Determinants of Information Center Success

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ABSTRACT: This paper examines determinants of information center (IC) success, defined as user satisfaction. The determinants are tested for their relationships to IC success and one another in order to evaluate which have a direct impact on success and which operate indirectly. Prior studies have not looked for relationships among factors, omitting potentially helpful information.

Data were gathered from 151 users representing three organizations and were used to develop a model of IC success. The model is consistent with Anthony's levels of management activity in that the determinants correspond to specific levels of planning and control. The determinants and their corresponding management activity levels are as follows: IC role definition is associated with strategic planning, while management control encompasses a variety of services, staff infrastructure, and organizational commitment. Operational control, in the IC environment, is concerned with quality of user-developed applications, quality of individual staff, quality of services, facilitation of end-user computing, and user self-sufficiency.

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This model of IC success can guide researchers studying information centers and, especially, managers charged with establishing and operating information centers.

KEY WORDS AND PHRASES: end-user computing, information center, information system success, management levels.

ADVANCES IN TECHNOLOGY, THE INABILITY OF TRADITIONAL centralized methods to deliver information adequately, and increased user literacy have contributed to the rapid expansion of the direct use of information technology by end users, a phenomenon called end-user computing (EUC). The effective management of EUC has been consistently identified as a top management issue [3, 5, 6, 8, 12, 17]. If properly managed, EUC is believed to improve users' productivity and, in turn, the effectiveness of the organization. If poorly managed, EUC could be disastrous to the organization (e.g., [10, 15, 18, 32]). Thus, the provision of a support infrastructure that maximizes the benefits and minimizes the risks of EUC can be critical to the achievement of organizational goals.

The formal end-user support group is commonly formed as an Information Center (IC). The role of the IC is to provide a variety of services that facilitate and coordinate EUC activities. The use of such a unit to support EUC has grown from 40 percent of organizations in 1985 [38], to 58 percent in 1991 [39], to 78 percent in 1996 [15]. In organizations that do not provide formal support, almost all have some informal avenue for supporting EUC [15]. EUC support is consuming an increasing portion of an organization's computing resources. Faced with increased budgetary constraints, ICs (and EUC in general) are being scrutinized by top management and expected to justify their existence. Consequently, managers are under increasing pressure to manage their ICs efficiently and effectively and to ensure that they are successful.

The determinants of IC success have been the focus of much research. IC managers were queried to determine the critical success factors for the IC and to evaluate a stages-of-growth model for ICs [29]. This work was extended later to identify three broad dimensions that affect a measure of user satisfaction [27], and a number of end-user traits have been shown to be related to IC satisfaction [31]. Recently, firms have been found to adopt a number of strategies for managing EUC effectively, and not all are equally successful [15]. Thus, important characteristics of IC users, organizations, support environments, types of support, and applications have been discovered in prior research. In most cases, these characteristics were found to be strongly related to users' overall satisfaction with the IC.

While prior studies contributed significantly to our understanding of IC effectiveness, they were uncoordinated, and each study focused on only one or a few aspects. The interrelationships among the factors determining IC success were not identified. An understanding of how the determinants collectively affect IC success could provide valuable guidance to both managers and researchers. In this paper, we use a review of previous studies to identify key determinants of IC success and develop a model to explain how the determinants influence one another and IC success.

The Model Variables

IC Success

THE MEASUREMENT OF INFORMATION SYSTEM (IS) SUCCESS has received a great deal of attention in the IS literature in the last two decades. A number of measures have been proposed [11], such as resource utilization, response times, flexibility, and reliability rates. Many of the measures are difficult to assess. For example, determination of a system's benefit can be obscured by the inability to differentiate between the contribution made by the information system versus the contribution made by, say, superior marketing or materials. Another potential measure, system utilization is a suspect measure of IC success when system use may not be completely voluntary. Of the numerous possible measures, user satisfaction has received the most attention [11] and has been the primary measure of success [30]. User satisfaction has also been the predominant means of evaluating EUC and IC success [13, 21, 25, 27, 32, 37]. Therefore, IC success is interpreted in this study as user satisfaction with the IC.

Determinants of IC Success

As noted above, a number of prior studies have focused on determinants of IC success. The following eight determinants of IC success were identified from a review of these studies:

- Quality of user-developed applications;
- User self-sufficiency;
- Organizational commitment;
- Quality of staff;
- Variety of services;
- Quality of services;
- Facilitation of EUC;
- IC role definition.

Selection criteria for the determinants included one limiting factor: the ability of managers to influence the factor either directly or through policy choices. Accordingly, omitted from this study are individual, task, or firm characteristics that might be difficult for a manager to change. As an example, IC success is probably related to the amount of money spent on IC activities; however, the firm's budget for IC activities is likely to be affected by the general economy. Because managers have little control over their total budgets, that variable is not studied here.

Justification for the choices and a review of the literature supporting the inclusion of these factors in this study, along with the specific measurement items used for each determinant, is provided below.

Quality of User-Developed Applications

One of the major contributions to IC success is the quality of the information obtained through applications developed primarily by the user (e.g., [1, 4, 13, 27, 37]. Users

who are unhappy with their applications tend to consider the IC at fault for not providing appropriate support. At a minimum, allowing users to develop and operate low-quality applications, even if they are done quickly and cost effectively, is counterproductive for the organization, since users are not getting optimal information to support their needs. Successful IC managers, thus, must be concerned with the quality of user-developed applications.

Important aspects of information quality have been identified as content, accuracy, format, ease of use, and timeliness [13], as well as precision, reliability, and completeness [27]. Because content is a general term that is difficult to interpret without reference to one or more of the other criteria (e.g., accuracy of the content), it is excluded here. Consolidating the remaining items yields the following list of components making up the factor called *quality of user-developed applications*:

- Accuracy;
- Format;
- Ease of use;
- Timeliness;
- Precision;
- Reliability;
- Completeness.

User Self-Sufficiency

In an ideal EUC environment, users would be completely self-reliant and would not have to depend on information technology (IT) experts for advice or support. While this degree of self-sufficiency is unlikely to be realized, IC personnel can strive to minimize the end user's dependence. Independence from the information systems function has been found to be the most important factor affecting user satisfaction with application development [37].

Five components of self-sufficiency have been identified: feeling of control over user-developed applications, feeling of independence from the systems function, users' understanding of the IC concept and services, degree of training provided, and feeling of participation by users [27]. The first two of these variables are included in our instrument, and, as described below, the third is adapted, the fourth is moved, and the last is dropped.

Users' understanding of the IC concept and services is extended in this study to include the notions of mastering tools [4] and understanding applications [31]. The item is rephrased as users' understanding of information technology.

A priori, degree of training provided to the user is not expected to relate as well to user self-sufficiency as to the quality and variety of services offered by the IC. Although training loaded in the user self-sufficiency factor in Magal [27], that study was exploratory and variables were forced to load somewhere. Training may have loaded inappropriately. In this study, training issues are examined under the quality and variety of services factors rather than with user self-sufficiency.

Feeling of participation as a variable originated with the study by Ives, Olson, and Baroudi [22] of user information satisfaction. That study was not limited to end-user computing. The feeling of participation component is excluded here because, by definition, the user must participate in EUC.

Finally, an additional component of user self-sufficiency is the ability to set up a small system using IC tools [4]. This ability enhances user autonomy and, ultimately, user satisfaction. It is included in this study. Thus, the following four components define the *user self-sufficiency* dimension:

- User's feeling of control;
- User's independence from the IC;
- User's understanding of information technology;
- User's ability to develop a small system.

Organizational Commitment

Organizational commitment has been shown to be a major determinant of IC success at all evolutionary stages of the organization's IC [27]. Further, organizational commitment has long been understood to be a critical success factor for ICs and has been identified with top management support [19, 24, 26, 29], organizational acceptance of the IC concept [26, 29], and obtaining commitment from end users [29]. Other variables identified in the literature that are related to organizational commitment include the existence of an adequate budget [4], the rank of the IC executive [9], the monitoring and tracking of IC successes [24, 28], and active promotion of IC services [24, 29]. All seven of the items, as listed below, are included in the third factor, *organizational commitment*:

- Top management support;
- Organizational acceptance of the IC concept;
- End-user commitment to the IC concept;
- Existence of sufficient budget;
- Rank of the IC executive;
- Monitoring and tracking of IC successes;
- Promotion of IC services.

Quality of Staff

The end user's contact with the IC is going to be with its personnel. For better or worse, users' beliefs about the performance of the IC are likely to be influenced by their perceptions of individual IC staff members. Variables that relate to the staff's ability to provide quality services include technical competency [4, 26, 29], staff training [29], and knowledge of changes in technology [35, 36]. In addition, an ability to understand and relate to the end users is necessary for high-quality services. For this, the IC staff must be able to communicate with users [26, 28, 32] and must have a good

understanding of the users' business tasks and problems [26, 29]. Finally, the availability of future career paths to attract and retain competent staff members [29] and the number of IC employees [4] are deemed to be important. Thus, the items used to define *quality of staff* are:

- Technical competency of IC staff;
- Training for IC staff;
- Knowledge of changes in technology;
- Communication with users;
- Knowledge of the users' business and problems;
- Career paths for IC staff;
- Number of IC employees.

Variety of Services

The variety of services offered helps determine the success of the IC [4, 7, 32], and one of the IC manager's biggest challenges is to satisfy the extremely diverse needs of many end users within the constraints of limited resources. In prior studies, IC services have been associated with the categories of hardware, software, data, functional activities, and end-user training [7].

While variety of services, in general, has been associated with user satisfaction [4, 32], only a few of the above categories have been investigated for such a relationship. In one study, a positive association between the provision of a variety of software and satisfaction was reported [32], but in another study a negative association was found between satisfaction and the number of databases and software tools supported [4]. Given the paucity of prior research in this area, all of the above categories of service are examined in this study, so the factor *variety of services* includes the following five areas:

- Variety of hardware support;
- Variety of software tools;
- Variety of data support;
- Variety of functional support;
- Variety of end-user training.

Quality of Services

Merely offering a wide enough variety of services to meet any user requirement is not enough to satisfy the users if the quality of those services is poor [4, 7, 26, 27, 29]. Accordingly, quality attributes corresponding to each of the five categories in variety of services, above, are placed in this factor. In addition, the timely response of IC personnel to various requests for service is also assigned to this determinant [4, 26, 27, 32]. Accordingly, the list of components defining *quality of services* includes:

- Quality of hardware support;

- Quality of software support;
- Quality of data support;
- Quality of functional support;
- Quality of end-user training;
- Timeliness of service response.

Facilitation of End-User Computing

The IC's role is to ensure that EUC will thrive and prosper in the hands of the users. Facilitation of EUC can be viewed as an extension of the commitment factor in that, once commitment is established, the IC should make maintenance of that commitment easy for users and management alike. Prior research suggests that continuing commitment is encouraged when the IC has a friendly atmosphere, so that users believe that the IC will help find cost-effective solutions to their problems and the users will not hesitate to seek answers [26, 29]. Management of end-user expectations, so that all have a clear understanding of the limits of IC and technology resources, also has been shown to be important [23, 26, 29].

In addition to providing a supportive EUC environment, the IC may be expected to handle many of the inherent coordination problems that arise with multiple users. Successful IC managers establish priority criteria for application development [28]. Further, in successful EUC environments, user-developed applications are monitored and coordinated to reduce duplication of organizational efforts [26, 28]. The literature, thus, provides the following five components for the *facilitation of end-user computing* factor:

- Maintenance of user-friendly atmosphere;
- Offering of cost-effective solutions;
- Management of end-user expectations;
- Establishment of priority criteria for application development;
- Coordination of organization's user-developed applications.

IC Role Definition

The final major determinant of success is probably the first that should be addressed by management, that is, the role of the IC within the organization. The IC's strategy should correspond with and support the organization's strategy [35]. If the responsibilities of the IC are well defined, many problems related to the appropriate variety of services, commitment of the organization, and the facilitation of EUC may be avoided.

A basic issue involving the IC is the level of decentralization for information processing [19], which entails determining which applications belong in the domain of EUC and which should remain centralized in the MIS department. Role conflict and role ambiguity were reported to be two of the most important factors causing dissatisfaction among IC staff [21]. Thus, at a minimum, unclear definition of the IC mission is likely to produce less-motivated and -effective IC staff and, ultimately, a

less-successful user support group. Further, not only is it important for the IC to have a defined mission, but management must ensure that the users understand their own and the IC's responsibilities with respect to EUC [27].

The IC is a resource shared by many in the organization. Both chargeback criteria and other control procedures may be used to ensure that organizational standards and policies are being followed [19, 26, 28, 29]. Prior research has indicated that having too much control, however, may be harmful to user satisfaction [28].

Based on the above studies, *IC role definition* is comprised of the following variables:

- Alignment of IC strategy to organizational strategy;
- Defined IC mission;
- Users' understanding of the IC concept;
- Appropriate chargeback criteria;
- Effective EUC control procedures.

Table 1 summarizes the components of each of the eight determinants and lists references to their sources in the literature.

Methodology

A QUESTIONNAIRE WAS USED TO GATHER DATA ABOUT EACH of the forty-six component items and a summary (one item) determinant measure for each of the eight determinants. Participants responded to all items on an anchored Likert scale where the end labeled "Low or not applicable" was assigned a value of 1 and "High" was at the top end of the seven-point scale.

Although user satisfaction often has been measured with a multidimensional instrument that combines responses related to a number of potential variables into one score, one-item summary measures have been reported to be more reliable with respect to test–retest [14]. Accordingly, participants were asked also to report an overall (one item) rating of IC satisfaction, using the same scales described above.

Technology users from three independent organizations were asked to respond to this survey. The workplaces included an executive office at a large glass manufacturer, a business college at a public university, and a financial services company. Of the 475 survey instruments distributed, 151 were returned and usable, a 31.8 percent response rate; no significant response bias across organizations was found. Statistics related to the responses are reported in Table 2.

Table 3 reports statistics related to participant demographics. Analysis of variance indicated no significant differences in responses across the three companies; therefore, the data were combined for analysis. Our usable sample contains approximately 50 percent men and 50 percent women. The median age falls into the range of thirty-one to forty years old. Fifty-four respondents (35.8 percent) report their IT experience as covering eleven or more years; thirty-two (21.2 percent) disclose eight to ten years of experience with IT. Thus, over 95 percent of the sample report having at least two years of IT experience. As expected, due to changing technology, this work experience

Table 1. The Determinants of Information Center Success

Determinant factor	Components
Quality of user-developed applications	Accuracy [13, 27, 32] Format [13] Ease of use [4, 13] Timeliness [4, 13] Precision [27, 32] Reliability [28, 32] Completeness [27, 32]
User self-sufficiency	User's feeling of control [4, 27] User's independence from the IC [4, 27, 37] User's understanding of information technology [4, 27, 32] User's ability to develop a small system [4]
Organizational commitment	Top management support [19, 23, 24, 26, 28, 29] Organizational acceptance of the IC concept [26, 29] End-user commitment to IC concept [29] Existence of sufficient budget [4] Rank of the IC executive [9] Monitoring and tracking of IC successes [26, 28] Promotion of IC services [24, 26, 29]
Quality of staff	Technical competency of IC staff [4, 26, 27, 29] Training for IC staff [28, 29, 32] Current knowledge of changes in technology [32, 35, 36] Communication with users [26, 28, 32] Knowledge of users' business and problems [26, 28, 29] Career paths for IC staff [29] Number of IC employees [4]
Variety of services	Variety of hardware support [7] Variety of software tools [4, 7, 26, 32] Variety of data support [4, 7] Variety of functional support [4, 7] Variety of end-user training [4, 7, 29]
Quality of services	Quality of hardware support Quality of software support [4, 26] Quality of data support [4, 32] Quality of functional support [26, 32] Quality of end-user training [4, 26] Timeliness of service response [4, 26, 27, 32]
Facilitation of end-user computing	Maintenance of user-friendly atmosphere [26, 29] Offering of cost-effective solutions [26, 29] Management of end-user expectations [26, 29] Establishment of priority criteria for applications development [29] Coordination of organization's user-developed applications [7, 26, 27, 29, 32]
IC role definition	Alignment of IC strategy to organizational strategy [35] Defined IC mission [26, 28, 29] Users' understanding of the IC concept [27, 29, 32] Appropriate chargeback criteria [28, 29] Effective EUC control procedures [19, 29, 32]

Table 2. Number of Responses by Organization

	Glass manufacturer	College of business	Financial institution	Total
Number distributed	176	145	150	471
Number returned and usable	57	42	52	151
Percentage returned and usable	32.4	29	34.7	31.8

Table 3. Participant Demographics

Characteristic	Frequency[a]	Percent of responses
Gender		
Male	71	47.0
Female	73	48.3
Age		
Below 30 years old	30	19.8
31–40 years old	51	33.8
41–50 years old	44	29.1
51–60 years old	17	11.3
More than 60 years old	1	0.7
IT experience		
1 year or less	7	4.6
2 to 4 years	23	15.2
5 to 7 years	29	19.2
8 to 10 years	32	21.2
11 or more years	54	35.8
Usage of support services in last year		
One time	5	3.2
2 to 4 times	30	19.9
5 to 9 times	54	35.8
10 to 14 times	20	13.2
15 or more times	38	25.2

[a] Numbers may not add up to total number of respondents (151) because of missing demographic data from a few people in each category.

has not made the respondents totally independent of the IC. Thirty-eight (25.2 percent) report using IC services at least fifteen times in the preceding year; only five (3.3 percent) state that they used IC services fewer than two times in the preceding year.

Analysis

THE VALIDITY AND RELIABILITY OF THE INSTRUMENT were evaluated in a number of ways. Construct validity was examined (a) via correlations between the component items and the corresponding summary determinant measure and (b) by factor-analyz-

ing each of the eight determinants, using the principal components method with a varimax rotation.

The mean responses to all of the component items and the summary measures are reported in Table 4. Responses on all items are above or near the scale's midpoint, denoting a relatively high level of user satisfaction with the respective determinants. Correlations between responses for each component item and its respective summary determinant measure are presented in the last column. High correlations suggest construct validity. All but one of the correlations are significant at the 0.01 level, and the one lower correlation is significant at the 0.10 level. Six of the eight determinants have no component-summary correlations below 0.40, and four of the eight have no such correlations below 0.50. Accordingly, assuming that the summary determinant measures are valid, the component items exhibit construct validity.

The factor-analysis results, in general, support the theoretical development of the factors. All but one of the proposed determinants of IC success (as discussed below) were found to consist of one factor, and all factors had eigenvalues greater than one. Table 5 reports the factor loadings, eigenvalues, explained variance, and alphas for each of the factors. Factor reliabilities, as demonstrated with Cronbach's alpha, were between 0.59 and 0.97 for each factor, and only one factor had a reliability below 0.80. Coefficients of 0.80 or higher are desirable, but reliability coefficients above 0.60 are typically considered satisfactory for research in exploratory areas [34].

The determinant, quality of staff, appears to be two factors rather than just one. Four of the proposed component items (technical competency of IC staff, communication with users, knowledge of user's business and problems, and keeping abreast of changes in technology) load on the first factor. The other three items (training for IC staff, career paths for IC staff, and number of IC employees) load on a second factor. Because the two sets of items have distinctive features, they are treated as two separate determinants for the remainder of the study. The first factor, describing the characteristics of individual staff members in the IC, is called *quality of individual staff*. The second factor, representing the characteristics of the IC organization or its infrastructure, is called *staff infrastructure*.

Model Development

WE NEXT INVESTIGATED THE RELATIONSHIPS AMONG THE INDIVIDUAL determinants and IC success. A regression analysis, similar in concept to stepwise regression, of all nine determinants on IC success is undertaken as a first step. As reported in Table 6, five of the nine variables have a direct and significant impact upon IC success. These five primary determinants are the quality of user-developed applications, user self-sufficiency, quality of individual staff, quality of services, and facilitation of end-user computing.

While the remaining determinants do not have a significant direct impact on IC success, they could have a strong relationship with the primary determinants and thereby indirectly affect IC success. Accordingly, the next task was the identification of second-level effects. Successive regression analyses utilized each of the five

Table 4. Within-Determinant Relationships

Determinant	Summary determinant mean	Component item	Component item mean	Correlation between component item and summary determinant
Quality of user-developed applications	4.5	Accuracy	4.6	0.894**
		Format	4.4	0.840**
		Ease of use	4.2	0.816**
		Timeliness	4.3	0.804**
		Precision	4.5	0.889**
		Reliability	4.5	0.914**
		Completeness	4.4	0.908**
User self-sufficiency	4.3	User's feeling of control	4.7	0.689**
		User's independence from the IC	4.4	0.586**
		User's understanding of information technology	4.5	0.667*
		User's ability to develop a small system	3.5	0.580**
Organizational commitment	4.2	Top management support	4.5	0.573**
		Organizational acceptance of the IC concept	4.4	0.699**
		End-user commitment to IC concept	4.0	0.706**
		Existence of sufficient budget	3.5	0.512**
		Rank of the IC executive	4.4	0.615**
		Monitoring and tracking of IC successes	3.7	0.633**
		Promotion of IC services	4.0	0.739**
Quality of staff	4.7	Technical competency of IC staff	4.8	0.734**
		Training for IC staff	4.3	0.425**
		Current knowledge of changes in technology	4.8	0.597**
		Communication with users	4.5	0.555**
		Knowledge of users' business and problems	4.6	0.700**
		Career paths for IC staff	3.5	0.247**
		Number of IC employees	4.3	0.350**
Variety of services	4.5	Variety of hardware support	4.4	0.521**
		Variety of software tools	4.3	0.418**
		Variety of data support	3.8	0.472**

Table 4. Continued

Determinant	Summary determinant mean	Component item	Component item mean	Correlation between component item and summary determinant
		Variety of functional support	4.3	0.724**
		Variety of end-user training	3.9	0.462**
Quality of services	4.6	Quality of hardware support	4.5	0.480**
		Quality of software support	4.3	0.560**
		Quality of data support	4.0	0.551**
		Quality of functional support	4.3	0.729**
		Quality of end-user training	4.0	0.561**
		Timeliness of service response	4.6	0.709**
Facilitation of end-user computing	3.5	Maintenance of user-friendly atmosphere	5.0	0.244**
		Offering of cost-effective solutions	3.9	0.288**
		Management of end-user expectations	4.3	0.306**
		Establishment of priority criteria for applications development	3.9	0.231*
		Coordination of organization's user-developed applications	3.8	0.235**
IC role definition	3.8	Alignment of IC strategy to organizational strategy	4.0	0.844**
		Defined IC mission	3.8	0.835**
		Users' understanding of IC concept	3.5	0.760**
		Appropriate chargeback criteria	3.4	0.663**
		Effective EUC control procedures	4.0	0.581**

* Significant at $p < 0.1$; ** significant at $p < 0.01$.

primary determinants as the dependent variable and the four remaining determinants as independent variables. As shown in Table 7, four of the five primary determinants were found to be significantly related to two of the remaining factors, staff infrastructure and variety of services. Furthermore, organizational commitment was related to both user self-sufficiency and facilitation of end-user computing.

Table 5. Factor Loadings for the Determinants of IC Success

Determinant and component items	Factor loading		Eigen-value	Variance explained	Alpha
Quality of user-developed applications			5.8	82.90%	0.97
Accuracy	0.929				
Format	0.906				
Ease of use	0.864				
Timeliness	0.856				
Precision	0.924				
Reliability	0.941				
Completeness	0.949				
User self-sufficiency			2.7	64.37%	0.84
User's feeling of control	0.889				
User's independence from the IC	0.739				
User's understanding of information technology	0.906				
User's ability to develop small system	0.734				
Organizational commitment			4.2	59.98%	0.89
Top management support	0.782				
Organizational acceptance of the IC concept	0.832				
End-user commitment to IC concept	0.838				
Existence of sufficient budget	0.707				
Rank of the IC executive	0.687				
Monitoring and tracking of successes	0.771				
Promotion of services	0.791				
Quality of individual staff (factor 1)[a]	Factor 1	Factor 2	2.5	47.15%	0.59
Technical competency of IC staff	0.774	0.167			
Current knowledge of changes in technology	0.679	0.308			
Communication with users	0.739	0.170			
Knowledge of users' business and problems	0.848	0.178			
Staff infrastructure (factor 2)[a]			1.8	61.47%	0.81
Training for IC staff	0.372	0.757			
Career paths for IC staff	0.115	0.766			
Number of IC employees	0.161	0.676			

Table 5. Continued

Determinant and component items	Factor loading	Eigen-value	Variance explained	Alpha
Variety of services		2.41	48.19%	0.73
Variety of hardware support	0.673			
Variety of software tools	0.654			
Variety of data support	0.743			
Variety of functional support	0.772			
Variety of end-user training	0.617			
Quality of services		3.12	51.91%	0.81
Quality of hardware support	0.654			
Quality of software support	0.602			
Quality of data support	0.731			
Quality of functional support	0.851			
Quality of end-user training	0.704			
Timeliness of service response	0.754			
Facilitation of end-user computing		2.77	55.43%	0.8
Maintenance of user-friendly atmosphere	0.728			
Offering of cost-effective solutions	0.635			
Management of end-user expectations	0.830			
Establishment of priority criteria for applications development	0.733			
Coordination of organization's user-developed applications	0.782			
IC role definition		3.38	67.60%	0.88
Alignment of IC strategy to organizational strategy	0.812			
Defined IC mission	0.892			
Users' understanding of IC concept	0.878			
Appropriate chargeback criteria	0.797			
Effective EUC control procedures	0.721			

[a] The determinant "quality of services" loaded not on just one factor, but on two. They are labeled here as "quality of individual staff" and "staff infrastructure." All other determinants loaded on only one factor.

Table 6. Regression Results—First-Level Relationships

Dependent variable: Overall satisfaction

Source:	SS	MS	*F*-value	*PR* > *F*	R^2
Model	96.68	19.34	23.33	0.0001	0.5311
Error	85.35	0.83			
Total	182.04				

Variable	Beta	*T*-value	Prob > *T*
Quality of user-developed applications	0.132	1.873	0.0639
User self-sufficiency	0.271	3.595	0.0005
Quality of individual staff	0.208	1.938	0.0553
Quality of services	0.208	1.804	0.0742
Facilitation of end-user computing	0.325	2.932	0.0042

One determinant, IC role definition, is not significant in any of the first- or second-level regressions. Successive regressions using each of the second-level determinants, identified above, as the dependent variable and with IC role definition as the independent variable are completed next. IC role definition is shown to have a significant relationship with all three second-level variables, as detailed in Table 8.

Diagramming the significant effects discovered in the regression analyses yielded a basic structure of relationships among the nine determinants of IC success considered in this study. This model for IC success is shown in figure 1.

Discussion

INSPECTION OF THE MODEL SUGGESTS THAT IC SUCCESS determinants are related to the three levels of managerial activity: strategic planning, management control, and operational control [2]. As such, the placement of determinants signifies a variety of opportunities for promoting IC success.

Strategic Planning

The strategic planning function involves definition of mission and establishment of mechanisms to ensure that the mission is achieved. The only factor included in the strategic portion of the model is IC role definition. Analysis of the items in this factor indicates that, in the IC context, strategic planning includes defining the role and mission of the IC, so that it is congruent with the overall organizational strategy and philosophy. As is typical of strategic planning, top management of the firm—not just the departmental (i.e., the IC) manager—must be involved.

Several possible strategies for ICs have been identified [33], ranging from restrictive and reactive to supportive and proactive. The choice must be a function of the role

Table 7. Regression Results—Second-Level Relationships

Dependent variable: Quality of user-developed applications

Source:	SS	MS	*F*-value	*PR* > *F*	R^2
Model	66.14	33.07	21.53	0.0001	0.2889
Error	162.83	1.54			
Total	228.96				

Variable	Beta	*T*-value	*PR* > *T*
Staff infrastructure	0.198	1.679	0.0960
Variety of services	0.610	4.830	0.0001

Dependent variable: User self-sufficiency

Source:	SS	MS	*F*-value	*PR* > *F*	R^2
Model	12.66	12.66	9.33	0.0028	0.0802
Error	145.19	1.36			
Total	157.85				

Variable	Beta	*T*-value	*PR* > *T*
Organizational commitment	0.259	3.054	0.0028

Dependent variable: Quality of individual staff

Source:	SS	MS	*F*-value	*PR* > *F*	R^2
Model	43.38	21.69	26.23	0.0001	0.3311
Error	87.63	0.83			
Total	131.01				

Variable	Beta	*T*-value	*PR* > *T*
Staff infrastructure	0.3350	3.878	0.000
Variety of services	0.3340	3.606	0.001

Dependent variable: Quality of services

Source:	SS	MS	*F*-value	*PR* > *F*	R^2
Model	105.53	52.77	210.98	0.0001	0.7992
Error	26.51	0.25			
Total	132.04				

Variable	Beta	*T*-value	*PR* > *T*
Staff infrastructure	0.0900	1.886	0.062
Variety of services	0.8780	17.221	0.000

Table 7. Continued

Dependent variable: Facilitation of end-user computing					
Source:	SS	MS	*F*-value	*PR* > *F*	R^2
Model	57.38	19.13	26.29	0.0001	0.4289
Error	76.39	0.73			
Total	133.77				
Variable			Beta	*T*-value	*PR* > *T*
Organizational commitment			0.210	2.618	0.0101
Staff infrastructure			0.248	2.948	0.0039
Variety of services			0.307	3.098	0.0025

that corporate strategy and philosophy place on technology. In addition, steps must be taken to ensure that the stated IC mission is understood by all and that control mechanisms are established to ensure that the IC functions within this mission.

Management Control

Management control is concerned with the medium term. At this level of planning, the focus is on establishment of the infrastructure needed to achieve the stated IC mission. This level of management is often the domain of middle managers, and the IC manager must work with top management to ensure that the resources needed by the IC are identified, justified, and acquired.

The factors included in this section of the model were variety of services, staff infrastructure, and organizational commitment. A commitment is required of all constituents—users, the IC staff, and top management—to devote the resources (e.g., provision of appropriate budget) and to engage in activities (e.g., promotion of IC services) that will ensure the success of EUC activity. The type and variety of services needed to achieve the IC mission must be identified, and the staff needed to deliver the services must be recruited, trained, and retained.

Clearly, the type of commitment, services, and staff is directly influenced by the mission. A restrictive mission with a limited role for the IC will require different commitments, services, and staff than one that is proactive and sees a crucial role for the IC within the organization.

Operational Control

Operational control focuses on the short term and is concerned with the effective utilization of resources. Five of the nine factors in our model relate to this level of planning. Two—facilitation of EUC and user self-sufficiency—relate to typical goals [26, 27] of an IC, while the others deal with various aspects of quality.

A common goal of the IC, and one focus of Hammond's [16] original definition, is

Table 8. Regression Results—Third-Level Relationships

Dependent variable: Organizational commitment

Source:	SS	MS	*F*-value	*PR* > *F*	R^2
Model	100.81	100.81	123.47	0.0001	0.5357
Error	87.36	0.82			
Total	188.18				

Variable	Beta	*T*-value	*PR* > *T*
IC role definition	0.666	11.112	0.0001

Dependent variable: Staff infrastructure

Source:	SS	MS	*F*-value	*PR* > *F*	R^2
Model	31.36	31.36	30.42	0.0001	0.2213
Error	110.31	1.03			
Total	141.67				

Variable	Beta	*T*-value	*PR* > *T*
IC role definition	0.372	5.515	0.0001

Dependent variable: Variety of services

Source:	SS	MS	*F*-value	*PR* > *F*	R^2
Model	40.78	40.78	53.18	0.0001	0.3320
Error	85.05	0.77			
Total	228.96				

Variable	Beta	*T*-value	*PR* > *T*
IC role definition	0.424	7.292	0.0001

to equip users so that they are as self-sufficient as possible in developing UDAs. Achievement of this goal requires the IC to provide the types of services needed to educate and train the users with tools and knowledge relevant to their particular tasks. If service provision is adequate, the users will assume control of their applications and become independent of the IC.

The facilitation goal requires that the IC staff establish priorities and procedures that are conducive to developing cost-effective solutions. Maintenance of a welcoming and friendly atmosphere should invite users to seek this help as necessary. A successful IC staff also must encourage reasonable user expectations about EUC and about priorities for the limited IC resources.

Finally, operational control involves enhancement of the quality aspects of staff, services, and developed applications. Not only must daily control activities encourage EUC, they also must promote EUC activities that work well for the users in their own

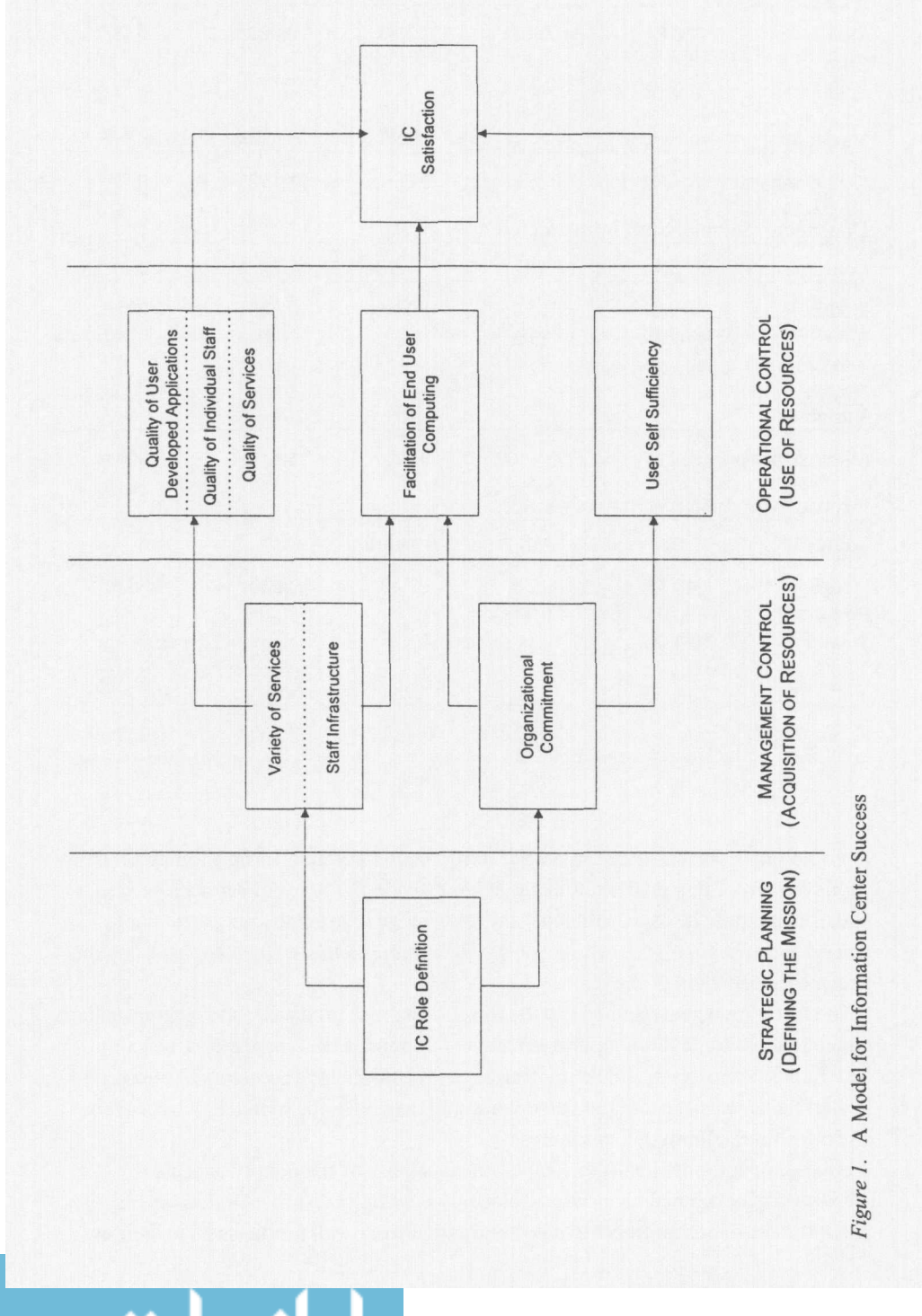

Figure 1. A Model for Information Center Success

domains. Without high-quality applications, enhanced by quality staff and support services, EUC is likely to languish.

Summary and Conclusion

THIS STUDY UTILIZED PRIOR WORK TO GUIDE A SYSTEMATIC ANALYSIS of the relationships among the determinants of IC success, defined as end-user satisfaction. A questionnaire asking about component items, related to these determinants, was developed and administered to technology users from three different environments. Subsequent factor analysis indicated that the component items were better matched to nine determinants, rather than the original eight, and that the nine factors seemed to be reliable and valid measures of the underlying constructs.

Regression analysis was used to examine relationships among the determinants, and a model was built to relate these factors to the three levels of management. As such, this model placed specific management decisions with respect to the IC into a meaningful framework for planning and controlling IC endeavors.

The results are very pertinent to managers because the model can help them understand the types of decisions necessary to ensure success. The need for planning at all three levels of management activities is clarified, as is the manner in which decisions on one level influence the next. Further, the model and the component items of each determinant can help managers identify elements that have directly visible results—which are the main focus of user critiques—as well as aspects that other people, such as top management and IC staff, must address to increase the satisfaction of the users.

Besides providing guidance for management, the model offers benefits to researchers because of its ability to organize prior research in a new light. That is, the model presents a framework for evaluating the influences of organizational and situational factors on IC success. There is ample opportunity for further research to broaden the model's applicability. Potentially fruitful avenues could involve other stakeholder groups, such as IC managers or top executives, for comparison with the results from users reported here. In addition, because this study was limited in geographic area and to these three companies, extension of the results to other organizations could be studied.

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