STRATEGY-ORIENTED EVALUATION OF MIS

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Abstract

Performance evaluation is essential for the successful management and operation of MIS.   The more MIS grows and relevant investment enlarges, the more performance evaluation grows in importance.

However, MIS managers as well as top management still have difficulty in evaluating the performance of MIS.   This arises from various reasons, such as the specialty of MIS, diversified influences of MIS, multidimensionality of evaluation items, and the difference between evaluation levels.

In this paper, MIS is understood in a broad sense.   MIS's scope is of a very wide range from each application system to system innovation view.   The MIS should support the firm's objectives, and, consequently, MIS evaluation should be implemented at corporate level, not merely at application system level.

The most critical problem of MIS evaluation is that a systematic frame covering various viewpoints and factors of MIS evaluation does not exist.   Not a single measure covers all aspects of MIS evaluation.   To help resolve this problem, this paper proposes an hierarchical approach for practical use that includes most aspects of evaluation approaches from previous studies, and, furthermore, emphasizes the evaluation of strategic aspects of MIS.

Previous Viewpoints on MIS Evaluation

Subjective vs. Objective

From the indicator used in evaluation, MIS evaluations can be divided into two types - subjective and objective[25].   While it seems that the objective evaluation is ideal, subjective evaluation has usually been applied to previous studies due to the ease of measurement.   Since an organization needs a broad spectrum of MIS, and it is substantially made up of qualitative and subjective parts, most parts of evaluation indicators are no more than subjective. Subjective evaluation uses the measure variables selected by subjective and a priori method, not by actual proof, thus, it may be biased by individual cognitive style[3].   There are several articles on the subjective type [1][4][19][23][24][27][42].

Though objective evaluation has a merit of eliminating the evaluator's subjective bias, it is difficult to convert all MIS characteristics into

objective indicators. Many studies are debilitated because they often evaluate whole MIS by a few objective indicators. Swanson[42], King and Rodriguez[23] use the objective indicators of either system usage or system efficiency as a supplementary evaluation method. Hurtado[16] proposes a quantitative model consisting of three seperate algorithms which develop an effectiveness index in the three related EDP areas. But, against his intention of eliminating the subjectivity in evaluation, his model seems to have a considerable amount of arbitrariness. A current trend appears to show that evaluation processes become more qualitative and less quantitative[39].

Outcome vs. Process

There are two general types of system evaluation; one is the outcome or goal-oriented type which evaluates performance against goal, the other is the process or means-oriented type which evaluates how resources are ideally used[38]. Early, Hamilton and Cherany [14] point out that MIS evaluation is difficult due to its multidimensionality, its qualitative and quantitative aspects, and evaluators' viewpoints. Solving this problem, they used a goal-centered / system resource view jointly. According to them, the way to assess a system in the goal-centered view is, first, to determine the task objectives of the system (or the organizational units utilizing the system), and then to compare performances with objectives. In the system-resource view, the system is assessed by attaining a normative state, e.g., standards for good practices which might be indicated by the quality of the system or the service levels. Most studies are inclined toward the process-oriented view because of difficulty in establishing and measuring the goal[23][27][42]. Studies of the outcome-oriented view merely focused on the level of validating process-oriented evaluation[1][19].

Scope and Area

Four scopes of MIS evaluation, which are aimed at computer operation, MIS project, MIS department, and MIS at corporate level, respectively, are proposed [25]. It is a recent tendency that MIS is being utilized strategically at the corporate level. Consequently, MIS evaluation should be carried out at the corporate level. Evaluation at the lower level seems to be still adopted because of the ease in evaluation.
Since the evaluation area can be categorized by the functional areas of system, user, organization, and management, the several evaluation approaches suitable to each evaluation area have been proposed[7][14][15][16][40][41]. Other studies show different evaluation contents and methods according to the type of factor they use[14]. Additionally, the evaluation viewpoint changes accordingly with user, MIS manager, top management and internal auditor executing the MIS evaluation.

A Proposed Approach : An Hierarchy of MIS Evaluation

Because the system area or efficiency factor is easy to measure, many studies remain on a low level of MIS evaluation, not at corporate level.   In the previous studies, no applicable method can be found for MIS evaluation at corporate level.   The combination of several methods from different studies poses the problem of being too heterogeneous.

King and Rodrieguez[23] interpret MIS evaluation as a dynamic process made prior to the design of an MIS, through the various phases of development, and subsequently follows system implementation.   Hamilton and Chervany[14] insist on recognizing the dynamic nature of the MIS implementation process and enlarging the range of performance being evaluated.   From an idealistic viewpoint, MIS should be evaluated with equal consideration given to both various users and various applications[7].   In addition, a set of measures including operational level, managerial level and strategic level is suggested[39].   These contents show that an overall and systematic evaluation method, considering various evaluation factors and viewpoints, is needed.

Meanwhile, Bowman[5] proposes the three stage model of MIS planning, which consists of strategic MIS planning, information requirement analysis(IRA), and resource allocation.   First, during the strategic MIS planning stage, the relationship between the overall organizational plan and the MIS plan should be established.   Second, in the IRA stage, the organizational information requirement should be identified to establish the strategic information architecture that can be used to direct a specific application system development project.   Finally, in the resource allocation stage, the allocation of both MIS application development resources and operational resources is fulfilled.

Dansker[9] understand the MIS planning process as three distinct parts : strategic objectives for opportunities facing the organization, application plan, and system architecture plan.

There are two common denominators in the above MIS planning studies; emphasizing the strategic planning concept and using a staged or hierarchical approach. This commonality can be used in the MIS evaluation process.   It is shown in the previous section that the uni-dimensional approach to MIS evaluation is not sufficient to evaluate MIS effectively.   An effective solution for these problems is a hierarchical approach toward MIS evaluation; (a) evaluating the contribution of MIS to an organization, (b) evaluating the MIS department or MIS function as an organizational subfunction through the overall MIS lifecycle, and (c) evaluating the quality or productivity of the application systems as MIS outputs.

Evaluation of strategic aspects

As Ives and Learmonth point out an information system as being a competitive weapon[17], a current trend shows that MIS should not be treated on the MIS department level, but on a corporate or strategic level. Since the 1980s, traditional MIS has been criticized for its difficulty in practical systemization and its ambiguous performance owing to its wide-ranged concept. As the result, the purpose of MIS use has changed from efficiency improvement and cost reduction on a functional level of enterprise to the increase of corporate performance on a strategic level. This fact might be caused by the new perspective on MIS rather than improved information technology. Business process reengineering, referred recently, also seems to be one trend of strategic use of MIS.

Strategic use of MIS produces effects on epochal improvement of productivity or organizational activation from the inside, and acquisition of competitive power or advances into a new business from a market-oriented standpoint.

A new trend of MIS, called strategic information systems, focuses on where information technology is used, and is closely related to organization strategy. Top management is more concerned about strategic use of MIS and/or information technology than efficiency of MIS operation. Therefore, it should be the first consideration in MIS evaluation to assess the degree of reflecting organization strategy to MIS. Without this consideration, MIS evaluation becomes a partial and low-level evaluation.

In this level of the hierarchy, it is important to evaluate the purpose of MIS from a macro perspective, that is, MIS strategy.

Evaluation of MIS function

MIS function is also a subfunction of an organization. Therefore, the key to successful MIS depends not only on good support to other function divisions but on goodness of the MIS department's own functional flow. As management function has the general cycle of plan-do-see, MIS function also should adequately achieve such a cycle. To evaluate whether an MIS department has a systematically organized function or not is important, especially in terms of the efficiency.

In this level of the hierarchy, management of the MIS department, system development process, and departmental operation should be evaluated. First, in evaluating the MIS department, MIS planning, budget, organization, and manpower are the major parts that need to be evaluated. Among these, MIS planning is the most meaningful evaluation criterion. Successful MIS function begins with an effective and efficient MIS plan. Further, an MIS plan gives a primary basis for MIS evaluation. Strategic meaning is given to MIS planning accordingly as the domain of MIS is expanded from the routine job at the operational level to strategic support at top management level. So, strategic

MIS planning from a macro perspective, with careful consideration to other functional areas, is needed. Up to now, an MIS plan could not be used in MIS evaluation because of the tendency of MIS planning not to be established in clear terms.

Next, evaluation of system development process means evaluating project management in system development process, where observance to formal procedure and project lifecycle might be evaluated.

Finally, control procedures, as well as the overall operating function, should be checked in a system operation area.

Evaluation of Application Systems

No matter how MIS is used, either for strategic purposes, or for operational purposes, the results of MIS appear in application systems. Accordingly, it is proper that we should evaluate the application system which is a primary output of MIS. Previous studies on MIS evaluation also have main concern in this area. Evans and Riha [11] propose system throughput, productivity, utilization, cost for efficiency evaluation and availability, accuracy, reliability of output, timeliness, and output quality for effective system evaluation criteria. The analysis of previous studies by Weill and Olson[43] shows that MIS performance is typically operationalized by perceptual measures such as user satisfaction, system success, system effectiveness, and system innovativeness. Also, the efficiency variable of the system, as a practical measure, was proposed in many studies.

	evaluation of system	evaluation of MIS function	evaluation of strategic use
1. target	system quality	operation of MIS function	strategic aspect of MIS
2. dimension	level of application system	level of MIS department	corporate level
3. viewpoint	efficiency	effectiveness	competitiveness
4. evaluation contents	.technical quality of system	.management of MIS department	. MIS strategy
	.service quality	.process of system development and operation	.accomplishment of organizational strategy
	.output quality		.improvement of organizational performance
	.user satisfaction	.MIS planning and controlling	

Table 1. Outline of MIS Evaluation Hierarchy

Major concerns of system evaluation in the previous studies can be grouped into three areas; technical quality of the system, service quality, and user satisfaction. Lucas[27], King and Rodriguez[23], Bailey and Pearson[1], Ives, Olson and Baroudi[19] approach user satisfaction, Boland[4] considers service quality, and King and Schrems[21], Maish [28], Chandler[7] refer to technical quality of system. Though all of these evaluating items are included and the validity of measurement is satisfied, those studies need a more broad view of MIS' purpose since they aim at evaluation of the system itself, which is the result of MIS.

Table 1 shows an outline of each level of the hierarchy.

Survey

It is ideal for MIS evaluation to include all three levels of the hierarchy presented in Table 1. However, practical MIS evaluation, depending upon which level of the hierarchy is emphasized, can be divided into three types: system-oriented, function-oriented and strategy-oriented evaluation, respectively. For instance, strategy-oriented evaluation type means evaluation of strategic aspects is more emphasized than that of MIS function and/or system. It is meaningful to examine various aspects of these three evaluation types for the sake of practical utilization of an hierarchical approach toward MIS evaluation. To this end, this survey is concerned with the following: a) which evaluation type is mainly used in most organizations? b) what is the relationship between evaluation type and related factors suggested in the following? and c) which evaluation type is helpful for MIS success?

Factors related to evaluation type

In previous MIS studies, factors which affect MIS were considered such as: strategy, structure, environment, technology, task, individual, maturity, resource, and time frame[8][10][12][35][43]. Directly applying these factors to an MIS evaluation type is not appropriate since they focus either on system development or an MIS implementation, and their dependent variable is MIS performance or MIS success. In this survey we deal with the following three factors.

MIS maturity

In the context of MIS application, MIS goes to maturity from level of operational control, through that of management control, to that of strategic planning in the end. That is, the main target of MIS is changed according to the degree of MIS maturity. Likewise, the content of the MIS evaluation also would be differentiated by the degree of MIS maturity.

Information intensity

Porter and Millar[32] introduce the concept of information intensity as a factor determining the utilization of information technology. The chance to utilize information technology increases accordingly with an increase in information intensity. Information intensity can be used as the relative standard in measuring strategic potentiality of information technology. Similarly, MIS evaluation possibly puts more emphasis on strategic potentiality as information intensity becomes higher.

Organizational size

In organization theory, organizational size has often been referred to as a contingency variable and its moderating effect also is pointed out as being the same in MIS field. Ein-Dor and Segev[10] posit that organizational size is directly associated to MIS success, larger firms tending to be more organizationally mature, to have more resources to allocate for MIS, and to function on a longer organizational time frame. Lehman[26] also suggests that larger organizations have more sophisticated information system use than smaller ones. However, Raymond[35] maintains that organizational size is not significantly associated to either user satisfaction or MIS use, but is significantly related to many of the other organizational characteristics.

Hypotheses

Assuming that the three factors, stated above, have a positive effect on evaluation type, hypothesis 1, 2 and 3 are developed. Furthermore, hypothesis 4, regarding the relationship between evaluation type and MIS performance, is developed.

Hypothesis 1.   The higher the level of MIS maturity, the more
                organizations use strategy-oriented MIS evaluation.
Hypothesis 2.   The higher the level of information intensity,
                the more organizations use strategy-oriented MIS
                evaluation.
Hypothesis 3.   The larger organizations are, the more they use
                strategy-oriented MIS evaluation.
Hypothesis 4.   Organizations using strategy-oriented evaluation
                have an higher MIS performance.

Methods

Questionnaires were sent to MIS managers of 145 Korean firms selected randomly from a Korean company directory. Among them 79 answered. The firms were scattered by industry ranging from manufacturing, trade, financial and insurance, construction, distribution, tourism, transportation and so on. The number of employees of each company was in the range of 128 to 22,000.
MIS maturity is measured by using a 5 point Likert scale with 6 questions

concerning technology level, application portfolio, MIS organization, MIS planning and control, and user awareness given by Nolan's stage model[31]. The firms whose average score are not less than 4 are estimated at a high level of MIS maturity. Otherwise, the firms are estimated at a low level of MIS maturity.

Information intensity is appraised by industry as illustrated by Porter and Millar[32]. Firms conducting trade business, financial and insurance business, and distribution business are grouped into higher intensity of information than others. Additionally, perceptual information intensity of each company is investigated by using a 5 point scale. Firms with a score 4 or above are classified into an high intensity group, while the others are categorized into a low intensity group.

Organizational size is measured by the number of employees. A company above 3,000 employees, which represents a median of the collected data, is grouped into larger firms than others.

Finally, MIS performance is measured on a 5 point scale with 12 questions on financial contribution of MIS, quality of decision making, and user satisfaction, etc.

Chi-square test for goodness of fit is used for testing the relationships between evaluation type and three related factors, respectively. In order to check the effect of evaluation type upon MIS performance, one way ANOVA is performed.

Results

At present most companies, over 80 percent, are using the system-oriented or funtion-oriented evaluation. Conversely, 91 percent of the MIS managers think the strategy-oriented evaluation is ideal(see Table 2). It is possible that difficulty in evaluation is the major reason for not using the strategy-oriented type. However, this result may imply that the strategy-oriented type will increase in the future.

	system-oriented	function-oriented	strategy-oriented	total
current type	35 (44.3%)	31 (39.2%)	13 (16.5%)	79
ideal type	1 (1.3%)	6 (7.6%)	72 (91.1%)	(100%)

Table 2. Current / ideal type of MIS evaluation

Table 3 presents the number of firms with regard to evaluation type and considered factors. For instance, 6 firms use the system-oriented evaluation type and is at a higher level of MIS maturity. From the results of

hypothetical tests, it is noted that MIS maturity and information intensity (including perceptual intensity) have a significant relationship to the MIS evaluation type. That is, most companies at a low level of either MIS maturity or information intensity use the system-oriented evaluation type, and the others tend to use the strategy-oriented type. This inclination appears to be stronger in MIS maturity than in information intensity. However, in the case of organizational size, any significant relationship of this kind is not found(see Table 3).

		system-oriented	function-oriented	strategy-oriented	χ^2 value
1) MIS maturity	high	9	18	10	* 12.567
	low	26	13	3	
2) information intensity	high	7	17	4	** 8.869
	low	28	14	9	
3) perceptual information intensity	high	14	19	11	** 8.294
	low	21	12	2	
4) organizational size	high	16	15	7	0.253
	low	19	16	6	

Table 3. number of firms using respective evaluation types with related factors

Associated with hypothesis 1, 2 and 3, MIS managers were asked which evaluation type is better when MIS maturity / information intensity / organizational size are at a high level, respectively. The result is that the companies of high MIS maturity or high information intensity should take the strategy-oriented evaluation type. However, organizational size does not show clear results as seen above(see Table 4).

	system-oriented	function-oriented	strategy-oriented	no relation
1) larger organizational size	8 (10.1%)	15 (19.0%)	37 (46.8%)	19 (24.1%)
2) higher MIS maturity	3 (3.8%)	12 (15.2%)	63 (79.7%)	1 (1.3%)
3) higher information intensity	2 (2.5%)	12 (15.2%)	63 (79.7%)	2 (2.5%)

Table 4. MIS managers' opinion toward evaluation type

Finally, the results of one way ANOVA of MIS performance on the evaluation type show that companies using strategy-oriented evaluation have higher MIS performances(Table 5).

	MIS performance *	F value
system-oriented evaluation	3.36	
function-oriented evaluation	3.47	3.80 **
strategy-oriented evaluation	3.77	

* average score on 5 point scale with 12 questions
** $p < 0.05$
Table 5. ANOVA of MIS performance by evaluation type

Results of this survey indicate that we should use different MIS evaluation type according to current characteristics of companies and that the strategy-oriented evaluation type should be emphasized for higher MIS performance.

Conclusions

Previous studies on MIS evaluation tend to be concentrated in specific areas. Though various methods for evaluation were proposed, they were one-sided, showing partiality for specific areas. Therefore, we failed to evaluate various aspects of MIS using single factor one at a time. To solve such a problem, this paper proposes an hierarchical approach. Now the necessity of strategic use of MIS is manifested. MIS evaluation also should turn attention to the strategic aspects of MIS for the technical quality of computerized application systems. Without targeting MIS for organizational strategy, evaluation of the application systems itself is not meaningful. Though previous studies mostly focus on the system itself, the hierarchical approach toward MIS evaluation of this paper includes evaluation of strategic aspects of MIS and MIS functions, as well as the system itself. For that reason, overall evaluation from a macro perspective can be accomplished by this approach. Above all, it has the merit of evaluating the strategic aspects of MIS, which is a more recent tendency. The results of the survey also show that organizations using strategy-oriented evaluation type have an higher MIS performance.
We understand that the proposed approach remains at the same level of previous studies in measuring methods. Hereafter, concrete evaluation procedures and measuring methods considering characteristics of companies should be studied.

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