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DECIDING WHICH IS TO BUILD AND ASSESSING SUCCESS: LEARNING TO DO IT BETTER

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ABSTRACT

 This paper investigates the effects of efforts by firms to improve the quality and frequency of evaluation for information systems project ideas and completed systems. We develop a framework, based on organizational learning theory, for the expected impacts, singly and together, of efforts to increase evaluation and to improve evaluation processes. We investigate whether developing the evaluation process leads to more frequent and more thorough evaluation and whether increased evaluation, improved evaluation, or both jointly affect evaluation quality.

 We found that improved evaluation led to more frequent evaluation. Neither improved evaluation processes nor increased frequency and thoroughness of evaluation clearly led to higher evaluation quality. Jointly they resulted in decidedly mixed results. We infer from the results that managers want better methods and tools to (1) develop better information for IS evaluation, (2) help them use information better in decision making, and (3) better align IS plans and projects with strategic business plans.

INTRODUCTION

That information systems today are important to firms is as well known in popular culture as it is in the IS research literature. Firms are increasingly dependent on such systems in order to be able to conduct day-to-day operations. Many firms have sought to use innovative IS to slash costs, establish marketing channels, or add information value to products and services. Others have sought to redesign production processes around products, using databases and electronic communications to coordinate diverse activities across functional and even organizational boundaries (Venkatraman 1994). Managers have sought to redefine the organization by using IS capabilities to lend assistance in management coordination and control activities, thereby allowing organizations to distribute supply chains globally, to outsource activities that aren't core competencies, and to squash organizational hierarchies by eliminating layers of management. Given all of these potential opportunities, managers should be eager to apply IS in the firm.

Unfortunately, managers as a group aren't confident about their ability to make the right choices among these many opportunities (Peffers and Saarinen 2002). The record on payoffs from IS investments is mixed to the extent that some researchers have suggested that there is no relationship, per se, between IS investments and adding value to the firm, e.g., (Brynjolfsson 1993; Brynjolfsson and Hitt 1998; Dos Santos, Peffers and Mauer 1993). Furthermore, the record of IS projects that have failed to produce the desired results, were unusable, were never finished, or ran away with the budget, is nothing less than shocking (Keil and Mann 2000).

Information systems now account for expenses equal to up to 8% of revenue in some industries and often have wide ranging impacts on the organization, so it is essential that managers have the tools to determine whether potential IS investments are worthwhile, in terms of strategy, feasibility, risk, and financial impact on the firm. Furthermore, managers need to be able to evaluate these systems at a strategic level to determine whether they are aligned with firm objectives, as well as to zoom in to evaluate the functionality of specific features and the effectiveness of whole systems (Dos Santos and Peffers 1993). Finally, it is important to evaluate systems at several points over the project life cycle, including at the time of the investment decision, during development, and at the completion of the project (Farbey, Land and Targett 1992; Hallikainen, Heikkilä, Peffers, Saarinen and Wijnhoven 1998), so as to ensure that expected benefits are realized.

Sadly, although many attempts have been made over the years to develop effective evaluation methods (Lincoln 1986; Ward 1990; Wen and Sylla 1999), real managers don't often use them. Apparently, most decisions about IS investments and development are made intuitively, without the benefit of using any of the formal methods (Hallikainen, Heikkilä, Peffers, Saarinen and Wijnhoven 1998). In most organizations where there is formal evaluation, it is limited to financial analysis, without any systematic process to learn more about how to evaluate systems (Lederer and Mendelow 1993; Peffers and

CONTRIBUTION

This paper applies organizational learning theory to investigate efforts to improve the information systems evaluation processes. To our knowledge there is no earlier research that has applied organizational learning concepts for this purpose.

The research provides a conceptual means to understand initiatives to improve IS evaluation processes. The findings of the paper are interesting, since they provide somewhat mixed results. It is clear that improved evaluation processes lead to more frequent evaluation. Higher quality evaluation, however, seems to be very difficult to achieve. This reinforces the need to develop better evaluation methods and to design more effective evaluation processes for companies.

The paper is expected to be interesting for researchers interested in the evolution and improvement of IS evaluation processes in organizations as well as for managers considering the improvement of IS planning and evaluation processes.

Saarinen 2002; Willcocks and Lester 1993). This is unfortunate, because the value of IS investments are difficult to understand using monetary terms alone, especially when the benefits won't be realized until after a long period of time (Peffers and Dos Santos 1996) or when they depend on subsequent IS investments that have yet to be approved (Dos Santos 1991).

Would a process to learn how to evaluate systems better result in better understanding of current and potential IS in the firm? Here we investigate whether companies have made efforts to develop better IS evaluation processes in the firm and we study the impact of these efforts on how satisfied managers are with IS evaluation.

RESULTS PREVIEW

The main results and implications of the study can be summarized as follows: (1) Efforts to improve the evaluation process do lead to more frequent and thorough IS evaluation. (2) Neither improved evaluation nor increased evaluation, by itself, appears to have much effect on evaluation quality. (3) When considered together, improved evaluation processes and increased frequency and thoroughness of evaluation produce decidedly mixed results. The majority of firms in our sample, who both improved and increased evaluation, were evenly split on satisfaction. These results have important implications for the need for better evaluation theory and tools. The results reported here should be considered subject to replication because study participants included a small number of firms in a specific location.

EVALUATING IS PROJECT IDEAS AND COMPLETED SYSTEMS

IS evaluation can be defined, according to Farbey, Land and Targett (1999), as "a process … for searching and for making explicit, quantitatively or qualitatively, all the impacts of an IT project and the programme and strategy of which it is a part." A great number of evaluation methods for IT investments have been suggested in the literature (Ward 1990; Wen and Sylla 1999). Marchewka and Keil (1995) identified four basic approaches for selecting IT projects:

cost/benefit analysis, scoring or ranking models, management science models, and the portfolio management approach. Peffers and Saarinen (2002) identified 25 evaluation concepts in five categories: profitability, use and operations, strategic value, development & procurement, and risk. Evaluation can serve a variety of objectives, according to Farbey, Land and Targett (1992), including system justification, allocation of scarce resources among competing ideas, management control for projects, and comparing expected vs. actual achievements. In addition to estimating the value of the IS project, evaluation allows problem diagnosis, planning and reduction of uncertainty (Smithson and Hirscheim 1998).

The evaluation process: learning to do it better

Intuitively, these all seem to be very important objectives for the firm. Consequently, if managers have found evaluation difficult or impractical in the past, it would seem very worthwhile to devote firm resources to the task of learning how to do it well. In addition, it would seem worthwhile for firms to continuously improve evaluation methods to enable them to adapt to the rapidly changing business environment in which they find themselves today.

Learning in organizations, according to Argyris and Schön (1978), occurs in two basic types: single loop learning and double loop learning. Single loop learning involves learning to perform a task or implement a technology better. Double loop learning involves modifying the task or technology to make it more effective. We can apply this concept to learning to better evaluate information systems. Single-loop learning occurs when an organization learns to better implement its existing evaluation processes. Double-loop learning would include modifying the evaluation processes. This would involve setting new "norms[,]…strategies and assumptions" (Argyris and Schön 1978) for evaluation. In practice, this could mean developing the evaluation process by, for example, searching for new evaluation methods or redefining the responsibilities for conducting evaluation.

Our objective in this paper is to investigate the impact of learning on the

quality of IS evaluation in the firm. In the next section, we develop the research framework and research questions to be addressed in the study.

Research Framework and Questions

Does learning lead to better IS evaluation? In this study, we investigate whether an improved evaluation process (double loop learning) and an improved implementation of evaluation processes (single loop learning) affect the quality and effectiveness of IS evaluation, as perceived by managers. Figure 1 shows our specific research framework graphically.

Efforts to improve evaluation processes are expected to affect the quality of IS evaluation in two ways. First, it should affect it directly because better methods and procedures should result in better evaluation. We expect managers to recognize improved evaluation. Secondly, it should affect it jointly, with improved implementation of the evaluation process, because improved evaluation methods can only affect outcomes to the extent that they are actually used. Thirdly, they should affect single-loop learning. As managers recognize that the evaluation process has improved, it should be more efficiently implemented.

To test these relationships we ask four specific research questions:

RQ 1. Does improving an evaluation process (double loop learning) lead to improved implementation (single loop learning)? Although we would expect that the improved process would result in improved implementation of evaluation processes, this may be a lengthy and difficult process in an organization.

RQ 2. Does an improved evaluation process lead to better evaluation quality? We expect it should.

RQ 3. Does improved evaluation implementation lead to improved evaluation quality? We expect it should, provided the organization has been able to develop the evaluation process to the right direction.

RQ 4. Do improvement in evaluation processes and in implementation of evaluation processes jointly affect perceived evaluation quality? We expect them to. We would expect that those organizations that are successful in both developing the evaluation process and in successfully implementing it would be most satisfied with IS evaluation.

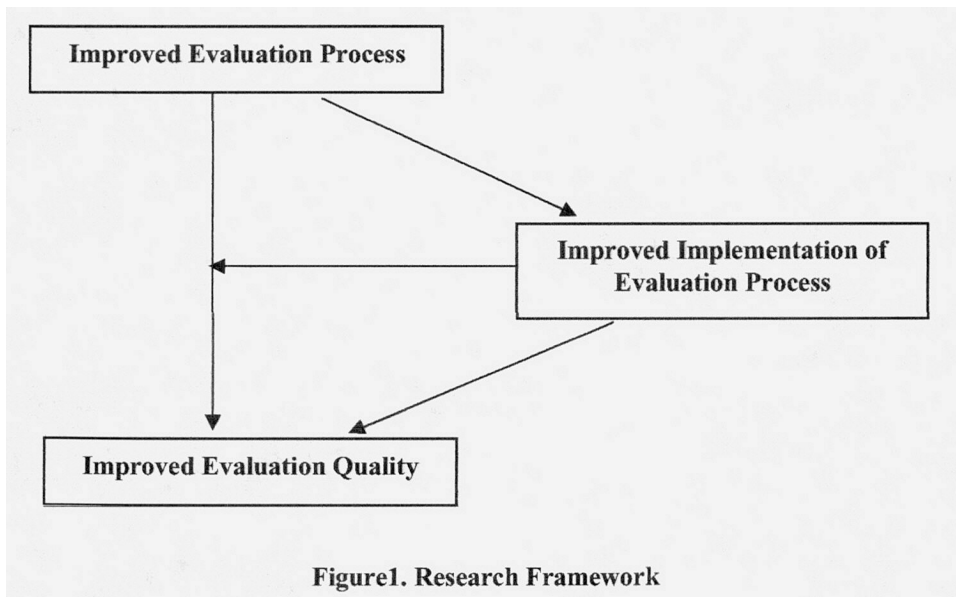In the next section we develop and implement a field study to investigate these questions.

Figure1. Research Framework

DATA AND METHODOLOGY

In this section we describe a field study in which we investigate the research questions by means of a survey of the experiences of a sample of Finnish managers. We begin by describing the study and its respondents. Then we define the variables and describe their measurement.

Data gathering & respondent profile

We studied large Finnish companies to learn how they evaluated IS investments in practice. The data we used came from a questionnaire mailed to the IS manager, or other person responsible for IS at the corporate level, of the 300 largest firms in Finland. We received 98 responses to the survey, after reminders and phone calls, a 32% response rate. Of the respondents, 39 completed the full questionnaire and 59 companies declined to complete it, for a variety of reasons. IS managers in 37 companies said that they had no formal evaluation methods or guidelines, managers in 20 companies said that they were too busy, and managers in 10 companies offered various reasons, such as recently changed responsibilities or organizational changes. In two companies the IS manager felt that the information we asked was too confidential to be given out of the company. One of the questionnaires was discarded because it contained a number of missing values. This left us with 38 usable returned questionnaires.

Table 1 summarizes basic statistics, including annual revenue and number of employees, for the average of the 300 largest Finnish firms, the 98 firms that responded, and the 38 firms that provided usable data for this study. From this information, it appears that the firms providing usable data for the study were slightly larger than the average of this group. About one third of the 38 companies are from manufacturing, 29 % from retail and whole sales and 27 % from service sector, similar to proportions for the population of the 300 largest Finnish companies.

Operationalization of research variables

We separated the sample firms into two groups by asking in an open-ended question about whether there had been substantial efforts to improve the IS evaluation process in the organization during the past three years. The subjects of improvement were specified in the question as the instructions, procedures, criteria and responsibilities for evaluating IS investments in the firm, to make sure that the respondents understand what was meant by the question. The answers were then carefully transcribed and the status with respect to the improvement of the company-wide guidelines for the IS evaluation process was defined. Based on this the companies were placed in two categories: 1) companies that had made a considerable effort to improve IS evaluation process in last three years and 2) companies that had not made substantial effort to improve the IS evaluation process.

Improved implementation of the evaluation process was observed as an increase or decrease in evaluation thoroughness and frequency. Data was collected and recorded as a Likert scale ranging from 1 (substantially decreased) to 5 (substantially increased).

The measures for perceived evaluation quality were constructed for this study. We divided evaluation quality into three categories: evaluation efficiency, evaluation precision, and evaluation effectiveness. Evaluation

Table 1. Characteristics of the respondent population and sample

	Average revenue (million USD)	Average number of employees	N
300 largest firms in Finland	US $375	2158	300
Firms that responded	US $520	2274	98
Firms that completed the questionnaire	US $739	2441	38†

† Managers from 39 firms returned the questionnaire, but one was dropped from the sample because it contained too many missing values.

efficiency includes the efficiency of the evaluation process and evaluation cost. Evaluation precision was further divided to evaluation criteria and their weights, evaluation methods, and information resulting from evaluation. Finally, evaluation effectiveness includes evaluation's impact on making decisions on IS investments, impact on aligning IT with business needs, and impact on early recognition of project problems. All these dimensions were measured using a Likert scale from 1=fully unsatisfied to 5=very satisfied.

Before conducting the mail survey the above measures were tested in case studies (Hallikainen 1996; Viita 1996).

RESULTS AND DISCUSSION

In this section we present the results of the empirical study and discuss the findings.

Effect of improving the evaluation process on the implementation of the evaluation process

To investigate research question 1, we asked whether there have been substantial efforts in the organization over the past three years to improve IS evaluation processes. Additionally, we asked whether the frequency and thoroughness of evaluation has increased, indicating improved implementation of evaluation processes. We compared the responses for increased frequency and thoroughness for firms that had and had not improved their evaluation processes. The results are shown in Table 2.

Firms that had improved evaluation processes indicated higher Likert scores for increasing evaluation thoroughness and

frequency than firms that had not improved evaluation processes. The differences are statistically significant.

Recalling the earlier research results in the IS evaluation field, these results seem promising. Efforts to develop the evaluation process appear to have actually resulted in more evaluation. They have also resulted in more thorough evaluation, but from this information we are not able to say whether they have resulted in better evaluation.

Effect of improving the evaluation process on evaluation quality

To investigate research question 2, we asked the managers how satisfied they were with IS evaluation in their organization at the present moment. Again, we calculated the mean response for two groups, those in organizations where the evaluation process had been improved and those where it had not. The effect of improving the evaluation process on the evaluation quality is shown in Table 3.

The results show no clear differences between the two groups with respect to the evaluation quality perceived by managers. The results suggest that improving the evaluation process doesn't result in higher satisfaction unless the improved methods and procedures are actually taken into use in an organization.

Effect of improved implementation of the evaluation process on evaluation quality

To investigate research question 3, we looked how the increased evaluation thoroughness and frequency affect the evaluation quality. We compared mean evaluation quality measures for firms that increased the frequency and thoroughness

Table 2. Effect of improving the evaluation process on the implementation of the evaluation process (scale 1=substantially decreased to 5=substantially increased)

	Evaluation process improved	Evaluation process not improved	Significance level (Mann-Whitney tests)
Increased evaluation thoroughness	4.00	3.07	.00
Increased evaluation frequency	4.08	3.14	.00

Table 3. The effect of improving the evaluation process on the evaluation quality

Evaluation Quality	Evaluation process not improved	Evaluation process improved	P-value
Conduct of evaluation process	2.62	2.54	0.80
Costs of evaluation	3.42	3.79	0.20
Evaluation criteria and their weighting	2.54	2.92	0.12
Evaluation methods	2.54	2.58	0.81
Information resulting from evaluation	2.62	2.63	0.85
Evaluation helping in decision making about IS investments	3.23	2.86	0.35
Evaluation helping in aligning information technology function and the needs of business functions	2.77	2.91	0.76
Evaluation as a means to recognize problem projects in time	2.46	2.71	0.55

Table 4. Effect of improved implementation of the evaluation process on evaluation quality

| Evaluation Quality | Evaluation thoroughness and frequency | | P-value |
	Remained same or decreased	Increased	
Conduct of evaluation process	2.45	2.62	0.60
Costs of evaluation	3.20	3.85	0.03
Evaluation criteria and their weighting	2.36	2.96	0.02
Evaluation methods	2.27	2.69	0.12
Information resulting from evaluation	2.45	2.69	0.29
Evaluation helping in decision making about IS investments	2.82	3.08	0.46
Evaluation helping in aligning information technology function and the needs of business functions	2.55	3.00	0.22
Evaluation as a means to recognize problem projects in time	2.18	2.81	0.09

of evaluation with those that did not. We defined evaluation frequency and thoroughness as "increased" when the value of the Likert scale measure for either evaluation frequency or the evaluation thoroughness was greater than 3, otherwise the company was placed in the "remained same or decreased" category. The results are shown in Table 4.

In general, managers seem to be slightly more satisfied with evaluation in companies where evaluation thoroughness and frequency increased. Statistically significant differences are, however, only found with

respect to the satisfaction with evaluation criteria and their weights, and evaluation cost. This suggests that, although evaluation may be seen as having some value, increasing its thoroughness and frequency isn't necessarily sufficient to providing adequate information for decision making.
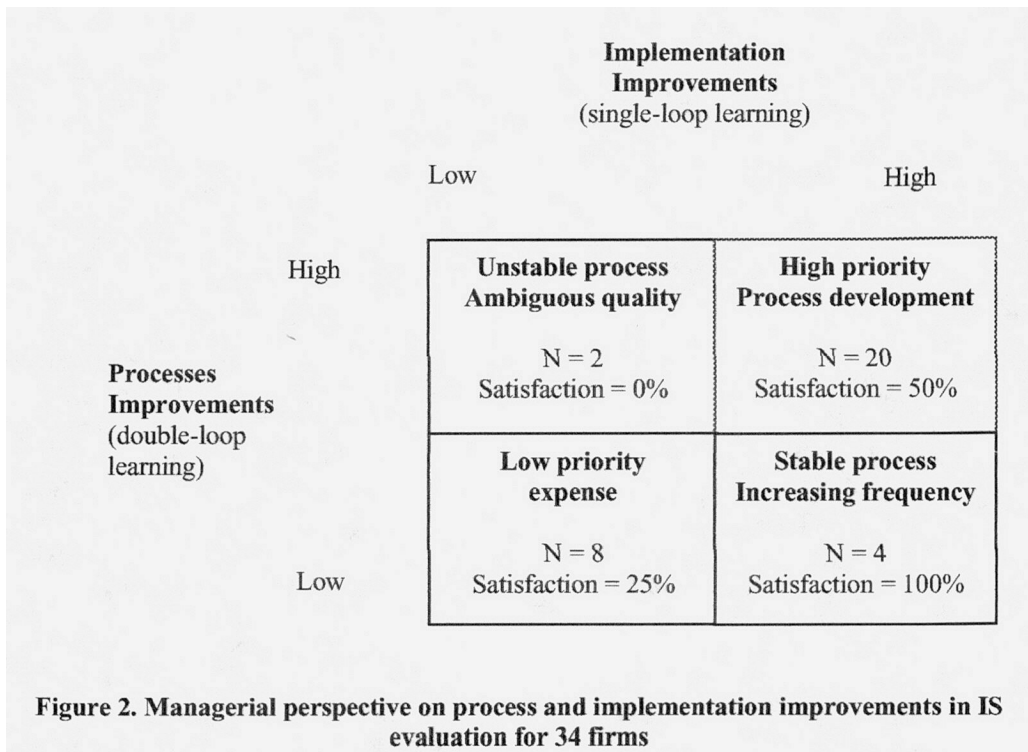
Combined effect of improving the evaluation process and improved implementation of the process on evaluation quality

To investigate research question 4, we classified firms into four cells based on whether they had made an effort to improve the evaluation process (double loop learning) and whether this resulted in better implementation of the evaluation process (single loop learning). Figure 2 shows the firms classified into the four resulting cells. We then calculated the proportion of firms satisfied with evaluation in each of the cells. Satisfaction was determined computing the mean of all the dimensions of the satisfaction with evaluation variable. When the mean is more than 3 a company is classified as being

satisfied with the evaluation practice. Four firms were dropped because of missing data values.

More than half (20 of 34 = 59%) of the firms fell into the upper right cell indicating that they had improved both evaluation processes and its implementation, i.e., that they had engaged in both double and single loop learning. The second highest percentage (24%) were observed with neither type of learning. Much smaller numbers were observed with one type of learning but not the other.

Firms differed dramatically by cell in terms of the proportion satisfied with evaluation. All of the firms that had increased frequency and thoroughness of evaluation, but had not improved processes, were satisfied with evaluation, compared to none of those that had only improved the process. Firms that had both increased evaluation and improved it were evenly split between satisfied and unsatisfied firms. Just two of eight firms observed with no learning were satisfied.

Figure 2. Managerial perspective on process and implementation improvements in IS evaluation for 34 firms

Looking at the firms' learning activities and the perceived evaluation quality, we can draw some very tentative inferences about the likely management perspectives on IS evaluation in each category. The categories are discussed below.

High priority—process development

We characterized evaluation for firms in the upper right cell as "high priority—process development" because firms in this cell had allocated resources to both improve evaluation processes and to improve implementation. In this group we infer that evaluation is a high priority activity and one in which it is understood that learning to improve the process is worthwhile.

Only 50% of the companies in this group are satisfied with the evaluation process. To try to determine the focus of their dissatisfaction, we compared the differences in overall satisfaction with differences in satisfaction for individual evaluation criteria. In doing so we were able to ascertain that four of the individual evaluation criteria account for most of the differences among the firms in overall satisfaction with evaluation:

1) Evaluation helping in decision making about IS investments

2) Evaluation methods

3) Evaluation helping in aligning information technology function and the needs of business functions

4) Information resulting from evaluation

Other individual evaluation criteria, including conduct of evaluation process, costs of evaluation, evaluation criteria and their weighting, and evaluation as a means to recognize problem projects in time, did not account for much of the difference in satisfaction among these firms.

Clearly the important evaluation criteria, in this respect, are those that directly involve the information that evaluation provides for decision making. Firms that are dissatisfied with evaluation are highly dissatisfied with the value of such information for making decisions.

We could speculate further about this dissatisfaction. First, it may be that the improved evaluation procedures and methods have only recently been placed into use and the learning process is still going on. Second, an obvious possible reason is that the improved evaluation methods and procedures are still insufficient or poorly designed. Third, the evaluation needs of the firm may have changed more rapidly than the processes designed to provide the evaluation.

Low priority expense

We characterized evaluation for firms in lower left cell as "low priority expense" because these firms, even though they use formal evaluation processes, are willing neither to allocate resources to improve evaluation processes nor to implement them better. In this group where little of either type of learning occurs, IS evaluation is probably seen as a low priority activity, perhaps an expense to be minimized. That just 25% of companies in this cell are satisfied with the evaluation suggests that these firms are not, as a group, sure that they are doing the right thing.

Stable process—increasing frequency

For firms in the lower right cell, we characterized the evaluation process as "stable process—increasing frequency" because the most stable evaluation process can be found in this group where double loop learning is low and single loop learning is high. In this group the learning activities are targeted towards increasing evaluation quantity without any major changes in evaluation process. The inference that could be drawn about these firms is that they are happy with their IS evaluation processes and just want to do more of it. It seems likely that this group will only make efforts to change the evaluation process when organizational and environmental changes render currently satisfactory processes obsolete.

Unstable process—ambiguous quality

We characterized evaluation among firms in the upper left cell as "unstable process—ambiguous quality" because these firms, while devoting resources to improving evaluation processes, haven't been willing to allocate resources to implement the improved

processes. This group, with concurrent high double loop learning and low single loop learning, would seem to represent a logically unstable state. Firms in this group are improving the evaluation processes, but not increasing their use. Satisfaction is very low. Firms in this cell appear to be hesitating about increasing implementation of evaluation processes that they have acknowledged as being inadequate; they don't yet think that they have improved evaluation sufficiently to make it worthwhile to do more of it. Firms aren't likely to remain in this cell for long. Either they will begin to implement improved processes, moving to the cell in the upper right, or they'll eventually give up on improving the evaluation process, withdrawing resources from it, and move to the cell at the lower left.

CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

Conclusions

In this paper we constructed a research framework to investigate efforts to improve IS evaluation processes and increase evaluation and their impact on evaluation quality. We used the concept of organizational learning (Argyris and Schön 1978) as the basis for this framework. Then we used the framework as the basis of an empirical study in which we studied the evaluation efforts in 38 Finnish companies.

In the organizations that we studied, efforts to improve evaluation processes led to more frequent and thorough evaluation. Of course, we had strong expectations that this would be the case. Firms that have allocated resources to improve evaluation seem likely to have done so in order to use the improved processes. This suggests to us that such efforts to improve evaluation are likely to lead to more evaluation in other firms, if for no other reason than that such efforts to improve evaluation are likely to come from a realization or belief that evaluation is important.

The results with respect to evaluation quality are not, however, so sanguine. Improved evaluation processes had no discernable systematic effect, in themselves, on evaluation quality. Likewise, increased evaluation frequency and thoroughness did not appear to lead to improved evaluation quality, except in terms of two measures, satisfaction with the cost of evaluation and with the evaluation criteria. Arguably, these two measures don't address the heart of evaluation quality, the desire to make better decisions.

When we consider increased and improved evaluation jointly, we saw a pattern of satisfaction that suggests that managers' satisfaction with evaluation has much to do with the role of evaluation in the firm. In firms where IS evaluation is likely to be considered important, i.e., the majority of firms in the study that were working both to improve and increase IS evaluation, attitudes toward current evaluation processes were decidedly mixed. The inference that we draw is that, while these firms had made efforts to improve evaluation processes, managers still experienced difficulty in getting relevant information for making decisions on IS investments. Existing evaluation methods just aren't good enough to satisfy managers.

Limitations

There are three limitations of the study that should be noted. First, the 38 firms in our study are not a representative sample of firms in the economy. They were selected from among the 300 largest firms in Finland. Consequently, they don't include any small firms. In addition, they don't include firms that said that they do not use formal evaluation methods. Second, the statistical power of our analysis was affected by the relatively small sample, which, while technically large enough for statistical analysis, did limit the ability of our analysis to recognize small effects. Readers should note, however, that our use of non-parametric analysis insured that, in spite of the small sample size, our conclusions about statistical significance are valid. Because the firm sample was relatively small and localized, these results should be understood to be subject to replication elsewhere. Third, the respondents to our study were IS managers and thus we were not able to explore the effects of the interest group viewpoints on the results. To achieve broader generalizability, the study should be extended to include the different stakeholder views in the future. These limitations suggest that much more work needs to be done in this area, however, in spite of the limitations, we believe our results

are interesting and valuable to both researchers and practitioners.

Future Research

For future research, one of the most interesting results is the clear implication, also seen by Peffers and Saarinen (2002), that managers are not satisfied with the evaluation methods available to them. IS researchers should devote more of their intellectual resources to developing applicable theory and tools for managers that can (1) develop better information for IS evaluation, (2) help managers use information better in decision making, and (3) provide better support for the alignment of IS plans and projects with strategic business plans.

On a more prosaic level, other issues for future research would be to investigate the development of evaluation processes for IS in small and medium sized firms, as well as for firms like those who told us that they used no formal methods for IS evaluation. Small and medium sized firms don't have planning departments and they're unlikely to have staff in the IS department who specialize in planning. When they say that they use no formal methods for IS evaluation, it seems very plausible that they are speaking the truth. Based on the analysis in the current study, we cannot say too much about these companies. What do they do? How do they decide which systems to build? Can we not develop evaluation and planning methods for them?

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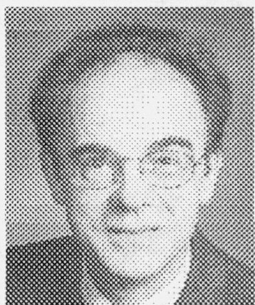
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