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ANTICIPATED BENEFITS OF NEW INFORMATION SYSTEMS: THE ROLE OF THE PROPOSER

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ABSTRACT

The assessment of the anticipated benefits of new information systems is important to the process of information system planning. A study of the anticipated benefits of 178 projects revealed nine benefits factors: improved information, strategic advantage, return on investment, reduced technology cost, better applications development, reduced travel costs, reduced workforce costs, business redesign, and adherence to government regulations.

A variety of personnel propose new information systems. User departments are the most active proposers. Top management and IS departments are about equally active and strategic planning groups are considerably less active. User departments and top management propose more strategic advantage applications than do IS department or strategic planning groups. IS departments most actively propose reduced technology cost and better applications development applications while user departments propose improved information, return on investment, reduced workforce costs, business redesign, and adherence to government regulations applications.

INTRODUCTION

The identification of new information systems proposals is important to the organization because new systems can have a significant impact on its success. On one hand, the process of identifying them includes the formal determination of the organization's key information needs and opportunities, identification of broad initiatives to respond to those needs and opportunities, and justification and prioritization of associated projects based on their anticipated costs and benefits (McLean and Soden, 1977). On the other hand, the process of identifying them may be seen as an informal, intuitive, and creative act (Ward, Griffiths, and Whitmore, 1992).

Much has been written about predicting the costs of new information systems but less has appeared

about planning their benefits (Lederer and Prasad, 1991). Nevertheless, an understanding of these anticipated benefits is very important.

An understanding of these benefits of can give researchers an opportunity to characterize IS projects thematically. For example, some information systems have been referred to as strategic information systems that enhance competitiveness (Cash, McFarlan, McKinney, and Applegate, 1992). However, evidence to the deliberate planning of such a type of system has not always been persuasive (Powell, 1992). Moreover, in addition to strategic information systems, other information systems might be described in terms of their major benefits (Diromualdo, 1990). Such a characterization can permit researchers to further study proposed information systems in terms of their benefits.

An understanding of these benefits can also help researchers better comprehend the process of identifying the benefits of proposed information systems. This may be valuable because by better understanding the process, it may eventually be possible to improve it. For example, by confirming that particular parties typically propose information systems with specific benefits, it may be possible eventually to understand why some systems achieve their benefits and others do not. Critics have often claimed that the benefits of proposed information systems are not achieved (Loveiman, 1988, 1991) and any evidence explaining why would be useful.

The study reported herein thus asked the following questions:

1. What are the major, anticipated benefits of information systems projects?
2. Who propose new information systems with these particular benefits?

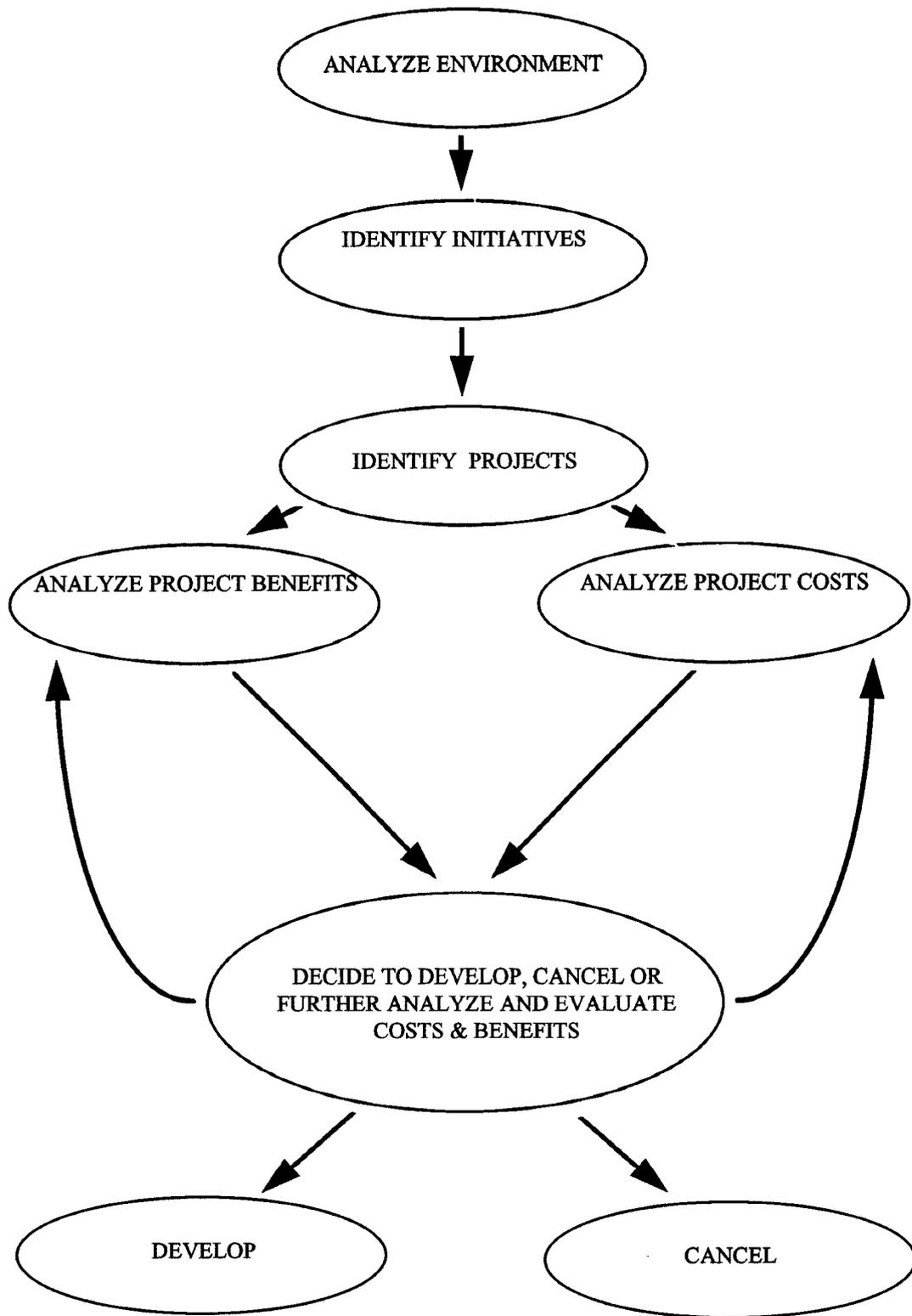
A FRAMEWORK FOR BENEFITS ANALYSIS

Figure 1 shows where benefits analysis fits into the planning and implementation process. The organization analyzes its environment, identifies business objectives, and conceives computer initiatives to help it achieve them (Lederer and Gardiner, 1992). On that basis, information systems planners, top management, IS management, user departments, or others propose specific projects.

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Figure 1: A Framework for Benefits Analysis



Cost and benefit analyses are conducted simultaneously based on information about the current project as well as previous ones (Bacon, 1992). While more technically-oriented information systems professionals might typically analyze costs, users and business-oriented information systems analysts assess benefits. Quantitative and non-quantitative benefits are both considered (Keim and Janaro, 1982; Litecky, 1981).

A decision analysis combines the benefits and costs (Bacon, 1992). If it initially reveals unexpectedly high costs or meager benefits, it may require some reconsideration of the project to reduce costs and increase benefits as shown by the back arrows in the figure. At this time, it may become evident that acceptable costs and benefits cannot be achieved and hence the project may be dropped without formally presenting it for final approval. However, if presented, a decision to develop the project or cancel it follows.

THE POTENTIAL, ANTICIPATED BENEFITS

Observers have long attributed many benefits to information systems. Many are directly related to financial savings. For example, information systems have been used to control work force costs by reducing the number of employees (Orli and Tom, 1987; Parker and Benson, 1987; Rivard and Kaiser, 1989; Sullivan-Trainor, 1989) or avoiding increases in them (Smith, 1983). Information systems have been used to reduce travel costs and communication costs (Smith, 1983). New information systems can also save money by reducing the number of modifications or enhancements to existing systems (Smith, 1983; Vaid-Raizada, 1983) and they can reduce costs by reducing hardware use (Orli and Tom, 1987).

Information systems provide benefits by increasing the usefulness of their output without necessarily providing financial impact. They enable faster retrieval or delivery of information (Rivard and Kaiser, 1989; Sullivan-Trainor, 1989) and present information in a more concise manner or better format (Rivard and Kaiser, 1989). They increase the flexibility of information requests (King and Schrems, 1978; Orli and Tom, 1987) and enable easier access to information (Orli and Tom, 1987; Rivard and Kaiser, 1989). They improve the accuracy or reliability of information (King and Schrems, 1978; Orli and Tom, 1987; Rivard and Kaiser, 1989; Vaid-Raizada, 1983) and increase the volume of information output (Rivard and Kaiser, 1989; Sullivan-Trainor, 1989).

The benefits of some information systems projects involve the facilitation of systems development. For example, new projects can allow other applications to be developed faster (Smith, 1983), allow previously infeasible applications to be implemented (Orli and Tom, 1987; Sullivan-Trainor, 1990), and provide greater data or software security (Vaid-Raizada, 1983)

Some benefits are related to management planning and control. New information systems can improve management information for strategic planning (King and Schrems, 1978; Parker and Benson, 1987), improve information for management control (King and Schrems, 1978; Orli and Tom, 1987; Parker and Benson, 1987), or improve information for operational control (Parker and Benson, 1987).

Some information systems improve productivity. They do this by speeding up transactions or shortening product cycles (Anonymous, 1990; Orli and Tom, 1987; Parker and Benson, 1987). They may enhance employee productivity or business efficiency (King and Schrems, 1978; McGugan, 1987; Smith, 1983; Sullivan-Trainor, 1989; Sullivan-Trainor, 1990; Rivard and Kaiser, 1989). They also change the way the organization conducts business (Parker and Benson, 1987; Sullivan-Trainor, 1989).

Some benefits are directly related to customers. These include improving customer relations (Orli and Tom, 1987; Rivard and Kaiser, 1989), providing new products or services to customers (Sullivan-Trainor, 1989), and providing better products or services to customers (Anonymous, 1990; Parker and Benson, 1987; Sullivan-Trainor, 1989).

Some information systems improve the ability of the organization to compete. For example, they enhance competitiveness or create strategic advantage (Anonymous, 1990; Janulaitis, 1984; McGugan, 1987; Lay, 1985; Parker and Benson, 1987; Sullivan-Trainor, 1989; Sullivan-Trainor, 1990). They enable the organization to catch up with competitors (Parker and Benson, 1987). Other related benefits include that they align well with stated organizational goals (Parker and Benson, 1987), help establish useful linkages with other organizations (Parker and Benson, 1987), and enhance the credibility and prestige of the organization (Orli and Tom, 1987).

Table 1 contains the comprehensive list of these potential benefits. (A pilot test described below resulted in the addition of four items in the table.)

Table 1: The Benefits of IS

Save money by reducing the work force (Orli and Tom, 1987; Parker and Benson, 1987; Rivard and Kaiser, 1989; Sullivan-Trainor, 1989)

Save money by avoiding the need to increase the work force (Smith, 1983)

Save money by reducing travel costs (Smith, 1983)

Save money by reducing communication costs (Smith, 1983)

Save money by reducing system modification or enhancement costs (Smith, 1983; Vaid-Raizada, 1983)

Save money by reducing hardware use (Orli and Tom, 1987)

Increase return on financial assets (added during pilot)

Enable faster retrieval or delivery of information or reports (Rivard and Kaiser, 1989; Sullivan-Trainor, 1989)

Present information in a more concise manner or better format (Rivard and Kaiser, 1989)

Increase the flexibility of information requests (King and Schrems, 1978; Orli and Tom, 1987)

Enable easier access to information (Orli and Tom, 1987; Rivard and Kaiser, 1989)

Improve the accuracy or reliability of information (King and Schrems, 1978; Orli and Tom, 1987; Rivard and Kaiser, 1989; Vaid-Raizada, 1983)

Increase the volume of information output (Rivard and Kaiser, 1989; Sullivan-Trainor, 1989)

Allow other applications to be developed faster (Smith, 1983)

Allow previously infeasible applications to be implemented (Orli and Tom, 1987; Sullivan-Trainor, 1990)

Provide the ability to perform maintenance faster (added during pilot)

Provide greater data or software security (Vaid-Raizada, 1983)

Improve management information for strategic planning (King and Schrems, 1978; Parker and Benson, 1987)

Improve information for management control (King and Schrems, 1978; Orli and Tom, 1987; Parker and Benson, 1987)

Improve information for operational control (Parker and Benson, 1987)

Speed up transactions or shorten product cycles (Anonymous, 1990; Orli and Tom, 1987; Parker and Benson, 1987)

Enhance employee productivity or business efficiency (King and Schrems, 1978, McGugan, 1987; Smith, 1983; Sullivan-Trainor, 1989; Sullivan-Trainor, 1990; Rivard and Kaiser, 1989)

Enable the organization to respond more quickly to change (added during pilot)

Change the way the organization conducts business (Parker and Benson, 1987; Sullivan-Trainor, 1989)

Facilitate organizational adherence to governmental regulations (added during pilot)

Improve customer relations (Orli and Tom, 1987; Rivard and Kaiser, 1989)

Provide new products or services to customers (Sullivan-Trainor, 1989)

Provide better products or services to customers (Anonymous, 1990; Parker and Benson, 1987; Sullivan-Trainor, 1989)

Enhance competitiveness or create strategic advantage (Anonymous, 1990; Janulaitis, 1984, McGugan, 1987; Lay, 1985; Parker and Benson, 1987; Sullivan-Trainor, 1989; Sullivan-Trainor, 1990)

Enable the organization to catch up with competitors (Parker and Benson, 1987)

Align well with stated organizational goals (Parker and Benson, 1987)

Help establish useful linkages with other organizations (Parker and Benson, 1987)

Enhance the credibility and prestige of the organization (Orli and Tom, 1987)

METHODOLOGY

The authors developed a questionnaire based on the framework and these benefits. Major parts were:

- A set of a few general questions about benefits analysis in the organization. Subjects were asked to answer in terms of what their organization defined as "large projects" to prevent them from considering trivial tasks routinely handled without formal analysis.
- A set of questions about the analysis of the benefits of the most recent large project proposal

for which benefits were estimated and an approval process was carried out resulting in either final approval or disapproval. Subjects identified the proposers and other characteristics of the project.

A list of anticipated benefits based on Table 1. Respondents identified their view of the importance of each anticipated benefit relative to the other anticipated benefits of the proposed project on a 1 to 7 scale (1 is not a benefit, 7 is very important).

- Demographic questions about the organization and respondent.

Subjects were permitted to augment the responses to many of the questions. For example, they could add an anticipated benefit if it was not already identified in the questionnaire.

The authors conducted pilot tests with four experienced information systems managers and analysts. These resulted in the addition of four anticipated benefits and in other revisions to improve the questionnaire's clarity. The authors then mailed it to 936 randomly selected members of a large, nationwide association of information systems managers and analysts. After a second mailing to non-respondents, they received a total of 200 responses. Since 33 were returned with incorrect addresses, the response rate was 22%.

Because all of the respondents participated in or supervised the identification of benefits or the development of information systems based on them, they were knowledgeable about the questions in this study and are appropriate participants in it. However, it should be noted that their responses represent the perceptions of information systems managers and analysts and these could differ considerably from those of users and others.

THE SAMPLE

Respondents were generally highly experienced and educated. They had worked in information systems for an average of 20 years with the past twelve at their current employer. Approximately 24 employees reported to each respondent with a range of 0 to 480. Over 86% had a 4 year degree and about half had attended at least some graduate school.

About one third of their firms were in manufacturing while insurance and government were the second and third most prominent employers. Their firms' IS departments had an average of 785 employees. Annual IS budgets averaged \$52 million with a range of \$60,000 to \$2 billion.

One hundred ninety of the 200 respondents answered a question as to whether or not their project was ultimately approved. One hundred seventy eight of their 190 projects, or 94%, were approved. Thus only 12 progressed through the entire cost/benefit decision analysis without ultimately receiving management approval. (This is consistent with the observation above that clearly non-justifiable projects may be dropped from a decision analysis before a final decision.) For the sake of homogeneity of data, the subsequent analysis uses these 178 projects.

Hence, the sample represents a variety of industries and sizes. Moreover, no two subjects came from the same firm. Thus the results of the study are probably generalizable.

FINDINGS

As expected, benefits analysis is important to IS managers and professionals. The mean rating of a general question asking the importance of benefits analysis was 5.35 on a scale of one to seven. This rating is significantly above a mid-point score of 4.00 (with $p \leq .001$) which would have indicated the respondents' indifference. On the other hand, the mean rating of the satisfaction of the subjects with their benefits analysis process was only 3.98. Hence, it appears that benefits analysis is important but respondents are not particularly satisfied with it. This confirms the importance of studying benefits analysis. The specific research questions and their answers now follow.

1. What are the major, anticipated benefits of IS projects?

An exploratory factor analysis was conducted on the importance ratings to categorize benefits into thematically related groups. An exploratory, rather than confirmatory analysis was used because no firm theoretical basis for a categorization exists. Thus, the loose grouping of benefits into the paragraphs of the literature review above is based on intuition rather than established theory.

The results of a principal components analysis followed by a varimax orthogonal rotation of the axes appear in Table 2. The analysis conducted on the 33 benefits yielded 9 factors. If a benefit did not have a loading of 0.6 or more on at least one of the nine factors, it was dropped from subsequent analysis. Based on this criterion, 11 benefits were dropped. Together, the nine extracted factors accounted for 64.3% of the variance in the data. Reliability coefficients, as shown in the table, exceeded .60 for all factors with more than one item.

Table 2: Eigenvalue, Percentage of Variance, and Reliability For Each Factor

Factor	Eigenvalue	Percentage of variance	Reliability
1	8.55	25.9	0.86
2	2.86	8.7	0.85
3	2.34	7.1	-
4	1.57	4.8	0.63
5	1.29	3.9	0.63
6	1.22	3.7	-
7	1.16	3.5	0.70
8	1.13	3.5	-
9	1.06	<u>3.2</u>	-
		64.3	

Table 3 shows the individual, anticipated benefits and the factors on which they loaded. Meaningful names were assigned to each factor. Factor loadings appear for each benefit.

Table 3: The Factors with Items and Loadings

Factor 1: Improved information	
Improve management information for strategic planning	.646
Enable faster retrieval or delivery of information or reports	.764
Present information in a more concise manner or better format	.730
Increase the flexibility of information requests	.699
Enable easier access to information	.783
Improve the accuracy or reliability of information	.641
Improve information for management control	.620
Factor 2: Strategic advantage	
Enhance competitiveness or create strategic advantage	.614
Enhance the credibility and prestige of the organization	.736
Improve customer relations	.789
Provide new products or services to customers	.752
Provide better products or services to customers	.798
Factor 3: Return on investment	
Increase return on financial assets	.752
Factor 4: Reduced technology cost	
Save money by reducing system modification or enhancement costs	.738
Save money by reducing hardware use	.621
Factor 5: Better applications development	
Allow other applications to be developed faster	.700
Allow previously infeasible applications to be implemented	.666
Factor 6: Reduced travel costs	
Save money by reducing travel costs	.708
Factor 7: Reduced workforce costs	
Save money by reducing the workforce	.744
Save money by avoiding the need to increase the workforce	.731
Factor 8: Business redesign	
Change the way the organization conducts business	.753
Factor 9: Adherence to government regulations	
Facilitate organizational adherence to governmental regulations	.681

2. Who propose new information systems?

Table 4 lists the parties who propose information systems and their anticipated benefits factors. Each column represents one of the nine factors for the projects where the particular factor was the highest or tied for highest in importance. Each row (user departments, information systems department, top management, and strategic planning group) represents a potential proposer. Intersecting cells contain the number of proposers of the projects. For example, user departments proposed 14 projects with improved information as its top benefit.

The Total Projects row shows the number of

projects with the corresponding top (or tied for top) benefit. The sum of the proposers in each column (not shown) exceeds the Total Projects for each factor because more than one party may have proposed a particular project with the top benefit. Improved information (F1) was thus the top benefit in 29 projects whereas 39 parties (i.e., 14+9+11+5) proposed it. Finally, asterisks represented the statistically significant differences resulting from a chi square goodness of fit test on each column assuming a uniform distribution.

Table 4: Frequency of Proposers

When the top factor is:	F1	F2	F3	F4	F5	F6	F7	F8	F9	Total
			*	**					*	**
User Department	14	11	16	9	7	1	13	65	24	160
IS Department	9	5	9	12	11	0	7	48	11	112
Top Management	11	11	9	4	7	2	8	41	17	110
Strategic Planning Group	<u>5</u>	<u>5</u>	<u>3</u>	<u>1</u>	<u>4</u>	<u>0</u>	<u>5</u>	<u>18</u>	<u>10</u>	41
Total Projects	29	17	27	16	15	3	20	98	35	

Key: F1 Improved information
 F2 Strategic advantage
 F3 Return on investment
 F4 Reduced technology cost
 F5 Better applications development
 F6 Reduced travel costs
 F7 Reduced workforce costs
 F9 Adherence to government regulations
 * Statistically significant at the .05 level of confidence
 ** Statistically significant at the .01 level of confidence

DISCUSSION

The findings provide a basis for discussing the research questions.

The major, anticipated benefits

The factor analysis produced a set of meaningful factors. Five of them contain multiple items. Improved information (factor 1) deals with very broad benefits that focus on individual users and their ability to have better retrieval, conciseness, flexibility, ease of access, accuracy, reliability in their data. It is not surprising that organizations plan new information systems distinguished by them. After all, its items have long been considered among the major benefits of information systems and are a major objective in developing them (Rivard and Kaiser, 1989).

On the other hand, strategic advantage (factor 2) is a relatively newer benefit. Its items focus on organizational issues rather than the individual user concerns. They involve competitors, customers, products, and services and these are the typically discussed aspects of strategic information systems. In a sense, the factor analysis validates the existence of a strategic advantage type of benefit. In doing so, it confirms a greater interest in competitive applications than had previously appeared (Willcocks and Lester, 1991). More important, it confirms the notion that organizations deliberately use planning to identify new information systems that will deliver strategic advantage (Earl, 1993).

Three factors had two items. Reduced technology cost (factor 4) is probably be a less frequently discussed benefit of new information systems. However, one of its two items, saving money by reducing hardware use, is associated with the current trend toward downsiz-

ing from more expensive mainframes to local area networks of personal computers. It is thus a meaningful factor.

Better applications development (factor 5) focuses on issues related to IS professionals and their responsibility in developing new applications. Perhaps the only out-of-place item in the entire set of factors is saving money by reducing system modification or enhancement costs; it appeared in reduced technology cost (factor 4) but might have been expected to appear within better applications development (factor 5). Nevertheless, an argument could easily be made for it in either factor.

Finally, reduced workforce costs (factor 7) reasonably focuses on labor cost reduction and labor cost avoidance. This factor thus substantiates the older, conventional view of the computer as a labor saving device for reducing costs and improving operational efficiency (Diromualdo, 1990).

Four factors had one item. Return on investment (factor 3) is a very tangible benefit. Reduced travel costs (factor 6) may not be so popular but it is certainly a benefit of group decision support and other telecommunications-based systems. Adherence to government regulations (factor 9) often imposes inefficiencies on manual processes and thus demands that many new information systems be built.

Business redesign (factor 8), the final one item factor, refers to a process that is quickly growing popular (Davenport, 1993). It is being highly praised for its ability to improve business performance dramatically by reducing cost and time and by increasing quality.

Hence, the factor structure gives a meaningful perspective on the anticipated benefits of information systems.

The proposers of new information systems

The columns in Table 7 suggest the following four propositions. Some stem from statistically significant differences but others are related strictly to numerical differences. Each is briefly discussed below.

- User departments are the most active proposers of new information systems; top management and information systems departments are about equally active; and strategic planning groups are considerably less active in proposing all applications (deduced from Total column).

Interestingly, user departments are very actively involved in proposing new information systems. This finding contradicts the notion of an information systems department imposing new applications on unwilling user departments (Lucas, 1975) and is more consistent with one of them being knowledgeable about their needs and aggressively seeking resource allocations for new systems (Joshi, 1989). The finding contrasts the possibly expected notion that strategic planning groups might play a greater role in the proposal process (Gupta and Raghunathan, 1989).

Top management is also fairly active in proposing new applications. This may be surprising. The finding contrasts the view of a disinterested top management delegating the ideas for new information systems to computer technicians and instead suggests that top management takes the competitive aspects of the technology in an increasingly serious manner (McFarlan, 1984).

- User departments and top management more actively propose strategic advantage applications than do information systems department or strategic planning groups (deduced because the user department and top management cells are greater than the information systems department or strategic planning cells in the F2 column).

Top management's proposals exceeded or matched the other groups only in strategic advantage applications. Top management's involvement with applications concerning competitors, customers, products, and services - the typically discussed aspects of strategic information systems - signals a computer-wise business leadership. On the other hand, information systems departments' lesser involvement may not be surprising but is probably disappointing. Perhaps they are not sufficiently knowledgeable or enthusiastic about the key business issues of strategic advantage applications. The minor role by planning groups also raises the question as to their importance in the proposal process because, given their broad view of the organization, one might have expected a greater role in them.

- Information systems departments most actively propose reduced technology cost (F4) and better applications development applications (F5).

Information systems departments led all other groups only in proposing reduced technology cost and better applications development applications. Information systems departments clearly propose the applications whose benefits are most relevant to them.

- User departments most actively propose improved information (F1), return on investment (F3), reduced workforce costs (F7), business redesign (F8), and adherence to government regulations (F9) applications.

User departments are clearly most active in proposing information systems with potential benefits that will affect them. Presumably they are most knowledgeable about how improved information will help them, how their new information systems will give them a return on their investment, and how they will reduce their own workforce costs. Users are also presumably most knowledgeable about the benefits of redesigning their work processes and meeting the government requirements. Moreover, users take the initiative in proposing applications that provide such benefits.

CONTRIBUTIONS TO RESEARCH

This research has identified a set of nine factors categorizing the anticipated benefits of proposed information systems. The classification scheme can be used as a measurement tool to increase researcher's understanding of both proposed and implemented information systems. Moreover, the emergence of meaningful themes in this research gives impetus to the study of the analysis process that identifies them.

The set of factors can thus help researchers investigate why the benefits of information systems are or are not achieved. Researchers can use it to identify both the anticipated benefits of particular proposed systems and later their final, delivered benefits. Researchers would then investigate why some benefits may have been achieved while others were not. In other words, used in further research, it may help focus on the benefits identification practices and implementation practices that result in the more successful achievement of benefits than do other practices.

Researchers might thus ask, What are the key issues in the successful identification of realizable benefits? How can benefits be identified more accurately? How are benefits quantified and how should they be quantified? How does management evaluate the anticipated benefits presented to them and how does it decide to support a project? Most relevant to the study at hand, do the answers to such questions differ depending on the types of benefits sought from the proposed system? Researchers might ask these questions by presenting the factors in this study to information systems professionals as done herein but they might also use them by presenting them to users.

Researchers might also further investigate the proposing of new information systems by different groups of computer personnel. Many of the differences in this research were not statistically significant but this may have been due to the small size of groups of projects where each individual factor was most important. Researchers might confirm the different proposing roles with a larger sample but also might ask in more detail as to how each group goes about conceiving and proposing its new information systems. By studying this, researchers might learn how to identify proposals whose benefits are more often achieved.

CONTRIBUTIONS TO PRACTICE

This research makes several contributions to practitioners. For example, although earlier authors have described each of the potential benefits, Table 1 can serve as a reminder to planners of all possible benefits and they can use it as such when initially preparing a benefits analysis. Information systems managers can also use the nine anticipated benefits factors to describe, summarize, and communicate the benefits of new and existing information systems to other managers.

Information systems managers can also use the factors to assess their current portfolio of existing applications. They can assess the portfolio to help decide whether the mix of applications in the portfolio is consistent with the overall corporate role of information systems. For example, if most of their applications provide improved information yet their corporate goals include creating a strategic advantage or reducing the workforce, then they may want to consider other applications with, say, strategic advantage or reduced workforce benefits.

Managers can also use the factors to evaluate their information systems by comparing current ratings with desired ratings of specific projects. This could help them find opportunities for improvement.

Managers can also gain by recognizing the various roles that different groups play in the identification of new projects. The information systems department is clearly not the leader in proposing new applications. On one hand, some departments may even want to take a further reduced role in order to give more responsibility to users while other departments might want to take an expanded role in order to increase their contribution to the organization. Moreover, if organizations believe that their strategic planning groups should play a substantial role, then this research suggests perhaps they are not doing so.

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