

Assessing EIS Benefits: A Survey of Current Practices

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Abstract:

In order to explore what benefits are being realized from executive information systems (EISs), the kinds of benefit/cost analyses being performed, and the factors that affect whether and how a benefit/cost analysis is conducted, mail survey data were collected from 72 organizations, followed up by 16 telephone interviews. Prior to and after the development of the EISs, the most highly rated benefits were faster access to information, more timely information, and improved presentation of data. The lowest rated were better environmental scanning and support for downsizing the organization. In virtually all cases, the level of benefits realized was less than what was expected, with the largest gap involving those benefits associated with improving executive performance. When conducting a benefit/cost analysis prior to implementing an EIS, most organizations determine the expected costs and an intuitive feeling for the benefits. After implementation, fewer organizations quantify the benefits and costs. A number of factors affect EIS benefit/cost analyses, including the position of the executive sponsor, the cost of the system, the obvious benefits, turnover of the executive sponsor, and difficult economic times.

Keywords: executive information systems | benefit | cost

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ABSTRACT

In order to explore what benefits are being realized from executive information systems (EISs), the kinds of benefit/cost analyses being performed, and the factors that affect whether and how a benefit/cost analysis is conducted, mail survey data were collected from 72 organizations, followed up by 16 telephone interviews. Prior to and after the development of the EISs, the most highly rated benefits were faster access to information, more timely information, and improved presentation of data. The lowest rated were better environmental scanning and support for downsizing the organization. In virtually all cases, the level of benefits realized was less than what was expected, with the largest gap involving those benefits associated with improving executive performance. When conducting a benefit/cost analysis prior to implementing an EIS, most organizations determine the expected costs and an intuitive feeling for the benefits. After implementation, fewer organizations quantify the benefits and costs. A number of factors affect EIS benefit/cost analyses, including the position of the executive sponsor, the cost of the system, the obvious benefits, turnover of the executive sponsor, and difficult economic times.

Many organizations receive benefits from executive information systems (EISs). Some of the most frequently mentioned ones include more timely, accurate, relevant, and concise information; improved executive efficiency and effectiveness; and support for the accomplishment of strategic business objectives (Wallis, 1989; Volonino & Watson, 1990; Houdeshel & Watson, 1987). The potential benefits to firms are especially great from EISs because of the organizational level of the systems' users.

EISs are expensive to develop and maintain. A recent study found that the average cost of developing the initial version of an EIS is \$449,000 and the average annual cost of maintaining it is \$223,000 when hardware, software, personnel, and training costs are considered (Watson, Rainer, & Frolick, 1992). There is a high variance to these costs, however, depending on whether PCs and networks have to be purchased and installed, the software used, and the number of people required to develop and support the EIS.

The benefits from an EIS are much more difficult to assess. It is often hard to put a dollar value on benefits such

as "more timely" information or "improved information to support decision making." It is a problem that has continued to plague applications designed to support decision making (Keen, 1981; Hogue & Watson, 1983). The conventional wisdom is that organizations seldom perform a comprehensive benefit/cost analysis when developing an EIS, largely because of the difficulty of quantifying the anticipated returns (Paller with Laska, 1990). After the EIS is operational, it is easier to assess the benefits, and EIS managers are advised to document any hard dollar returns (Paller with Laska, 1990).

While a few empirical studies have explored the benefits realized from EISs, the kinds of benefit/cost analyses performed, and the factors that affect whether and how a benefit/cost analysis is conducted, none of these issues has been studied in depth. Insights about these issues have value to practitioners and academicians, which motivated our study. For executives considering the development of an EIS and for EIS managers given the responsibility for developing and maintaining an EIS the findings allow them to more realistically shape their expectations and practices. For academicians,

the findings add to the body of knowledge about the benefits and assessment of decision support applications.

The study contained three phases. First, the relevant literature was reviewed. Next, a questionnaire solicited data from 72 organizations with EISs. Finally, telephone interviews with 16 survey respondents added more depth.

LITERATURE REVIEW

It is customary for organizations to conduct an analysis of benefits and costs before approving large capital expenditures. Information systems are no exception. Indeed, the phenomenal spread of computer-based information systems in business, particularly transaction processing systems, can be attributed to detailed benefit/cost studies that clearly demonstrate their cost effectiveness in comparison to manual processes. Performing a benefit/cost analysis for a transaction processing systems is fairly straight-forward because a basis for comparison already exists—the process that is being replaced or automated—and the benefits derived (usually productivity gains) are tangible and computable in financial terms.

The emergence of decision support systems (DSSs) in the 1970s (Keen & Scott Morton, 1978; Sprague & Carlson, 1982) and executive information systems in the 1980s (Rockart & DeLong, 1988; Watson, Rainer, & Houdeshel, 1992) complicated matters considerably. DSSs were intended to support specific decision-making tasks (Keen & Scott Morton, 1978). A DSS was supposed to extend the cognitive capabilities of the user by providing a variety of tools with which to analyze data. Since cognitive processes are unobservable, it is difficult to judge the degree and manner in which decisions are influenced and, thus, the ultimate impact on the organization's profits.

EISs emerged in the late 1970s to meet the information needs of senior executives. While DSSs are decision focused, EISs are broader in scope. Although EISs often include analytical tools, they emphasize providing timely information about internal operations and the external environment. EISs are data-intensive, while DSSs are model-oriented (Rockart & DeLong, 1988). The executive is also typically provided with capabilities for rapidly communicating electronically (e.g., e-mail) with others in the organization.

Previous studies have identified a large number of potential EIS benefits (Rockart & DeLong, 1988; Paller with Laska, 1990). Many are related to the enhanced access, preparation, delivery, and presentation of executive information. EISs are also said to make executives more productive. They save executive time, improve executive performance, provide better problem understanding, and improve decision making. They also support the accomplishment of strategic business objectives, such as a total quality management (TQM) program, make the organization more responsive to

changing market conditions, and support downsizing efforts.

The benefits of an EIS are difficult to assess in financial terms. To illustrate, Paller with Laska (1990) describe a situation where an executive who made a decision based on information provided by his EIS helped the company earn an unanticipated \$50 million in a single day. Such windfalls cannot be systematically factored into an EIS benefits analysis; yet, these can occur when an executive has access to an EIS. In comparison, every hour that a computer-based transaction processing system is run can be directly compared to an hour of the labor-intensive process it replaces, and their relative merits can be determined.

Where doubts exist as to the merits of developing a decision support application, Keen (1981) suggests a value analysis. Given the sometimes high cost of developing and maintaining such systems, Keen recommends an evolutionary approach in which the expenditure incurred between two evolutionary stages is kept to a minimum; benefits are monitored and incremental costs are justified at every stage. The justification is performed intuitively, by relating costs to value received; but the incremental expenditures are kept low to reduce the risk of financial loss. In following such a process, there is no "full-blown" system. The system may evolve or stabilize at any stage, based on a series of value analyses performed at each stage. Money, Tromp, and Wegner (1988) describe a benefits evaluation methodology based on Keen's value analysis.

Developing a DSS or an EIS is aided by the fact that the principal, direct beneficiaries of the proposed system typically are executives who have the necessary budgetary authority to approve its creation. If they intuitively feel that the system is valuable, then the development and continued enhancement of the system is assured. Rockart and DeLong (1988) reported that none of the companies they studied performed an EIS benefit/cost analysis either before or after their systems were implemented. One executive remarked, "If we are going to improve our executives' effectiveness and save them time, this is cheaper than a corporate jet."

The research of Watson, Pitt, Cunningham, and Nel (1993) suggests an interesting approach to assessing the success of an EIS. Drawing on consumer satisfaction studies in marketing (Parasuraman, Zeithaml, & Berry, 1988), they assess user satisfaction by considering the gap between what users expected before the information service was provided and the perceptions about what was actually delivered. When applied to an EIS, it suggests calculating the difference between the level of benefits that were expected from the EIS prior to implementation and the benefit levels that were realized.

The EIS value assessment process used at Conoco considered both tangible and intangible benefits (Belcher & Watson, 1993). The tangible benefits included savings in the creation, distribution, and accessing of information; reduc-

tions in the acquisition of PC software; and from information services that may have been otherwise purchased. Although the savings were substantial, there was anecdotal evidence of significant intangible benefits, such as better coordinating the efforts of Conoco's executives worldwide. Although Conoco adopted a formal approach to benefits assessment, Belcher and Watson suggested that there is no single formula for conducting a benefits assessment.

Benefits assessment of EIS may be better understood against the backdrop of studies analyzing the benefits of information technology in general. In a survey conducted by Bacon (1992) of 80 major corporations in four countries, "support of explicit business objectives" was the highest ranked out of fifteen financial and other criteria used for justifying investments in information technology (IT). In comparison, a hard financial estimate of discounted cash flow was used in evaluating only 40 percent of all IT projects. Corporations were willing to make investments in IT if they were consonant with the direction of the business rather than an assessment of return on investment. This finding is consistent with Akram Yosri's advice (Caldwell, 1992) that CEOs should measure the "business value of the technology in the functional unit" and that assessing the contribution of IT to the entire corporation tends to obscure its contributions.

Huff (1990) speculates that it may not be possible to gain a complete understanding of the entire range of costs and benefits of IT because of the subtle ways in which organizational processes and outcomes are affected. If Huff is correct, then performing a benefit/cost analysis should never be the sole, or even the principal means of justifying IT investments. Economist Loveman (1991) agrees that we cannot meaningfully measure the value created by information technology for it produces benefits that may be intangible. Frequently, the value of a system may be determined by who uses it and how they use it.

THE STUDY

The purpose of the study was to provide answers to the following questions:

- What benefits are expected from EISs?
- What benefits are being realized from EISs?
- Are the benefits realized from EISs meeting expectations?
- What kinds of benefit/cost analyses are being performed?
- What factors affect whether and how a benefit/cost analysis is conducted?

The study utilized both a mail survey and telephone interviews. The survey instrument was designed to collect data on the participating firms, the respondents, their EISs, and benefit/cost related issues. It was pretested by three EIS managers to help ensure content and external validity. After minor modifi-

cations, the instrument was mailed to 215 firms from the University of Georgia's EIS database, which contains over 300 organizations believed to have an EIS. The database was created from a variety of sources, including magazines (e.g., *Computerworld*, *Information Week*), conference registration lists (e.g., The EIS Institute, DSS-XX), journals (e.g., *Harvard Business Review*), and personal contacts. The database is thought to be representative of firms with EISs and has been used in other studies (e.g., Watson, Rainer & Koh, 1991; Watson, Rainer & Frolick, 1992). A follow-up mailing was sent to non respondents. A total of 72 responses were received from the two mailings, resulting in a response rate of 33.5 percent.

The participants in the telephone interviews were selected from survey respondents who were willing to discuss in-depth how the benefit/cost assessment was conducted at their company. Respondents indicated their willingness to participate in a phone interview by checking a box on the survey instrument. An open-ended structure for the phone interview allowed the interviewer to probe for anecdotal information on how the benefit/cost analysis was performed. Sixteen people were interviewed and each interview typically lasted 15 to 20 minutes.

FINDINGS AND DISCUSSION

Demographics

The organizations come from a variety of industries with financial, insurance, and real estate (28.8 percent) and manufacturing (25.8 percent) the most heavily represented (see Table 1). Almost 14 percent of them are governmental. The organizations are generally large, with 45.5 percent of them reporting annual gross revenues over \$5 billion, while only 9.3 percent have revenues under \$250 million (see Table 2).

The respondents are seasoned managers and professionals, and average three years of EIS, 13 years of IS, and 18 years of total work experience. Their job categories include EIS manager (32.4 percent), IS manager (23.9 percent), and IS staff (14.1 percent) (see Table 3).

The executive sponsors for the EISs included vice presidents (35 percent), CEOs or presidents (21.7 percent), other executives (36.7 percent), and IS managers (1.7 percent). On average (i.e., median), the EISs have 38 active users, 100 screens, and are three years old. Pilot's Command Center (21.6 percent) and Comshare's Commander EIS (18.3 percent) are the most commonly used EIS software products.

What benefits are expected from EISs?

EISs offer many potential benefits. Drawing on the relevant literature, a long list of benefits was developed and respondents were asked to judge on a five-point anchored scale the expectation for each benefit in deciding whether to develop their EIS.

TABLE 1

Responding companies by industry

Industry	Percentage of firms
Finance, Insurance, and Real Estate	28.8
Manufacturing	25.8
Government Agencies	13.7
Transportation, Communication, and Utilities	12.1
Services (e.g., hotels, personal services, health services)	4.5
Mining	1.5
Agriculture, Forestry, and Fishing	1.5
Other	12.1
Total	100.0

TABLE 2

Responding companies' assets and gross revenues

	Assets	Gross Revenues
Under \$1 Million	0.0%	0.0%
\$1 Million-\$10 Million	0.0	0.0
\$10 Million-\$50 Million	5.2	2.4
\$50 Million-\$100 Million	1.8	2.4
\$100 Million-\$250 Million	5.2	4.5
\$250 Million-\$1 Billion	10.3	20.5
\$1 Billion-\$5 Billion	10.3	25.0
Over \$5 Billion	39.7	45.4
Total	100.0	100.0

As Table 4 shows, the most highly anticipated benefits were faster access to information (a mean of 4.79), more timely information (4.58), and improved presentation of data (4.22). Other studies have found the need for more timely information to be the primary motivation for developing an EIS (Watson, Rainer, & Koh, 1991). Faster access to information and improved presentation of data reflect the improved access and presentation of data that are possible with EISs.

In a number of areas, the expected benefits were not great. Even though EISs are often touted for their ability to provide information about the external environment, improved access to external data (2.42), better environmental scanning (1.83), more competitive information (2.27), and being more responsive to changing customer needs (2.55),

TABLE 3

Positions of respondents

Position	Percentage of respondents
EIS manager	32.4
IS manager	23.9
IS staff	14.1
EIS staff	11.3
Executive	5.6
Functional area staff	4.2
Other	8.5
Total	100.0

these factors were relatively unimportant. Providing better access to soft information (2.48) also was ranked low despite evidence that it adds to the value of an EIS (Watson, et al. 1992). There are several well-documented accounts of how EISs have facilitated increases in management's span of control and the downsizing of organizations (Paller with Laska, 1990), but these benefits were not a high expectation of most of the firms in the survey (as evidenced by means of 2.56 and 1.95, respectively). Finally, the better development of alternatives (2.89), cost savings (2.44), and support for a TQM program (2.23) received relatively low scores.

What benefits are being realized from EISs?

The mean benefits actually received from the EISs are also shown in Table 4. The highest marks go to faster access to information (4.29), improved presentation of data (4.05), and more timely information — the same benefits for which expectations were the greatest. The lowest benefits received include better environmental scanning (1.56), support for downsizing the organization (1.79), and support for a TQM program (1.98).

Are the benefits realized from EISs meeting expectations?

While there is a correlation between the expected and realized benefits (mean $r = .76$), the most dramatic finding is that with the exception of cost savings, the expected benefits were less than those received. This gap between expectations and reality highlights why so many EISs fail; they often do not live up to their promise (Watson & Glover, 1989). It should also be kept in mind that the data were collected from organizations in which the EISs are operational. One might speculate that this expectations/reality gap was even greater in those organizations with failed systems.

It is interesting to note that many of the benefits where

TABLE 4
Expected and realized benefits from the EISs

Benefit	Expected Benefits	Realized Benefits	(Realized – Expected
	Mean	Mean	Benefits)
Faster access to information	4.79	4.29	-0.50*
More timely information	4.58	3.98	-0.60*
Improved presentation of data	4.22	4.05	-0.17
Improved decision making	3.97	3.03	-0.94*
More concise information	3.94	3.67	-0.27*
More relevant information	3.85	3.40	-0.45*
More accurate information	3.81	3.53	-0.28
Better problem understanding	3.75	2.92	-0.83*
Save executive time	3.74	2.98	-0.76*
Improved communications	3.67	3.10	-0.57*
Less paper	3.42	3.17	-0.25
Improved planning	3.39	2.60	-0.79*
Improved executive performance	3.31	2.61	-0.70*
Better development of alternatives	2.89	2.41	-0.48*
Increased span of control	2.56	2.19	-0.37*
More responsive to changing customer needs	2.55	2.11	-0.44*
Better access to soft information	2.48	2.36	-0.12
Cost savings	2.44	2.60	0.16
Improved access to external data	2.42	2.34	-0.08
More competitive information	2.27	2.03	-0.24*
Support TQM program	2.23	1.98	-0.25*
Better environmental scanning	1.83	1.56	-0.27*
Support downsizing the organization	1.95	1.79	-0.16

* indicates significance $\alpha = 0.05$

the gap is the greatest are related directly to executive performance — improved decision making (-.94), better problem understanding (-.83), improved planning (-.79), save executive time (-.76), and improved executive performance (-.70). These disappointments are even more significant when one considers that expectations were not especially great in these areas. In contrast, the EISs have almost lived up to their potential in terms of the faster (-.50) presentation (-.17) of timely (-.60), accurate (-.28), relevant (-.45), concise (-.27) information.

It appears that the greatest problem with EISs today is their business oriented benefits rather than information delivery issues. This weakness is also indicated by the low levels of realized benefits in terms of the inclusion of soft information and information about the external environment — two areas in which executives value information.

While the study found interesting shortfalls between expected and realized EIS benefits, this finding should be

interpreted in light of how the data were collected. The study was cross-sectional rather than longitudinal. Respondents were asked to assess the pre- and post-implementation benefits at the same point in time — after the system was operational. This required them to accurately remember pre-implementation expectations. Also, the assessment of benefits reflects the perspective of developers because they were the respondents. It may be that users of the systems have different assessments. There is evidence, however, that users and developers typically have the same perceptions on the success of an EIS (Singh, 1993).

What kinds of benefit/cost analyses are being performed?

The respondents were asked what kind of benefit/cost analysis was performed prior to the implementation of their EISs (see Table 5). The majority of the firms (58.5 percent) reported that costs and an intuitive feeling for the benefits were determined. This finding is consistent with studies of

TABLE 5

Benefit/cost analysis prior to implementation

Analysis Method	Percentage of Respondents
Costs and "hard" benefits were determined	13.8
Costs and an intuitive feeling for the benefits were determined	58.5
Costs only were determined	3.4
Benefits only were determined	5.2
Neither costs nor benefits were determined	19.0
Benefit/Cost Total	100.0

TABLE 6

Benefit/cost analysis after implementation

Analysis Method	Percentage of Respondents
Costs and "hard" benefits were determined	7.4
Costs and an intuitive feeling for the benefits were determined	40.7
Costs only were determined	5.6
Benefits only were determined	5.6
Neither costs nor benefits were determined	40.7
Benefit/Cost Total	100.0

decision support systems (Keen, 1981; Hogue & Watson, 1983) and suggests the difficulty of quantifying the benefits of decision support applications. In 19 percent of the firms, neither costs nor benefits were determined. Costs and tangible benefits were determined in only 13.8 percent of the organizations.

What factors affect whether and how a benefit/cost analysis is conducted?

The difficulty of quantifying EIS benefits was not the only reason why little was done about it, as the interviews revealed. In some firms, the position of the executive sponsor was a factor. One interviewee reported that the president was the "chief EIS spokesperson" and that the project was therefore viewed very favorably; no benefit analysis was performed.

The cost of the system is also an important consideration. We found that the cost of developing an EIS varied from \$10,000 to \$1.5 million when hardware, software, personnel, and training costs are included. These differences are due to the nature of the EIS developed and whether additional hardware and software are required. Low cost systems are less likely to be subjected to close scrutiny. One respondent from a federal government agency reported that the development of his system cost "little more than a box of floppies" because a portable system was available from another governmental agency. He also pointed out that a rigorous benefit/cost analysis in government agencies is a cumbersome process to be avoided if possible.

A formal EIS proposal was prepared in a bank which included a qualitative description of the potential benefits and cost estimates. Of particular interest was how the costs were framed. In addition to a breakdown by hardware, soft-

ware, personnel, and training costs, they were subdivided on the basis of whether they were for the enhancement of executive information or for its presentation. Most of the cost of the system was for creating (e.g., collecting, processing, and interpreting) information rather than for its presentation on screens using EIS technology. In this context, it was obvious that it was an information tool rather than an expensive executive toy. The proposal also pointed out that most of the information creation costs already were being incurred by personnel feeding existing, inefficient, and ineffective systems. The development of the EIS was quickly approved.

Another company took an unusual approach to cost justifying its EIS. It required each business unit manager supported by the EIS to cut one business analyst from the staff. It was reasoned that the system would provide more support than the business analysts, and these personnel reduction savings more than covered the costs of the EIS.

Respondents also were asked about any benefit/cost analyses performed after the system was operational. The conventional wisdom is that benefits are easier to identify after the system is running and that significant benefits should be documented in case justification is necessary (Paller with Laska, 1990). The data presented in Table 6 suggest this advice is often ignored. In 40.7 percent of the firms, neither costs nor benefits have been determined, and in 40.7 percent of the organizations, costs and an intuitive feeling for the benefits have been determined.

Moreover, the interviews revealed why formal assessments are uncommon after implementation. In some organizations, there is a staunch belief that the benefits are so significant that they justify the system's cost. As one participant said, "the benefits have been so obvious." There is also a sense in a few organizations that the system has become so

embedded in management processes and critical to the success of the organization that its value is beyond question.

In our interviews we found that several events can trigger an EIS evaluation. One condition is difficult economic times. An EIS manager said that business conditions led to significant cost-cutting efforts in his company. As part of an organization-wide examination of all costs, he conducted a thorough benefit/cost analysis which saved his EIS from the cost-cutting ax.

The loss of the executive sponsor may also lead to a new environment for an EIS. In another firm, the president was the executive sponsor for the EIS, and after he died, so did the EIS. The system had a heavy financial orientation and the new president chose not to manage that way.

CONCLUSION

The study provided interesting findings about the expected and realized benefits from EISs, how their benefits and costs are assessed, and factors that affect the assessment. The findings should be of interest to executives who are considering the development of an EIS, the developers of EISs, and academicians who study the benefits of decision support applications.

Care must be taken to ensure that the system lives up to expectations because many do not. The biggest problem appears to be with the business oriented benefits rather than with information delivery. This suggests that more attention should be focused on determining the information requirements for the EIS. Watson and Frolick (1993) provide a portfolio of methods that can be used for this purpose.

The development of a formal EIS proposal is helpful, as Burkan (1991) suggests. Our telephone interviews with companies that prepared a proposal revealed that it helps set realistic expectations for what will be delivered and when, and what resources will be required. The approach used in our company's proposal where the costs of the EIS were divided into information creation and information delivery cost categories seems useful for providing a perspective on where the costs of building an EIS emanate.

Even though a strong executive sponsor may clear the way for EIS development, the wise EIS manager should not rely on this support exclusively. The sponsor may retire, die, or move to another company. The ideal situation is to have multiple sponsors, which requires a continuing effort to cultivate strong supporters for the system.

Difficult economic times may jeopardize any expenditures that are not returning demonstrable value. This suggests that EIS managers should document the benefits derived from their systems. The assessment methodology used at Conoco might be employed (Belcher & Watson, 1993). Taking a clue from information systems researchers, statistics such as the number of users, the average number of screens accessed

per user, and the average number of times each screen is accessed should be maintained. There is evidence that EISs are not judged solely on financial terms if it is clear that the system is supporting the business.

The study helps researchers and practitioners better understand the benefits of EISs. Because there appears to be a gap between expectations and reality, studies need to be undertaken to help practitioners develop better systems.

The study also adds to our understanding of how decision support-oriented applications are evaluated. As with decision support systems, the costs of EISs are often calculated but the system is either developed or maintained based on an intuitive feeling that the benefits exceed the costs. This approach is consistent with Keen's (1981) value analysis concept.

Bacon (1992) and others suggest that investments in IT need not be justified only on financial grounds (e.g., not discounted present value) if they clearly support the business. This theme — heard in several of the telephone interviews and noted elsewhere (Belcher & Watson, 1993) — suggests that researchers might make a valuable contribution if they develop methodologies that show how IT investments support the accomplishment of business objectives.

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