information systems and services.

34. *Personal control over the CBIS*: The awareness of the personal power or the lack of power to regulate, direct or dominate the development, alteration, and/or execution of the computer-based information systems or services which serve the user's perceived function.

35. *Training provided to users*: The amount of specialized instruction and practice that is provided to the user to increase the user's proficiency in utilizing the computer capability that is available.

36. *Job effects of computer-based support*: The changes in job freedom and job performance that are ascertained by the user as resulting from modifications induced by the computer-based information systems and services.

37. *Organizational position of the CBIS unit*: The hierarchical relationship of the CBIS function to the overall organizational structure.

38. *Flexibility of the systems*: The capacity of the information system to change or adjust to new conditions, demands, or circumstances.

39. *Integration of the systems*: The ability of systems to communicate/transmit data and models between systems servicing different functional areas.

A.2 Additional factors identified by this study:

40. *User's attitude toward using the CBIS*: The willingness and commitment of the user to achieve organizational goals by utilizing the CBIS capability.

41. *Clarity of output*: The degree to which output information is meaningful and unambiguous.

42. *Instructiveness of output*: The capacity of output information to indicate possible corrected actions when problem occurs.

43. *Support of productivity tools*: The quality and the quantity of available computer hardware and software as well as peripheral devices which support organization's functions.

44. *Productivity improved by the CBIS*: The ability of computer-based information systems to help user's

organization produce more or better quality output per dollar of resource input.

45. *Efficiency of the systems*: The ability of computer-based information systems to help the user's organization obtain the greatest possible return from the resources consumed.

46. *Effectiveness of the systems*: The capacity of computer-based information systems to assist user's organization in identifying what should be done to better resolve problems.

References

[1] J.E. Bailey and S.W. Pearson, "Development of a tool for measuring and analyzing computer user satisfaction," *Management Science*, 29(5), May 1983, pp. 519–529.

[2] J.J. Baroudi and W.J. Orlikowski, "A short-form measure of user information satisfaction: A psychometric evaluation and notes on use," *Journal of Management Information Systems*, 4(4), Spring 1988, pp. 44–59.

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

[4] D.W. Conrath and O.P. Mignen, "What is being done to measure user satisfaction with EDP/MIS," *Information and Management*, 19(1), August 1990, pp. 7–19.

[5] W.H. DeLone and E.R. McLean, "Information systems success: The quest for the dependent variable," *Information Systems Research*, 3(1), March 1992, pp. 60–95.

[6] G. DeSanctis and J.F. Courtney, "Toward friendly user MIS implementation," *Communications of the ACM*, 26(10), October 1983, pp. 732–738.

[7] E.M. Hufnagel and J.G. Birnberg, "Perceived chargeback system fairness in decentralized organizations: An examination of the issues," *MIS Quarterly*, 13(4), December 1989, pp. 415–429.

[8] J. Iivari and M. Karjalainen, "Impact of prototyping on user information satisfaction during the IS specification phase," *Information and Management*, 17(1), 1989, pp. 31–45.

[9] B. Ives, M.H. Olson and J.J. Baroudi, "The measurement of user information satisfaction," *Communications of the ACM*, 26(10), October 1983, pp. 785–793.

[10] K. Joshi, "An investigation of equity as a determinant of user information satisfaction," *Decision Sciences*, 21(4), Fall 1990, pp. 786–807.

[11] M.A. Mahmood and J.D. Becker, "Effect of organizational maturity on end-users' satisfaction with information systems," *Journal of Management Information Systems*, 2(3), Winter 1985–1986, pp. 37–64.

[12] J. Martin, *An Information Systems Manifesto*, Prentice-Hall, Englewood Cliffs, NJ, 1984.

[13] A.R. Montazemi, "Factors affecting information satisfaction in the context of the small business environment," *MIS Quarterly*, 12(2), June 1988, pp. 239–256.

[14] R.L. Nolan, "Effects of chargeout on user/management attitudes," *Communications of the ACM*, 20(3), March 1977, pp. 177–184.

[15] M.H. Olson and B. Ives, "Chargeback systems and user involvement in information systems: An Empirical Investigation," *MIS Quarterly*, 6(2), June 1982, pp. 47–60.

[16] S.W. Pearson, "Measurement of computer user satisfaction," Unpublished Ph.D. dissertation, Arizona State University, Tempe, AZ, 1977.

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

[18] E.B. Swanson, "Management information systems: Appreciation and involvement," *Management Science*, 21(2), February 1974, pp. 178–188.

[19] B.W. Tan and T.W. Lo, "Validation of a user satisfaction instrument for office automation success," *Information and Management*, 18(4), 1990, pp. 203–208.

[20] F. Wilcoxon, "Individual comparisons by ranking methods," *Biometrics*, 1, 1945, pp. 80–83.

Eldon Y. Li is a professor and a former coordinator of MIS at the College of Business, California Polytechnic State University, San Luis Obispo CA. He was the Founding Director of the Graduate Institute of Information Management at the National Chung Cheng University in Chia-Yi, Taiwan. He has received two first-prize "Best Paper" awards, one from the Quality Data Processing journal in 1990 and the other from the ACME Proceedings in 1991. Recently, he received the "Most Outstanding 1995 Research Award" from the National Science Council, Taipei, Taiwan, ROC. He holds a bachelor's degree from National Chengchi University in Taiwan and M.S. and Ph.D. degrees from Texas Tech University. He has provided consulting services to many firms for a variety of software projects and served as a management consultant to the clientele of the U.S. Small Business Administration. He was a software quality specialist at the Bechtel Corporation's Information Services Division and a visiting software scientist at the IBM Corporation. He is a Certified Data Educator (CDE) and is Certified in Production and Inventory Management (CPIM). He has been listed several times in *Who's Who Technology* and *Who's Who in the West*. His current research interest lies in human factors in information technology (IT), strategic IT planning, software engineering, quality assurance and information and systems management. He has published in *Information & Management*, *Information Resources Management Journal*, *Journal of Management Systems*, *Quality Data Processing*, the *Journal of Computer Information Systems* among others. He currently serves as a member of the editorial board for *The Journal of Quality Assurance Institute* (USA) and *Information Management* (Taiwan).