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Main Problems with Management Information Systems and Their Relationship to Critical MIS Success Factors

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Eastern Illinois University

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and
Their Relationship to Critical MIS Success Factors
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BY

Thomas Schmitt

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Thesis

Main Problems with Management Information Systems
and
Their Relationship to Critical MIS Success Factors

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Abstract

Most companies do not exploit all potential benefits of Management Information Systems (MIS). To enhance the understanding of how MIS might be better managed, a nationwide mail-survey among 280 randomly selected chief MIS executives of Corporate 1000 firms was conducted.

The first part of the thesis investigated the areas of importance for MIS success and performance ratings of the 85 participating managers on the issues. In the second part relationships between these variables and the success of the MIS operations were established to derive critical success factors.

The findings indicate that there is a shift towards an increased strategic importance of MIS in most companies. Accordingly, the MIS leaders take a strategic view of MIS and stress issues affecting the entire organization over those relating only to the MIS department.

The success of current operations, however, is still mainly influenced by technical factors. Because of the transition from a technical to a strategic orientation of MIS, major problems arise in the areas of strategic MIS issues. For the same reason, the factors perceived as important for future MIS success do not coincide with the twelve critical success factors for current operations.

The critical success factors, recruiting and training

data processing staff, end-user computing, and measuring effectiveness enhance MIS success in terms of user satisfaction, effectiveness, and efficiency. Alignment of MIS with business goals, integrating technologies, software development, data quality, user involvement, organizational learning and information system usage, information centers, and efficient data utilization contribute to user satisfaction and effectiveness, but not to efficiency.

Long-range MIS planning is not critical to MIS success since the focus of planning is shifting from internal MIS department issues to the support of the whole organization by aligning MIS with corporate objectives. In contrast to the prevailing opinion in the MIS literature, top management involvement in the definition of MIS goals is also not critical, as top management lacks a sufficient knowledge of MIS. Thus, the MIS manager is to be integrated in the corporate strategy setting and business planning process to ensure a proper alignment of MIS and business objectives.

1. Introduction

The information revolution is sweeping through the business world. Information technology is transforming the nature of products, processes, companies, industries, and even competitiveness (Porter and Millar 1985). Until recently information technology was treated as support services. Now however, many companies see it as a way to create substantial competitive advantages. The typical organization is far from realizing the full potential benefits of the computer (McFarlan and Bruns 1987, Saunders 1986, Salerno 1985). One reason for the suboptimal use of computers is the problems of managing the company's information systems.

A clear identification of the areas that are critical to success of an MIS department would help in decision making. To provide a better understanding of how Management Information Systems might be better managed, this thesis investigates which problems MIS executives perceive as most important and how MIS success is related to critical success factors. It is explored whether the critical success factors and the issues perceived as important by the MIS managers match.

The results of this study will be compared to those of other related studies to detect changes over time so that shifts in importance of certain issues or new emerging

problem areas can be discovered. The research identifies how issues and problems discussed in literature relate to the practitioner and to actual MIS success.

The description of MIS' main problems and the comparison with previous studies will help academicians as well as practitioners to respond faster to new developments by knowing the latest shifts in the continuously changing information systems environment. Knowledge of the critical MIS success factors will enable MIS managers as well as academicians to concentrate their efforts not only on the symptoms of surfacing problems with MIS but also on the underlying causes.

1.1. A Historical Perspective

Computer systems have passed through three separate eras of use (Rockart and Morton 1984). The first two of these were concerned primarily with the computerization of the paperwork process of a firm. In the first phase accounting functions were automated. During the 1960s the emphasis changed to operational support, such as manufacturing control systems and on-line order entry systems.

In contrast to the earlier eras the current third era of applications focuses on providing information to middle and top management (Keen and Morton 1978, Rockart and Treacy 1982) and on facilitating data analysis and the communicat-

ion of analytic results and other information. This third era is also characterized by profound changes in the technology which made information technology available to every user (Rockart and Scott Morton 1984). Additionally, the technologies of data processing, office automation, and communications are being integrated under a single department.

The fourth era of computer use which focuses on "blue collar productivity" is still in an embryonic state (Schonberger 1987). This coming phase of robotics and process control will have an enormous impact on productivity and production quality.

1.2. Definition of Management Information Systems

The meaning of "MIS" is often surrounded by vagueness. Some people think of MIS as a transaction system that generates reports. Others think it is a system to support managerial decision making, a decision support system. Still others think of MIS as a system to support their day-to-day activities. In fact, it is all of the above. To obtain a deeper understanding of its meaning, the words which comprise the term "Management Information Systems" are discussed individually.

1.2.1 Systems

A system is a set of components that interact with one another for some purpose. It is defined by the system elements, its environment, boundaries, inputs and outputs and the conversion process which changes the input elements into output elements. Most systems are comprised of sub-systems. The goal of an organizational system is to achieve overall system effectiveness through harmonizing the sometimes conflicting objectives of its components.

Optimizing the subsystems does not ensure that the total optimum is reached. Therefore, there must be planning and control. Control of a system is an important concern of management. Control means to compare current performance against some predetermined goals (Hodge 1984). For effective control, the identification of the system's goals and objectives is of paramount importance. Further, there must be means of measuring performance, means of comparison to detect divergences from the plan and means of correction and adjustment for deviations. These factors are critical to the success of any system.

1.2.2 Information

Information is a prerequisite to operate the control process. The managerial activities of planning, organizing, directing, and controlling depend on the collection, preparation, and dissemination of information. Information

is the aggregating and processing of data to provide knowledge and intelligence (Luthans 1985). It derives its value by its impact on user's productivity or decision making.

Information that affects decision making is difficult to appraise. The significance or value of information can be measured only by the recipient, since the value of information depends on a particular person's needs and desires (Wysong 1985). Thus, it is crucial that the users of information are involved in the determination of information needs (analysis), the design of an appropriate information system and its evaluation.

1.2.3. Management

Management is the guiding of human and physical resources to attain certain objectives and involves the functions of planning, organizing, directing, and controlling. Management is a decision making process whose success depends primarily on the availability of the right information and its conversion into "good" decisions (Luthans 1985). Since decision making is only as good as the information used, it is very important that management be involved in the definition of information requirements and that it is able to use this information properly.

The concept of MIS is all-inclusive from an information standpoint. It is an information producing system using a

network of interrelated intelligence and transaction recording systems which deal with data of an interdisciplinary nature.

The goal of a Management Information System is to relieve management from converting data into information. Thus, it has to provide each manager with current information which is relevant for that manager's decision making, in a usable and easily understood format.

The term "MIS" will be used in this thesis as defined by Walter J. Kennevan (1970):

A Management Information System is an organized method of providing past, present and projected information related to internal operations and external intelligence. It supports the planning, control and operational function of an organization by furnishing uniform information in the proper time-frame to assist the decision making process.

An organization's MIS must provide managers at all levels with the information they need to perform their functions of planning and control. Such information is produced internally by the organization and obtained from the external environment.

2. Methodology

A mail survey was conducted among chief MIS executives. The chief MIS executive was defined as the highest level executive in the organization that was directly responsible for the development and operation of the organization's computerized information or data processing services.

A pre-study conducted during a graduate level MIS class has shown that mail surveys are an appropriate method to obtain information on the problems of MIS. A stratified sample of 280 companies from Corporate 1000 firms of 1987 (Wade 1986) was selected to obtain balanced representation of different industries. Within the constraint of being in the Corporate 1000, a number of companies was selected from each industry which allowed comparisons of different industries. The industry referred to the parent organization served by the MIS organization.

Eighteen manufacturers of computer hardware or software, 100 manufacturers, 40 banks and other financial institutions, 17 transportation firms, 30 wholesalers and retailers, 50 companies which provide other services and 25 firms which did not fall in any of these categories, were selected.

The issues investigated in the survey were drawn from the literature reviewed. The survey instrument required the respondents to assess each factor on two seven-point interval scales. The first, the importance scale, required each respondent to rate the importance of each factor for

MIS operations. The second scale asked the vice-presidents how they rated the performance of their department on the issues.

2.1 Analysis of Data

After editing and coding the data, a computer-based data file was generated. The statistical analysis was conducted with the Statistical Package for the Social Sciences, version X (SPSSx), release 2.0 (Norusis 1986, SPSS Inc. 1983). To all variables univariate statistical analysis was applied.

The analysis of the data is divided into two parts. The first part deals with the performance and importance of MIS issues as they are seen by the chief MIS executive. The second part related the factors to the success of the MIS operations to derive critical success factors.

From the comparison of the importance and performance ratings the perceived problem areas are determined. A importance/performance difference was computed by subtracting importance mean from the performance mean of each issue. This performance gap was weighted with the assigned importance rating of each factor. The size of the weighted performance gap suggests the magnitude of an asset or problem, as follows: A plus sign (+) is desirable in that the performance of this variable exceeds its assigned importance; a minus sign (-) suggests a problem, in that the

performance of the variable is less than its importance.

This methodology can be formally expressed as follows:

$$PG_i = \{P_{Mi} - I_{Mi}\} \{I_{Mi}\}$$

where

PG_i = Performance gap of issue i

P_{Mi} = Average performance on issue i

I_{Mi} = Average importance of issue i

$PG_i > 0$ is desirable

$PG_i < 0$ indicates a problem

The factors are ranked according to the weighted performance gap. The resulting format of data presentation permits a quick identification of possible major problems or assets in the MIS operations.

Further, it is investigated whether there are differences between organizational variables, such as strategic impact of MIS or industry. ANOVA analysis is conducted to determine the statistical significance of means of different groups. The ANOVA procedure is complemented by the Tukey b procedure which allows the determination of which peculiar variables are actually different (Norusis 1986, Hamburg 1983).

In the second part the performance on MIS issues and several classification factors are related to the success of

MIS. Using chi-square tests and t-tests, relationships between these variables and the MIS success are established. Relationships are considered significant only at levels of significance .05. The significance levels are categorized in five groups of significance $\leq .05$, $\leq .01$, $\leq .001$, $\leq .0001$, and $\leq .00001$.

Chi-square tests are conducted to investigate the statistical significance of the differences between three and more categories. This approach allows a uniform analysis regardless of the type of data. Additionally, it avoids the assumption of cardinal interval data which is somewhat problematic, even though widely accepted.

If only two groups of data existed, t-tests are used instead of Chi-square tests to determine the statistical significance of differences. Of course, significant differences in the form of high Chi-square or t-values do not automatically mean that there is a causal relationship involved (Hamburg 1983, Zikmund 1983). It might also be that other variables are producing variations between the two variables of interest. Therefore, the causal relationship of the individual factors is assessed by discussing the relevant literature and drawing conclusions based on the combination of literature review and statistical tests. After the evaluation of possible causal connections, those factors which have major influence of the MIS (critical success factors) are determined.

2.2. The Measurement of MIS Success

Overall MIS success was assessed by asking MIS managers about their perceptions of the extent to which user demands are met and the MIS operates effectively and efficiently.

Ideally, one would like to evaluate the success of MIS based on its use in decision making and the resultant productivity benefits. The evaluation of MIS would be a simple economic determination insofar as its return on investment is compared with alternative uses of the company's limited resources. However, many difficulties are involved in evaluating MIS, such as the valuation of intangible benefits and the lack of data (Lay 1985).

The satisfaction of users with their information systems is generally accepted as a measurable surrogate for the utility of MIS (Lees 1987, Franz and Robey 1986, Doll 1985, Ives and Olson 1984, Bailey and Pearson 1983, Robey and Farrow 1982, Ein-Dor and Segev 1982, King and Rodriguez 1978, Edstroem 1977). User information satisfaction serves as a subjective measure for objective determinants of success which are mostly not available.

The construct of user information satisfaction has been operationalized in many different ways. Single-item scales have been criticized as unreliable (Larcker and Lessig 1980). Multiple-item scales have become increasingly common. The measure employed in this thesis is the short form of an overall measure proposed by Ives, Olson and Baroudi (1983),

which is conceptually based on the work of Pearson (Bailey and Pearson 1983).

They recommend to use their five-point-interval scale in a survey of MIS managers to assess information use when survey time is limited. They show that a measure which includes the meeting of user needs, effectiveness, and efficiency, is a reliable measure of MIS success and has a high correlation with a large 30 item instrument.

Both the satisfaction of user needs and effectiveness refer to the degree to which relevant and important information is communicated throughout the organization. Reflecting the impact of these two measures on the company, they are termed strategic success measures.

In contrast, efficiency deals with the operations within the MIS department, rather than the effects of MIS on the company. Thus, it is labeled operational success measure.

3. Findings

The presentation of the empirical findings is divided into four main parts. After a description of the sample, the importance and performance ratings are analyzed. Then the main problem areas are identified. Finally, the critical success factors are established and the results of the different analyses are compared.

3.1 Description of the Sample

On May 5, 1988, the first letter was sent to chief MIS executives which solicited the completion of the accompanying two page questionnaire. Fifty completed and usable questionnaires (17.9%) were returned. Four weeks later a follow-up study was conducted. The same questionnaire was mailed again to the remaining 198 companies which did not respond at all, i.e. neither returned a completed questionnaire nor declined participation in the survey as a company policy. Thirty five additional completed and usable questionnaires were received (17.5 % of the remaining companies). This translates in an overall response rate of 30.4 % which can be considered as high compared to other empirical research in this field.

As shown in table 1, four answers were received from manufacturers of computer hardware or software (22.2% response rate, 4.7% of sample), 27 from manufacturers (27%, 31.8%), six from banks and other financial institutions (15%, 7.1%), two from transportation firms (11.8%, 2.4), 13 from wholesalers and retailers (43.3%, 15.3%), 15 from companies which provide other services (30%, 17.6%), and 18 from firms which did not fall in any of these categories (72%, 21.2%).

Except for the analysis of the relationship between strategic impact and industries, the manufacturers of computer equipment are combined with manufacturing, and

Table 1. Frequencies of Responses

Industry	Freq.	Percent of Sample	Response Rate
Mfg. computer hard-/softwr.	4	4.7	22.2
Manufacturing	27	31.8	27.0
Banking & finance	6	7.1	15.0
Transportation	2	2.4	11.8
Wholesaler & retailer	13	15.3	43.3
Other services	15	17.6	30.0
Other	18	21.2	72.0
Total	85	100.0	30.4

banking and finance as well as transportation are assigned to the service industry due to the small number of companies in each group.

In 1987 the sales of the companies laid in the range from \$300 million to \$96 billion; Six (7.1%) of the responding firms reported a sales volume below \$500 million, 17 (20%) have sales between \$500 and \$1000 million, the majority (44 = 51.9%) has sales of \$1 to 5 billion, eight (9.4%) of \$5 to \$10 billion, and ten (11.5%) of more than \$10 billion.

3.1.1. Strategic Impact and Industries

For some organizations Management Information Systems represent an area of great strategic importance. For others MIS play a cost-effective, but only supporting role.

McFarlan, McKenney, and Pyburn (1983) developed a matrix which distinguishes four types of strategic impact. If a

company both is critically dependent on the proper functioning of MIS for the daily operations and their applications under development are vital to future success, the impact of MIS is termed "strategic". Organizations which do not absolutely depend on the smooth functioning of daily MIS operations, but for which the applications under development are vital for future competitiveness, are categorized as "turnaround". When companies depend heavily on current MIS, but new applications are not essential for future success, they fall in the "factory" category. In companies where MIS has only a "support" function, neither the current applications nor those which are under development are critical for success.

Table 2 shows the strategic impact for the seven groups of industries.

As assumed by McFarlan, Mc Kenney, and Pyburn, MIS has a strategic impact on most financial institutions (83.3%)

Table 2. Industry and Strategic Impact

Industry	Strategic	Turn-around	Factory	Support
Mfg. of computer equip.		3		1
Manufacturing	9	14	2	2
Banking and finance	5	1		
Transportation	1	1		
Services	5	8	1	1
Wholesalers & retailers	9	3		1
Other	6	5		7
Total	35	35	3	12
Percent	41.2	41.2	3.5	14.1

while only one company (16.7%) reports a turnaround impact. Also most trade firms (9=72.7%) are positioned on the strategic sector of the matrix. Point of sales inventory systems have apparently a heavy impact on these companies. It can be assumed that the trade firms with a turnaround impact of MIS are currently on the verge of introducing point of sales systems. The time span of five years since the publishing of the above article was apparently long enough for most firms to implement these systems and move from a turnaround to a strategic position.

There have also been major shifts in manufacturing. In 1983 MIS was thought to have a support function for most manufacturing firms. Now, new applications have a high impact on most firms (14=51.9%). For some companies are even the already existing applications (9=33.3%) critical. For computer manufacturers the impact of MIS is also increasing as can be seen by their turnaround position.

The strategic impact of MIS on most companies is either already high or will be high in the future (82.4%). Thus, a trend towards an increased role of MIS can be found for almost all businesses. This underscores the importance which must be attributed to MIS in the future.

As most strategic functions are currently being implemented in many firms, it can be predicted that the number of firms in the factory category will increase because the relevance of new applications will decrease.

3.2. Importance and Performance on MIS Issues

The MIS executives were asked to rate 23 issues regarding their importance to MIS success and their actual performance. In this chapter the findings are presented and compared to previous studies.

3.2.1. Past Studies

To allow comparisons over an extended period of time, most issues are drawn from previous empirical studies. Those issues which had a high rating for importance are included in this study after elimination of duplicates and synonyms. Further, issues which are considered important in the conceptual literature reviewed are also included.

Four studies were published between 1982 and 1988 which deal with the importance of MIS issues. They give an overview of the changes in importance as seen by MIS managers between 1980 and 1986.

In 1980, Ball and Harris (1982) conducted a descriptive research survey among 417 executives in middle and upper management. Members of the Society for Management Information Systems (SMIS) were asked to respond to questions regarding their demographics, their satisfaction with SMIS services, and the importance of eighteen management issues which MIS management might address. Only descriptive statistical analysis was used (Appendix A1).

Dickson, Leitheiser and Wetherbe (1984) used the Delphi

approach to identify and rank the 10 key management issues of MIS during 1982 to 1983. Due to fluctuations the number of participants in the Delphi process varied from 52 to 102. The Delphi approach is especially appropriate for exploratory and qualitative research. The ranking of the issues (Appendix A2) was not subject to major changes during the four rounds of the Delphi process. Since this research can rely on the information gathered during several previous studies, the drawbacks of the Delphi approach (e.g. not randomized sample, long time span, decreasing sample over time) outweigh its advantages.

Jerome Kanter (1986) asked 80 MIS executives from corporations and institutions throughout the U.S. on their attitudes on 15 issues between 1984 and 1985. The result was a list which showed the importance and perceived performance of each issue (Appendix A3 and A4).

Herbert and Hartog (1986) conducted the most recent survey in 1986. They asked the respondents to indicate the importance of 23 issues on a four point Likert Scale (Appendix A5).

Martin and Doll took much different approaches. Martin conducted in depth interviews with 15 chief MIS or data processing executives of sizable businesses in 1981 (Martin 1982). He unearthed seven factors which are important to the success of a MIS. Through field studies in 33 organizations Doll identified how the ways in which firms have managed

their MIS have influenced their success. He suggests six tentative guidelines for how top management and the MIS manager might improve the management of the MIS activities. The results of both studies are neither comparable with former studies nor with the following findings of this research.

3.2.2. Findings on Importance

The importance rankings of this study are presented in table 3. The results show that chief MIS executives ranked the alignment of MIS with business goals and user involvement in systems analysis, design and implementation significantly higher than all other issues. Both issues are very much intertwined. Aligning MIS with business goals means that MIS are integrated into the overall business strategy.

At a time when competitive pressures are squeezing many companies, MIS managers are concentrating on the strategic aspects of MIS to support business objectives defined by management. Aligning MIS and business goals reflects the strategic direction setting by top management while user involvement focuses on the more technical aspects of implementing the MIS strategies.

The involvement of users in the system development process is indispensable for successful information systems. Only they know which information is required and the value of the information provided. Users are the core of a

functioning MIS. After the strategic aspects of MIS have been managed by linking MIS and the corporate strategy, users must be involved in the selection and implementation of the systems needed to achieve the strategic plans.

Table 3. Ranked Importance of MIS Issues

	Importance	
	Mean	Standard Deviation
User involvement	6.22	0.82
Alignment of MIS	6.18	0.93
Data quality	6.01	0.92
Communication with top management	5.86	0.90
Education of end-users	5.75	1.03
Increasing productivity	5.73	1.03
Top management defining goals	5.70	1.22
Telecommunications	5.65	1.03
Long range MIS planning	5.62	1.10
Prioritization of system development	5.59	1.03
Recruit, train DP staff	5.58	0.98
MIS manager	5.54	0.97
Data security	5.39	1.18
Efficient data use	5.32	0.95
Educating top management	5.29	1.08
Integrating technologies	5.26	1.03
Measuring MIS effectiv.	5.13	1.08
Software development	5.07	1.29
IS learning and usage	4.94	1.11
End-user computing	4.93	1.12
Decision support systems	4.62	1.27
Office automation	4.47	1.11
Information centers	4.22	1.29

Ranked next in importance are data quality and communications with top management. Given the top rankings of MIS alignment and user involvement, the importance of communicating MIS's role and its potential contribution to senior management is a logical step. Increasingly, MIS management seeks to coordinate key decisions about information techno-

logy with corporate strategic and tactical objectives.

Good communication with top management is considered a prerequisite to direct MIS activities toward the attainment of business objectives. Many MIS managers focus apparently on corporate strategic plans to inform top management better about the business consequences of the MIS function.

Data quality is also regarded as a crucial issue, since not the quantity of the data is decisive, but its informational value to the decision maker (user). Data quality which is somewhat neglected by empirical research, makes the difference between a vast amount of unread paper and the use of MIS for the competitive advantage of the firm (Kahn 1983). It is the major discriminant between effective and ineffective systems and thus of high importance for MIS success.

Increasing productivity is rated sixth and contributes directly to MIS effectiveness and efficiency (Coombes 1986). The high rating of productivity is understandable considering that it represents one of the main tasks of MIS managers.

Telecommunication also has a quite high ranking although it is a rather technical issue. This indicates the role of MIS not only processing data and providing information but also disseminating and communicating information throughout the organization. Providing information, data analysis, and communicating analytic results are combined to information -

communication applications. To explicate the expanded character of MIS the term Information Technology (IT) is now sometimes used instead of MIS. Long-range planning, prioritization of system development, and recruiting and training of data processing staff are rated at the position nine to eleven. They embody all tactics to support superior objectives and MIS success. The low ranking of long-range planning is noteworthy as it was considered a main issue of MIS in older studies.

At the bottom half of the ranking three groups of topics can be found: a) Issues which contribute to the success of MIS, but apparently at a relatively low level are efficient data use (14), educating top management (15), integrating technologies (16), measuring MIS effectiveness (17), and organizational learning and information system usage (19). b) Narrowly focused items include the role of the MIS manager (12) and data security (13). c) Issues of reduced importance as they lose their actuality and are commonly incorporated in MIS also have low rankings, such as decision support systems (21), office automation (22), and information centers (23).

Software development and end-user computing rank surprisingly low. MIS managers attribute a minor importance to system development probably because most firms have reached a status where they have a relatively well established MIS and do not need to develop many new strategic

applications but concentrate more on detail improvement and maintenance. Further, the increased reliance on outside software packages reduces the need for in-house software development.

Overall, three of the four highest ranked issues comprise a strategic view of a MIS function oriented toward business objectives. MIS executives, traditionally thought of as good technical leaders, portrayed themselves in the survey as part of the corporate top management team. Consequently, the top issues reflect an emphasis on MIS effectiveness instead of efficiency.

3.2.2.1. Longitudinal Comparisons

Compared to past research significant changes can be found while other issues remained stable. Unfortunately, there are no data to compare the longitudinal changes of the issue rated most crucial, user involvement in system development. Table 4 gives a summary of the ranking of the issues compared to past studies.

The comparison with previous studies shows that the relevance of end-user computing is considerably decreasing over time from rank two in 1984 to rank 20 in this study. The precipitous fall of end-user computing suggests that the "end-user revolution" is either over or has not yet reached the real world in the anticipated volume.

Even more interesting is the reversal of the positions

of long range planning and alignment. The alignment of MIS with business goals has stabilized at a high level (2) after constantly increasing over the last years while long-range planning (9) fell steadily.

Table 4. Comparison of Rankings with Previous Studies

	Ranks				
	1988	1986	1984	1982	1980
User involvement	1				
Alignment of MIS	2	1	4	7	
Data quality	3	9			
Commun. with top mgt.	4		1		
Education of end-users	5		7		8
Increasing productivity	6	5			
Top mgt. defining goals	7				
Telecommunications	8	8	2	3	3
Long range MIS planning	9	6	3	1	1
Priorit. system develop.	10		9		
Recruit, train dp staff	11	13	6	8	7
MIS manager	12				4
Data security	13	11	5	14	12
Efficient data use	14	2		9	
Educating top management	15	3			
Integrating technologies	16	6		3	
Measuring MIS effectiv.	17			5	2
Software development	18	4		4	13
IS learning and usage	19			6	
End-user computing	20	12	13	2	
Decision support systems	21	16	12	10	5
Office automation	22	10	11	12	6
Information centers	23	14			

This suggests that alignment has replaced long-range planning as the key issue for MIS management. As MIS is performing increasingly well and the technology is better understood, the focus changes from managing the MIS department (long-range planning) to supporting business objectives (alignment). This finding is logical in light of the

critical success factor analysis which shows the pivotal role of alignment compared to a subordinate role of long-range planning for MIS success.

Educating top management (15) seems to have been a fad while the involvement and education of end-users (5) has gained high importance. Both developments are in line with the findings of the critical success factors analysis. The lower rating of telecommunications (8) can be explained with the adaption to the new environment after the deregulation of telecommunication. The decreased importance of recruiting and training (11) indicates that the shortage of data processing personnel is less severe.

The ranking of efficient data utilization (14), integration of technologies (16), measuring MIS effectiveness (17), software development (18), decision support systems (21), and office automation (22) has also decreased considerably. This reflects the general shift from a technical to a more strategic focus of MIS executives.

3.2.3. Findings on Performance

As the analysis of the standard deviations shows, the performance ratings of the different issues vary more than the importance. Obviously, the consensus regarding the importance of the issues is relatively large while the actual performance varies substantially with the specific environment of the industry and the individual firm.

The best performance is achieved with user involvement in the system development process. This suggests that the companies have generally comprehended the worth of involving users in system development and have taken the appropriate actions to facilitate the necessary user involvement.

The performance ratings on the next six issues, data security, recruiting and training of data processing staff,

Table 5. Ranked Performance on MIS Issues

	Performance	
	Mean	Standard Deviation
User involvement	5.35	0.97
Data security	5.06	1.28
Recruit, train dp staff	5.04	1.05
Prioritization of system development	5.04	1.27
Data quality	5.02	1.13
Telecommunications	5.00	1.30
MIS manager	4.97	1.11
Communication with top management	4.85	1.40
Alignment of MIS	4.80	1.11
Increasing productivity	4.73	1.14
Software development	4.73	1.04
Education of end-users	4.71	1.13
Long range MIS planning	4.59	1.47
Top mgt. defining goals	4.54	1.49
End-user computing	4.42	1.30
Integrating technologies	4.41	1.27
Office automation	4.40	1.20
Information centers	4.40	1.39
Efficient data use	4.39	1.16
IS learning and usage	4.28	1.06
Measuring MIS effectiv.	4.13	1.29
Educating top management	3.88	1.43
Decision support systems	3.86	1.37

prioritization of system development, data quality, telecommunication, and the role of the MIS manager are rated very close together. Except for data quality the performance on

these more technical issues is largely in line with the assigned importance.

Besides software development the issues rated 8 to 14 are generally of adequate performance, but of much higher importance. They include communication with top management, alignment of MIS with business goals, increasing productivity, software development, education of end-users, long-range MIS planning, and top management involvement in the definition of MIS goals.

At the bottom of the performance rating are mainly issues whose importance is also relatively low. Thus, the low performance ratings of the management of end-user computing, integrating technologies, office automation, information centers, efficient data utilization, organizational learning and information systems usage, and decision support systems are in line with presumed requirements. The only exceptions are measuring effectiveness and educating top management which show a very low performance compared to the assigned importance.

3.2.4. Analysis of Performance According to Strategic Impact, Industry, and Sales

The MIS executives were asked to classify their companies according to sales volume, industry, and the strategic impact of MIS on the company. The following section investigates to which degree these organizational variables

influence the performance of MIS on certain issues.

3.2.4.1. Classification According to Industries and Sales

Companies of different industries or sales volume exhibit a relatively uniform performance on the MIS issues. Conducting ANOVA analysis shows that there are no differences at a significance level of $\leq .05$. Additionally, the existing differences outweigh each other so that on average there are no major trends for the performance in different industries (Appendix 6).

3.2.4.2. Classification According to Strategic Impact of MIS

A company's placement in the matrix of strategic impact of MIS influences not only the required method of MIS planning, but also has implications for the role of the MIS issues in a company. In organizations where the impact of MIS is low, top management guidance is much less important than in those where the impact is strategic.

The classification according to the strategic impact of MIS on the companies (table 8) leads to interesting results. They support impressively the four grid matrix developed by McFarlan, McKenney and Pyburn (1983), irrespective of the fact that firms with a factory environment can not be analyzed due to the small number of firms in this category (3).

Table 6. Performance for Different Strategic Impact of MIS

Strategic Impact	Performance			
	Strategic	Turnaround	Factory	Support
User satisfaction	3.71 ¹	3.22 ¹	3.00	3.50
Effectiveness	3.89 ¹	3.43 ¹	3.33	3.50
Efficiency	4.17	3.80	4.33	3.92
Alignment of MIS	5.20	4.57	4.67	4.33
Efficient data use	4.51	4.26	5.67	4.08
Educating top management	4.14 ¹	3.91	4.33	2.92 ¹
Education of end-users	5.03	4.37	5.00	4.67
Recruit, train dp staff	5.17	4.94	5.00	4.92
Increasing productivity	5.09	4.49	5.00	4.33
Long range MIS planning	4.80	4.49	4.67	4.25
Integrating technologies	4.71	4.25	5.00	3.83
Telecommunications	5.23	4.74	5.00	5.08
Data quality	5.34 ¹	4.57 ¹	6.00	5.17
Data security	5.49 ¹	4.70 ¹	5.67	4.58
Office automation	4.49	4.34	4.67	4.25
End-user computing	4.60	4.14	4.67	4.67
User involvement	5.45	5.25	6.00	5.17
Top mgt. defining goals	4.66	4.66	5.00	3.75
Commun. with top mgt.	4.97	5.00	5.00	4.00
Information centers	4.54	4.22	3.67	4.67
Decision support systems	3.86	4.00	5.00	3.17
Priorit. system develop.	5.31	4.82	5.67	4.67
Measuring MIS effectiv.	4.25	4.02	4.33	4.00
MIS manager	5.26	4.71	5.33	4.75
IS learning and usage	4.34	4.17	5.33	4.16
Software development	5.14 ¹	4.42 ¹	5.00	4.33
Average	4.74	4.37	4.86	4.26

The MIS success in terms of user satisfaction and effectiveness is significantly higher for firms in an strategic MIS environment than for those in a turnaround environment. Companies for which current applications are crucial to business success perform better than those which are on the turning point to an increased strategic import-

¹ indicates pairs which are different at a significance level of $\leq .05$.

ance of their MIS. This finding is also supported by the significantly higher ratings for software development, data security, and data quality in firms which depend on the smooth operation of existing systems as these factors are generally highly related to the MIS success measures.

The average performance for firms which are critically dependent on the functioning of current MIS is higher than in those which are not so dependent on it. This expresses the different degrees of strategic impact of MIS very accurately since firms which do not depend on MIS for business success do not need as sophisticated information systems as those for which MIS is crucial.

Further, top management involvement in the definition of MIS goals and communications with top management receive higher ratings in firms with a strategic or turnaround role of MIS than in those where MIS has a support role. This finding concurs exactly with the statement of McFarlan, McKenney and Pyburn that the high impact of new applications requires this kind of top management involvement.

The results give strong support to the four grid matrix of strategic impact. It should receive more attention of future empirical research on the specific implications of the strategic position of MIS on its management.

3.3. Main Problems with MIS

To analyze the problem areas of MIS, the importance ratings are subtracted from the performance ratings. The resulting performance differences are weighted with the assigned importance since a under-performance on an important issue is more crucial than on an irrelevant one.

The results of this calculation are shown in Table 6. It shows very clearly which areas require additional management attention to bring performance in line with importance ratings of MIS chief executives.

Table 7. Ranked Problems with MIS

	Performance Mean (1)	Importance Mean (2)	Diff. (1-2)	Weighted Gap (1*3)
Alignment of MIS	4.80	6.18	-1.38	-8.53
Educating top management	3.88	5.29	-1.41	-7.46
Top mgt. defining goals	4.54	5.70	-1.16	-6.61
Education of end-users	4.71	5.75	-1.04	-5.98
Data quality	5.02	6.01	-0.99	-5.95
Commun. with top mgt.	4.85	5.86	-1.01	-5.92
Long range MIS planning	4.59	5.62	-1.03	-5.79
Increasing productivity	4.73	5.73	-1.00	-5.73
User involvement	5.35	6.22	-0.87	-5.41
Measuring MIS effectiv.	4.13	5.13	-1.00	-5.13
Efficient data use	4.39	5.32	-0.93	-4.95
Integrating technologies	4.41	5.26	-0.85	-4.47
Telecommunications	5.00	5.65	-0.65	-3.67
Decision support systems	3.86	4.62	-0.76	-3.51
IS learning and usage	4.28	4.94	-0.66	-3.26
MIS manager	4.97	5.54	-0.57	-3.16
Priorit. system develop.	5.04	5.59	-0.55	-3.07
Recruit, train dp staff	5.04	5.58	-0.54	-3.01
End-user computing	4.42	4.93	-0.51	-2.51
Data security	5.06	5.39	-0.33	-1.78
Software development	4.73	5.07	-0.34	-1.72
Office automation	4.40	4.47	-0.07	-0.31
Information centers	4.40	4.22	+0.18	+0.76

The performance ratings both on technical and strategic issues are generally lower than the corresponding importance ratings (only exception: information centers). This indicates that many problems of MIS are still not completely resolved and MIS is lacking behind the role it actually should play. Because of the enhanced strategic role of MIS which was explained above, the demand for MIS services increased rapidly while the performance of the MIS department could not keep pace with the ever increased requirements.

The biggest gap occurs with the alignment of MIS with business goals. On this issue, which is critical to the success of MIS (see below), the current performance is by no means sufficient. Useful ways to enhance the linking of MIS and business strategies are the incorporation of MIS in the overall business strategy (Tozer 1986b). It is helpful to communicate the business objectives down to MIS and translate them into MIS strategies.

The next two issues show the same pattern. Education of top management is a precondition that it understands the capabilities and uses of MIS and can be involved in the definition of MIS' objectives. Interestingly, both factors are not critical to MIS success so that the perceived performance gaps are not really critical. There is obviously a mismatch between the perceived and the actual problems of MIS which will be discussed in greater detail below.

The following three gaps in educating end-users, data-quality, and communication with top management are almost identical in size. At the ranks 7 to 9 follow long range MIS planning, increasing productivity and user involvement. They all exhibit the same pattern as the top three by emphasizing the strategic aspects of MIS. Obviously, there is a widespread lack of strategic guidance and coordination from the top management level while the technical issues appear typically to be of subordinate relevance.

Evidently, there has been a major shift of the direction of MIS from a technical to a strategic focus. Due to the relative newness of this development the accomplishments in this area did not keep pace with the change of the focus of MIS. Consequently, the strategic area lack adequate performance while the technical aspects show generally sufficient results.

This suggests that improved goal definition and strategy setting can contribute much more to better MIS operations in terms of effectiveness and efficiency, than the concentration on hardware, software or organizational issues.

3.4. The Critical Success Factors Method

The concept of critical success factors was introduced by John F. Rockart as an approach to defining the information needs of chief executives (Rockart 1979):

Critical success factors .. are, for any business, the limited number of areas in which results, if they are satisfactory, will ensure competitive performance for the organization. If results in these areas of activity are not adequate, the organization's efforts for the period will be less than desired. As a result, the critical success factors are areas of activity that should receive constant and careful attention from management.

This concept of critical success factors was originally designed by Rockart for the chief executive of an entire organization. Since it is equally applicable to any managerial activity within an organization, this thesis applies it to the Management Information Systems of a company. The critical success factor concept is equally important to top management, since several of these critical activities are not under the control of the MIS manager, but depend heavily on the top management of the company. It is operationalized by testing the statistical significance of a possible relationship between the three measures of MIS success and the various factors.

3.5. Findings on Critical Success Factors

In this chapter the results of the statistical tests are summarized. First, the stated hypotheses stated are tested. Then, additional relationships between critical success factors and MIS success are presented to obtain a complete overview of the relevant critical success factors.

3.5.1. Tests of Hypotheses

After a review of both empirical and conceptual literature 11 hypotheses were stated before the analysis of the data. The results of the testing of the hypotheses are reported in the following section to establish critical success factors.

3.5.1.1. Aligning MIS with Business Goals

The review of the concept of systems has shown that it is critical for the effectiveness of an overall system that the objectives of all subsystems are aligned to the superior objectives of an organization. Since Management Information Systems are a subsystem of a company it is pivotal that the objectives of the MIS support the company's goals. To be effective, the information system plan must be linked to the business strategy (Tozer 1986, Hoehn 1986). This link is two-way. Changes in business direction must be reflected, but also existing decision support systems may provide valuable planning assistance for future business cycles.

Increasingly, business activities will be constrained by what is possible in information technology (Rockart and Scott Morton 1984). Plans must be made to assure harmony between the organization's information needs and the MIS service capabilities (Tozer 1986, Flynn 1987). There should be a general framework of overall goals and directions which are transformed into specific quantifiable goals. These represent measurable factors which can be used to assess the degree of success which is being achieved in meeting the objectives (Stivers 1987). The empirical evidence reflects the importance of aligning business and MIS objectives for MIS success (Herbert and Hartog 1986, Kanter 1986, Ball and Harris 1982, Martin 1981).

Hypothesis 1. Thus, it is hypothesized that companies, in which the objectives of MIS and the entire company are highly aligned, have more successful MIS systems.

The relationship between the alignment of MIS with business goals and the three success measures is highly significant. The chi-square tests show significance levels of $\leq .0001$ for user satisfaction, $\leq .00001$ for effectiveness, and $\leq .05$ for MIS efficiency.

It is interesting to note that the relationship between the strategic success measures and alignment of MIS is much stronger than that with the operational success. This can be explained by the fact that the linkage of MIS and business objectives directly improves the strategic success by

setting the right direction. In contrast, the efficiency is much more affected by the intra-departmental operations of the MIS function so that top management guidance is less crucial.

The reasoning for the weight of goal alignment has been discussed in detail above. Therefore, aligning MIS with business goals qualifies as a causal critical success factor of MIS success.

3.5.1.2. Long-Range MIS Planning

All organizations need to plan. Correspondingly, they all need to plan their information systems in some form or another. While the need for business planning is widely recognized, the long-term planning of MIS is often not done properly (Potter 1987). Because of the rapid technological changes long-term planning for MIS seems to be especially important to take advantage of these changes in a way as to make changes as smoothly as possible (Rockart 1984, Thiel 1984). This overlaps with several of the other critical success factors. The perceived importance of long-term planning is also well established by empirical data (Herbert and Hartog 1986, Kanter 1986, Dickson, Leitheiser and Wetherbe 1984, Ball and Harris 1982, Martin 1981).

Hypothesis 2. It is hypothesized that businesses with high scores in long range planning have more successful MIS.

The testing of this hypothesis yields a most remarkable

result. The performance on long-range planning has a significant relationship only to the satisfaction of user needs (significance $\leq .05$) while the links to effectiveness and efficiency are not significant.

This finding concurs also with the results of the above analysis of the importance rankings. MIS managers attributed a constantly decreasing importance of long-range planning for their MIS operations. Apparently, the long-term planning of the MIS department becomes less critical over time as the familiarity with current technology increases and future technological developments become less predictable. The focus of MIS managers shifted from the more technical perspective of planning the MIS function to aligning it with the other business functions. The critical issue is not how to do MIS, but what to do to support business success.

This leads to the conclusion that the environment of MIS is so dynamic that it does not allow reliable forecasts of future developments of hardware and software technology. Without these projections there is no dependable base for long-term MIS planning. Accordingly, its impact on MIS effectiveness and efficiency are not significant.

Contrary, the positive influence of long-range planning on the user satisfaction suggests that it is feasible to predict the future user requirements and to base the system development planning on the derived prognostications.

Hence, an independent long-range plan of MIS itself

might be of subordinate importance. However, it is worthwhile to draw from already existing corporate long-term plans and to base the system development plans on those plans. This conclusion is validated by the fact that the performance on software development is significantly correlated with long-range planning (significance $\leq .0001$), and software development, in turn, shows a high impact on the meeting of user needs (significance $\leq .05$, see below).

3.5.1.3. Long-Term Funding Commitments

Funding commitments are a key mechanism of top management control. Effective MIS development is thought to require long-term financial commitments to acquire hardware, software and MIS staff (Radice 1987). Long-term funding provides the MIS function with a stable environment to plan new applications and systems. Empirical studies indicate that this may enhance MIS' effectiveness and efficiency in systems development (Doll 1985).

Hypothesis 3. It is hypothesized that companies in which top management gives long-term funding commitments to provide stable funding for system development activities, have more successful MIS.

The t-tests show that long-term funding commitments have no significant impact on the success of MIS. This finding is not surprising considering the low relevance of long-range planning for MIS success.

In an environment where long-range planning is more or less irrelevant, long-term funding commitments have correspondingly no importance as a base for this planning. Thus, it can be concluded that long-term funding commitments, though pleasant for the MIS manager, are not critical for MIS success.

3.5.1.4. Top Management Involvement in Defining MIS Objectives

The planning of MIS and overall business should be coordinated to insure that MIS activities are directed toward the achievement of primary organizational goals. Only senior management has the information and overview to set the appropriate priorities and directives (McAulay 1987, Thiel 1984, Willoughby 1977). Although top management is usually thought to do the overall and strategic management of a corporation (Wheelen and Hunger 1986), most literature in the MIS area regards more high level management interference as crucial for MIS. Top management action is considered necessary to establish MIS goals and standards, commit resources, assign responsibilities, monitor performance, and coordinate the information processing efforts (Radice 1987). The presumed importance of top management involvement in MIS planning as a factor is supported by empirical evidence (Doll 1985, Dickson, Leitheiser and Wetherbe 1984, Benson 1983).

Hypothesis 4. It is hypothesized that in organizations where top management involvement in defining MIS objectives is higher, the success of the MIS is greater.

Most interestingly, this hypothesis could not be empirically validated either. There is no statistically significant difference between any of the three MIS success measures and top management involvement in the definition of MIS goals. This finding is especially noteworthy as MIS chief executives attribute a relatively high importance ranking (7) to this issue and its performance gap is among the highest (3).

This result concurs with the finding on long-range planning. Apparently, top management guidance is only needed to define the general business direction and communicate it to the MIS group as a base for its planning. Involving top management in the more detailed definition of MIS does not contribute to the success of MIS. The reason for this surprising fact might be an insufficient proficiency of top management in MIS so that it cannot constructively support the definition of MIS objectives. Accordingly, the interference of top management in the MIS department should not exceed the its role in other departments but focus on the strategic direction setting.

3.5.1.5. Steering Committees

One way to facilitate consideration of top management goals is to have top level steering committees. They provide the MIS manager with access to top management and serve as a mechanism for top management guidance in shaping strategies and policies for the information system function. The responsibility of the committee is to allocate limited resources and to prioritize user requests in view of the organization's overall information needs (Stiver 1987). The committee is usually composed of representatives of senior management, MIS professionals and users. Empirical evidence shows that the use of an executive steering committee can enhance the success of MIS (Doll 1985) and influence the characteristics of the selected projects (McKeen and Guimaraes 1985).

Hypothesis 5. It is hypothesized that firms which use an executive steering committee as a vehicle for providing top management guidance of MIS have a more successful MIS.

This hypothesis must be rejected as the t-tests show no significant relationship between the existence of an executive steering committee and any of the MIS success measures. Even though steering committees are often mentioned in the literature as a way to facilitate the involvement of top management in MIS, they do not actually enhance MIS performance.

This outcome, although in contrast to most conceptual

literature, is in line with the above finding that top management involvement in detailed MIS planning is not related to MIS success but should be limited to the setting of general guidelines and strategies. Because of its superior technical know how the MIS function seems to be adequately prepared to manage its operations and planning without interference from outside. Even if these outside agents acquire some technical understanding through frequent engagement in MIS problems, like in steering committees, this is not adequate to promote MIS success.

Another possible explanation of this finding might be that steering committees are mainly introduced as a consequence of problems with MIS. If this is true, the usefulness of steering committees cannot categorically be dismissed because there might have been some improvement compared to the state before its introduction. This relationship can only be identified through a longitudinal study of particular firms which is beyond the scope of this research.

Even though the value of executive steering committees cannot be precluded with absolute certainty, the conclusion can be drawn from the preceding discussion and the consistency of the results that steering committees are not a critical success factor for MIS success.

3.5.1.6. Mutually agreed on Criteria for Prioritizing System Development

One of the most effective ways to involve top management is to develop together with MIS management a mutually agreed on priority scheme for project screening and selection. Only when there is mutual agreement on a set of criteria for deciding what to do first, the MIS department can be effective as an independent business within the business (Rockart and Gerrity 1986). The traditional gap between MIS and senior management can be bridged as each side increases its understanding of the priorities of the other side. Exchanging views with top management increases the MIS manager's appreciation of the needs for his unit to contribute to the company's operations rather than to limit his horizon on his own department. This view is also supported by some empirical evidence (Doll 1985).

Hypothesis 6. It is hypothesized that companies where MIS and top management have a mutually agreed upon set of criteria for deciding which application or systems to implement first, have a more successful MIS.

The existence of a mutually agreed upon set of criteria for the prioritization of systems development is also not instrumental to MIS success at a significant level. This shows again that top management involvement in the details of MIS is of minor importance for MIS success.

3.5.1.7. Measuring MIS Effectiveness

Another essential factor for effective management is the measurement of the performance of systems. Without information about a system's performance, control and management of the system is not feasible (Hodge 1984). Thus, all effective and efficient MIS need to have a performance measurement system. This factor, which was derived from the above discussion of systems, did not receive the appropriate attention in literature, perhaps it was assumed to be a matter of course. Performance measures to evaluate effectiveness and efficiency of a MIS must be established.

These measures are to be derived by the stated objectives of the MIS against which the actual performance is compared. Examples of such measures are efficient utilization of resources, adequate user service levels in terms of timeliness, accuracy, reliability, response time, downtime, and effective output.

Hypothesis 7. It is hypothesized that companies with good performances in measuring MIS effectiveness are more likely to have successful MIS.

The chi-square tests show that the measurement and evaluation of MIS effectiveness is an influential determinant of user satisfaction (significance $\leq .01$), MIS effectiveness (significance $\leq .05$), and especially efficiency (significance $\leq .0001$).

The measurement of MIS effectiveness provides an

important feedback instrument to evaluate the adequacy of current systems and their performance. Gaps of unmet information needs can be unearthed and current procedures of information procurement are constantly evaluated and optimized. The pivotal role of feedback is especially impressive when the relatively poor performance in this area is considered. There seems to remain much room for systems enhancement by introducing formalized and regular feedback procedures on MIS effectiveness. Thus, more management attention is to be directed to this issue by the MIS managers.

3.5.1.8. Charge-out of MIS Costs

The MIS function has historically been carried out in a centralized department to capture economies of scale and security. Although the degree of centralization will decrease due to the proliferation of end-user computing, most companies will keep a large centralized mainframe system (Rockart and Gerrity 1986, Dearden 1987). Charge-out of MIS costs is considered to be an important determinant of the success or failure of the MIS function through its effect on the user in terms of consumption of, involvement in, and satisfaction with, the MIS services (Rivard 1987).

The benefits of MIS costs allocation can be summarized as follows: individual users decide on their use of MIS services on the basis of what they are willing to pay for

the services. MIS services should be provided up to the point where the benefits of additional information do not exceed the costs. This cost-benefit analysis has to be done by the users and leads to optimal results if the prices charged represent incremental costs of IS services (Sircar et al. 1986, Andersen 1983). The charge-out of IS costs also helps to monitor IS costs within the IS department.

Because IS costs will be scrutinized by the users, cost efficient operations of the IS department itself can be ensured (Kull 1985, Hoffman 1984). As maximum capacity is approached, the charge-out system facilitates proper scheduling of the available capacity. Price incentives can help to redirect prime shift activity to other times (Willits and Lee 1985). A often mentioned benefit of charge-out systems is the increased participation of users in the IS operations. This leads to a better understanding of the capabilities of Information Systems and increases satisfaction with the services provided (Strassmann 1983, Olson and Ives 1982, Nolan 1977).

Hypothesis 8. It is hypothesized that companies which use a charge-out system for MIS costs, have more efficient MIS operations.

It is probably the most surprising result of this study that the hypothesized connection between cost charge-out and MIS success cannot be empirically validated. None of the t-tests shows any significant relationship between the MIS

success measures and the existence of a charge-out system for MIS costs.

This surprising result is in total contrast to the prevailing opinion in the literature. The reasons for this might be either that accounting does not provide relevant feedback information on the performance of MIS at all or that the way of charge-out might be inappropriate. The former view is advanced by some authors who stress the difficulties in quantifying the benefits of MIS (Lay 1985).

Given the large amount of literature on the subject of charging-out MIS costs to users and its convincing arguments it seems more likely that the actual problem lies in the design of the charge-out system. As many authors point out, just charging-out MIS costs, is not sufficient as a good feedback and motivation instrument (Gauntt and Grover 1985, Anthony and Reece 1983).

There are two basic methods of IS cost allocation: First, IS costs allocated from the corporate level as overhead to all departments, irrespective to actual usage, and second, allocation to user departments based on the actual utilization of IS services.

Determining the appropriate organization form must begin with a look at the standard growth pattern exhibited by most data processing departments (Davis-Stemp 1986). There are four basic phases of growth in the life of a data processing department, each with its distinctive applications and

managerial problems (Nolan and Gibson 1974, Nolan 1983a, King and Kraemer 1984). During the initiation and expansion phase the primary objective of senior management is to encourage the use of the new systems. Therefore, the MIS costs should not be charged to the users at all or be allocated as general overhead not related to the actual use. Since costs are not related to the use of information systems, the systems penetrate the organization more easily.

As long as this strategy is employed, the expense center approach is optimal to ensure efficient use of resources within the Data Processing department. However, this strategy does not promote efficient use of IS resources by the users. As the use of MIS resources is increasing, management becomes more concerned with the rapidly rising costs during the formalization and maturity phases (Gauntt and Porter 1985, Nolan 1983a). Management attempts to improve control measures and starts introducing charge-out systems to encourage a more efficient use of MIS. This strategy requires the profit center approach for the IS department.

In addition to be contingent on the company's stage in the systems' development cycle, allocation of costs can only be an important management tool to control the performance of the MIS department and the use of its services by the user departments if the allocated costs are both relevant costs and controllable by the charged departments. Only

then, are they a correct measure of the resources used by the center and improve comparability of their performances.

The major drawback of predetermined rates is that decisions on the utilization of the service based on full cost are not economically valid. Decisions should be based on incremental costs (Chan and Lam 1986). A marginal costing technique where costs vary with volume is a good pricing scheme. These incremental costs are relevant for short-term operating decisions, and the headache of assigning overhead costs is avoided (Wenk 1986).

Full cost pricing and predetermined rate pricing have distinctive disadvantages which can be avoided if variable and fixed IS costs are treated separately. A proper method of charge-out is to allocate fixed costs according to capacity requests and variable costs based on actual usage. This approach reflects incremental costs and therefore, allows optimal decision making by the user based on the relevant costs. To give the user maximum control over his MIS costs, it is important to charge him based on user units which he understands.

Considering these many contingencies on which a good charge-out system depends shows that the existence of charge-out alone does not sufficiently describe this complex problem. Thus, it does not appear justified to dismiss the usefulness of charge-out systems completely. However, it becomes clear that charging for information systems costs is

useful only if it is done in the right environment and in the right way. It certainly is an interesting area for future research to examine which, if any, charge-out systems promote MIS success.

3.5.1.9. User Involvement in System Analysis, Design, and Implementation

As discussed above, information derives its value from its impact on user's productivity or decision making. Only the user can gauge the significance of information since the value of information depends on a particular person's needs and desires. Consequently, it is indispensable that the users of information are involved in the analysis, the design and implementation of an appropriate information system. User involvement refers to participation of the user group in the system development process. User participation in systems development is predicted to improve systems quality by a more accurate assessment of user information requirement (Norton and McFarland 1975), providing expertise otherwise unavailable within the MIS group (Lucas 1974), and improving user understanding of the system (Lucas 1974, Robey and Farrow 1982). The improved chances of successful system implementation can be derived from the research in organizational behavior, including group problem solving, interpersonal communication, and individual motivation (Luthans 1985).

After the corporate organizational stage has been set, the MIS function should concentrate on its primary job, i.e. meeting information needs of users. It is almost unanimously accepted in literature that the MIS specialists need to acquire a knowledge of the business to combine with their computer expertise to do their job effectively. The user is responsible for specifying information requirements while the MIS professional is responsible for the actual project analysis, design and programming. A causal relationship between the influence of the user and the success of MIS is well established by empirical literature and is one of the axioms of systems development (Franz and Robey 1986, Baroudi, Olson, and Ives 1986, Ives and Olson 1984, Robey and Farrow 1982, Ein-Dor and Segev 1982, Ein-Dor and Segev 1978, Edstroem 1977).

Hypothesis 9. It is hypothesized that firms with high user involvement in the analysis, design and implementation of new systems are more likely to have successful MIS.

The chi-square tests results correspond directly with the above discussion of the literature reviewed to this issue. The relationship between user involvement and the satisfaction of user needs (significance $\leq .00001$) and effectiveness (significance $\leq .05$) are significant while there is no significant trend for efficiency.

Obviously, user involvement aids the process of defining the information needs of the users and thus contributes

greatly to the related success measure. However, the actual implementation of the system applications which depends on the quality and expertise of the system analysts and programmers, affects the effectiveness more than the participation of the users so that the relationship is less significant. The intra-departmental efficiency is not at all influenced by user involvement in the system development process. This explanation is validated by the very significant dependence of software development on the training of DP staff (significance $\leq .01$) and the influence of software development on MIS effectiveness (significance $\leq .01$) user satisfaction (significance $\leq .05$).

Consequently, it can be concluded in accordance with the literature that the involvement of users in the process of analyzing, designing and implementing new systems is extremely important for the development of applications, but that the actual design depends also on the quality of the DP staff.

3.7.1.10. Formal Procedures of System Development

The management of the system development process has often been cited as a problem with MIS. This area is crucial to success since systems development determines the MIS environment in which a company has to operate. Specific concerns include project selection, project management, responsiveness to user needs, and the timely development of

reliable and cost-effective applications. A systems life cycle approach is often recommended in literature as a mean to formalize this critical activity (Gordon, Necco and Tsai 1987). Benefits of a formalized systems development approach include enhanced management control and decision making, increased productivity, availability of more timely and more accurate information, and better record-keeping. It is generally accepted and empirically substantiated that a formal method of system development contributes to overall system success (Lees 1987, Martin 1987).

Hypothesis 10. It is hypothesized that companies which use formal procedures for systems analysis, design and development have more successful MIS.

T-tests on this issue show no significant differences of any MIS success measure contingent on the existence of formal procedures for system analysis, design, and development. While the software development still remains a pivotal factor of MIS success, formal procedures do not contribute to the effectiveness of the system development process.

With all caution which must be assigned to the fact that the null hypothesis could not be rejected, it seems to be appropriate to state that formal procedures of systems analysis, design and development do not enhance MIS success. The reasons for this might be that the advantages of a more systematic approach to software development are outweighed by its formalistic requirements.

3.5.1.11. Written Plans for System Development

Written plans for system development are widely seen as a prerequisite for effective management of system development activities (Stivers 1987). The strategies outlined by top management are to be transformed into specific action plans. The objective of such plans is to help management to understand where development activities are, where they are going, and what they cost. These plans define the prioritized business information needs which are directly related to the needs for running the business. The plans should cover all aspects of business information, service and support needs. They set application development priorities and develop strategies to support information systems development and operations (Tozer 1986). Empirical studies show that firms with written overall objectives have more successful MIS (Doll 1985).

Hypothesis 11. Thus, it is hypothesized that firms which have a written overall plan for systems development which 1) covers the major functional areas of the business and 2) clarifies the interrelationship between the applications have more successful MIS.

There is no significant relationship between the existence of written plans for systems development and the success of MIS. Obviously, the coordination of systems development can also be done successfully in another manner than by preparing a written overall plan. As the importance

of prioritizing system development for strategic MIS success shows (significance $\leq .05$) this factor is crucial, but the way of carrying it out is rather changeable. Accordingly, written overall plans for systems development are not critical success factors for MIS success.

3.5.2. Other Findings on Critical Success Factors

As can be seen in table 8, there are basically three groups of factors which influence MIS success. There are five factors which show a significant relationship to all three measures of MIS success. A group of eight factors has a significant impact only on the strategic measures of MIS success, i.e. the satisfaction of user needs and effectiveness. Sixteen factors influence only one or none of the success measures and thus carry a smaller weight.

The factors of the first two groups are discussed in further detail to establish additional critical success factors of MIS success.

3.5.2.1. End-User Computing

Two main trends have paved the way for end-user computing. First, there is a shift of the focus of information technology. While the technology in the earlier days served the paperwork- or data-processing needs of accountants and operational supervisors in a firm, the current end-user capabilities focus on information, problem solving, and

communication needs of a corporation's decision makers
(Rockart and Gerrity 1986, Rivard 1987)

Table 8. Significance of Factors Influencing MIS Success²

	User Satisfaction	Effective-ness	Efficiency
Data security	0.00001	0.01	0.05
Recruit, train dp staff	0.001	0.0001	0.05
End-user computing	0.01	0.01	0.05
Measuring MIS effectiv.	0.01	0.05	0.00001
IS learning and usage	0.00001	0.0001	
Information centers	0.00001	0.001	
Data quality	0.00001	0.001	
Integrating technologies	0.00001	0.01	
User involvement	0.00001	0.05	
Alignment of MIS	0.001	0.05	
Efficient data use	0.01	0.05	
Software development	0.05	0.01	
Priorit. system develop.	0.05	0.05	
Office automation	0.00001		
Increasing productivity	0.01		0.01
MIS manager	0.01		
Decision support systems	0.05		
Long range MIS planning	0.05		
Education of end-users		0.05	
Telecommunications		0.05	
Commun. with top mgt.			0.05
Top mgt. defining goals			
Educating top management			
Charge-out of MIS costs			
Criteria for system dev.			
Long-term funding			
Steering committee			
Written overall plan			
Formal system analysis			

Second, with the greatly enhanced performance and reduced costs of computer hardware and software, the economics of information technologies are changing. Micro

² A blank indicates that the relationship is not significant at a level of $\leq .05$.

and personal computers have already made users largely independent of mainframes, and future developments in software will do the same for software support, as well (Dearden 1987).

End-user computing helps to eliminate the dissatisfaction of users with information systems. Users are in the best position to assess the relevance and priority of applications, to control the interface between computerized and non-computerized information systems, and to react quickly to changes (Henderson and Treacy 1986).

However, there are some potential problems, such as to ensure compatibility of hardware and software, prevent duplication of systems and databases, ensure integrity and consistency of information, and to maintain computer linkages between the different users. Thus, the management of end-user computing has become a delicate task which is critical to the strategic success of MIS (significance $\leq .01$) as well as to its operational success (significance $\leq .05$).

The key to successful management of end-user computing lies in the development of a set of policies, standards, and guidelines. They ensure a standard technical and management environment and yield other benefits: volume hardware discounts from vendors, standard hard and software which allows for standardized education programs, and the capability to connect the stand-alones to a network (Rockart and Flannery 1983).

3.5.2.2. Organizational Learning and Information Systems' Usage

Successful implementation of a technology requires individuals to learn new ways of performing intellectual tasks. As this learning takes place, changes in the information flows as well as in individual roles occur.

It is important to motivate information system users to experiment with and thereby learn new capabilities of MIS to encourage efficient use of the provided information resources. Experimentation by the user can unlock creativity and stimulate new approaches to troublesome problems. Systems developed by the MIS function have to overcome more resistance in adoption than those initiated by the users themselves (Cash, McFarlan and McKenney 1983). Therefore, user participation becomes a crucial factor in the entire process of system development (see above).

The performance on organizational learning and information system usage is very significantly related to strategic MIS success (significance $\leq .0001$). Organizational learning was identified and described by Lewin (1958) and Schein (1961) as a process of unfreezing, moving and refreezing again. Nolan and Gibson (1974) translated this theory into a "four stage process" characteristic for the start of any new technology. This approach emphasizes the different strategies of organizational learning depending on the stage of the organization in the four stage process.

In developing solution strategies to behavioral problems associated with implementation of new systems, it seems logical to draw from Organizational Development (OD), a field whose entire focus is on implementing organizational change (Luthans 1985). It can be applied to information system design, implementation, and modification (Desanctis and Courtney 1983). A basic tenet of OD is that the method used to implement change is the primary variable influencing the acceptance of change (Bostrom and Heinen 1977a and 1977b). The way in which a system is implemented is thus vital to system acceptance and use.

3.5.2.3. Information Centers

An information center is a "centrally located group of personnel, distinct from the Information Systems staff, to whom users can come for guidance and support concerning the selection and use of appropriate hardware, software and data" (Gerrity and Rockart 1986). The purpose of the information centers is to act as a connection between end users and data processing (Sumner 1985, Guimaraes 1984, Nofel 1984). Users know what information they need, and data processing knows how it can be obtained. The information center brings the two together, training and supporting end-users until they are self-sufficient in computing skills (Dickie 1984, Abbott 1985, Oglesby 1987a, Kutnik 1985).

The information center coordinates and controls user

services, devices and programs (Bracy 1984). Ideally, they offer not only training programs but also help managers to evaluate new hardware and software, planning local area networks and electronic mail systems. (McCartney 1987, Oglesby 1987b)

The Chi-Square tests show that information centers are significantly related to strategic MIS success in terms of user satisfaction (significance $\leq .00001$) and effectiveness (significance $\leq .001$). Their importance is increasing because the proliferation of end-user computing requires some kind of user support as it is provided by information centers (Mills 1984, Thomas 1985, Petruzelli 1984). The performance of end-user computing is highly related to the performance on information centers. They make also a major contribution to organizational learning and information systems usage. Having identified a need, a user can go to a facility solely dedicated to helping him or her, and needs not go through the MIS department and become a part of the existing backlog (Morse and Chait 1984).

Thus, properly managed, an information center provides an organization with improved computer literacy, job productivity, use of information, data processing/end-user relations and a reduced data processing backlog and is critical to strategic MIS success.

3.5.2.4. Efficient Data Utilization

Efficient data utilization has become even more crucial in the light of the expanded role of MIS to support routine and strategic decisions. Even if a system does not impact on decision performance in measurable ways, it affects users' information acquisition and their usage behavior (King and Rodriguez 1978). Since a user of a new system, through his usage, has altered his behavior, an assessment of MIS value must be made in more substantive terms. The assessment may be made in terms of whether the system has motivated the user to assess the choice situation more systematically, or to use a particular decision model.

Efficient data use is significantly related to the satisfaction of user needs (significance $\leq .01$) and effectiveness (significance $\leq .05$), but not to efficiency. As data utilization is the ultimate goal of MIS, this finding is not astonishing.

It is obvious that MIS success depends on the MIS organization successfully delivering data processing services. However, to effectively utilize the data provided, the user must also be willing and capable of using them. The efficient use of the output of the information systems department is hampered by the tendency of top level managers to prefer verbal media over formal reports and quantitative documents (Mintzberg 1972).

3.5.2.5. Integrating Technologies

Management of data processing can no longer be considered an isolated concept. The technologies of computing, telecommunications, and office automation must be thought of in aggregate.

The performance on integrating technologies has a highly significant relationship to the strategic MIS success measures, satisfaction of user needs (significance $\leq .0001$) and effectiveness (significance $\leq .01$). The three technologies must be viewed as a whole because of the enormous level of physical interconnections between these three technologies and their very similar management problems. To ensure a proper management of the integration process, a program toward the merging of the "islands of technology" must be developed. It serves as a guide to balance the desires for a centralized against the advantages of a decentralized approach, and ensures that the different technologies are guided in an appropriate way (Cash, McFarlan, and McKenney 1983).

3.5.2.6. Prioritization of System Development

Top management and MIS leaders are constantly urged to improve the way in which they manage their system development efforts. An effective way to improve its output is the prioritization of the system development.

The prioritization process includes assessing from

management's viewpoint the implications of the set objective and identified critical success factors of business success on information system development priorities. The priorities of system development must be assigned according to the impact of the applications on the business success of the organization. The BSP (Business Systems Planning) method of IBM or the critical success factors technique are useful antecedents of the system prioritization process to determine the strategic relevance of information needs.

The main products of the prioritization phase are: a definition of specific, urgent actions required, a prioritization of the information needs and application processes, and a statement of direction for hardware, software, and other required technology items (Tozer 1986).

The transition from a business focus on objectives and critical success factors to system definition and prioritization is a difficult process. It relies heavily on the technical expertise, systems knowledge and business understanding of the design team (Rockart and Crescenzi 1984).

The prioritization of system development is a crucial factor contributing significantly to strategic MIS success (significance $\leq .05$). The reviewed literature supports that it qualifies as a critical success factor for MIS success.

3.5.2.7. Recruiting and Training of Data Processing Staff

Obviously, a necessary prerequisite to accomplish any goal is to have competent people. With sophisticated software and creative applications playing increasingly critical roles in the computer field, it is more important than ever to recruit and retain data processing talent. The ever more dominant, but unpopular maintenance work of already existing systems makes it especially difficult to maintain a high degree of employee satisfaction.

Hence, it is no surprise that recruiting and training of data processing staff has a very significant impact on the user satisfaction (significance $\leq .001$), effectiveness (significance $\leq .0001$), and efficiency (significance $\leq .05$).

Yet maintaining a competent staff is very difficult in the light of high turnover rates and chronic shortages of experienced data processing personnel (Bartol 1983). Thus, there are two main areas for human resource development in the MIS department: recruiting and retaining qualified staff and the professional development of the personnel.

Research shows that turnover is significantly related to job satisfaction (Mobley et. al. 1979), organizational commitment (Atchison and Lefferts 1972, Porter, Crampon, and Smith 1976, Porter, Steers, and Mowday 1974), perceived organizational reward criteria (Hall 1968, Kerr, von Glinow, and Schriesheim 1977), and professionalism (Kerr, von Glinow, and Schriesheim 1977).

Job satisfaction refers to the feeling of the employees about their work environment including work, supervision and pay. Organizational commitment addresses the degree of an individual's identification with and involvement in the organization. It involves the belief in and acceptance of the organization's goals and values, the desire to expend effort on the behalf of the organization and the willingness to remain in it. The reward criteria are to give significant weight to professional behavior. This is particularly relevant to the data processing field, where labor market pressure can lead to the hiring of less experienced employees at salaries that are higher than those of already existing employees.

Professionalism is characterized by a desire of the employee for professional autonomy, commitment to and identification with the profession, high ethics, and a belief in the collegial maintenance of standards. The development of professionalism is especially important in the MIS environment as the continuous change of technology requires a constant learning process on the part of the system analysts and programmers. The major qualification of successful systems is a solid business perspective of the MIS staff. Mutual interchange of people between MIS and operating department is a good way of developing an understanding of each other's activities.

3.5.2.8. Software Development

The management of system development projects has often been a problem, with high costs and time overruns being frequently reported.

After the business requirements and priorities of information needs are defined, specific hardware and software must be chosen. The strategy of the software development phase includes an overall systems development plan which specifies how the applications are to be grouped into projects, their implementation sequence, and their needs for resources. This area, which is the "bread and butter" business of the MIS function, contributes to the satisfaction of user needs (significance $\leq .05$) and effectiveness (significance $\leq .01$) at significant levels.

Software development cannot be seen in isolation. Its success is critically dependent on the right prioritization of the system development (significance $\leq .00001$) and on the degree on user involvement (significance $\leq .0001$). It is necessary to ensure that maximum responsibility and participation is assumed by the end-users themselves to meet their needs and encourage a smooth acceptance of the new systems.

The field of software development will undergo severe changes in the future as new software allows users to use computer systems without learning complicated rules of programming. Based on fourth generation or user-friendly languages this software allows managers to use computers

without waiting often several years until the MIS department produced the system.

3.5.2.9. Data Quality

The quality of the data in terms of consistency, reliability, timeliness, relevance, and completeness determines the value of information to the user. Accordingly, data quality is a critical success factor for the satisfaction of user needs (significance $\leq .0001$) and effectiveness (significance $\leq .001$). The success of MIS depends largely on the ability of the MIS function to provide information that is current and in an usable and easily understood format. MIS should present a maximum of information, as opposed to data, that is usable without further manipulation.

3.5.2.10. Data Security

Data security has a highly significant relationship to the three MIS measures, user satisfaction (significance $\leq .0001$), effectiveness (significance $\leq .01$), and efficiency (significance $\leq .05$).

However, the author believes that data security is less a factor promoting MIS success, than a result of successful MIS. Data security is highly correlated to the degree of user involvement (significance $\leq .001$) and the performance on information centers (significance $\leq .0001$). As the

understanding of both MIS staff and users about their access to information increases, security measures are implemented. Since both user involvement and information center are main contributors to MIS success, data security is more a result of that connection than a critical success factor of MIS success. There is no concept in the literature to support such a connection, either. Consequently, data security does not qualify as a critical success factor.

3.5. Comparison of the Results of the Different Methods

Table 9 shows how important MIS executives rank those issues which are identified as critical success factors. It shows whether the priorities of the MIS leaders match the actual critical issues. The three most important issues, user involvement, alignment of MIS with business goals and data quality are also critical success factors. Thus, the top priorities are set in the right direction. However, all issues ranked four to nine are not critical to MIS success.

Prioritization of system development (10) and recruitment and training of the data processing staff (11) are considered to be of average importance. All other critical success factors are rated relatively low. They include technical issues, such as efficient data use (14), software development (18), and information centers (23), as well as more strategic considerations, such as the integration of

technologies (16), organizational learning and information use (19), end-user computing (20), and measuring MIS effectiveness (21).

Table 9. Importance Rankings of Critical Success Factors³

Importance Rank	Satisfaction	User Effective-ness	Efficiency
1 User involvement	0.00001	0.05	0.05
2 Alignment of MIS	0.001	0.05	
3 Data quality	0.00001	0.001	
10 Priorit. system develop.	0.05	0.05	
11 Recruit, train dp staff	0.001	0.0001	0.05
14 Efficient data use	0.01	0.05	
16 Integrating technologies	0.00001	0.01	
18 Software development	0.05	0.01	
19 IS learning and usage	0.00001	0.0001	
20 End-user computing	0.01	0.01	0.05
21 Measuring MIS effectiv.	0.01	0.05	0.00001
23 Information centers	0.00001	0.001	

These results are most surprising. It seems rather unlikely that chief MIS executives are not aware of those factors contributing to the success of MIS. A possible explanation might be that the requirements in the future are different from the crucial issues of today. As MIS executives respond to the shifts towards an increasingly strategic impact of MIS on most companies, they focus on those factors which are important in the future. This anticipation of future requirements seems to be a plausible explanation of the striking discrepancy between the factors which are

³ A blank indicates that the relationship is not significant at a level of $\leq .05$

perceived important for MIS success and the factors which are actually contributing to MIS success.

Table 10 shows how the current performance on the critical success factors is rated. It gives an indication which issues need further improvement to enhance the success of the current MIS. Four of the five best performing issues are critical success factors. Thus, the performance on user involvement, prioritizing system development, recruitment and training, and data quality is in line with their pivotal role. The alignment of MIS with business objectives (9) and software development (10) shows a moderate performance. The performance on the other issues is very disappointing.

Table 10. Performance Ranking of Critical Success Factors⁴

Performance Rank	User Satisfaction	Effective-ness	Efficiency
1 User involvement	0.00001	0.05	0.05
3 Recruit, train dp staff	0.001	0.0001	0.05
4 Priorit. system develop.	0.05	0.05	
5 Data quality	0.00001	0.001	
9 Alignment of MIS	0.001	0.05	
11 Software development	0.05	0.01	
15 End-user computing	0.01	0.01	0.05
16 Integrating technologies	0.00001	0.01	
18 Information centers	0.00001	0.001	
19 Efficient data use	0.01	0.05	
20 IS learning and usage	0.00001	0.0001	
21 Measuring MIS effectiv.	0.01	0.05	0.00001

End-user computing (15), integration of technologies

⁴ A blank indicates that the relationship is not significant at a level of $\leq .05$

(16), information centers (18), efficient data use (19), organizational learning and information system use (20), and measuring effectiveness (21) are on the bottom of the performance rankings.

All these issues are under almost complete control of the MIS manager. Since good performance on these issues makes the difference between successful and unsuccessful MIS, MIS managers should concentrate on these issues to improve their MIS. The low ratings indicate that there is much room for major improvements so that it is feasible to achieve major improvements of MIS by enhancing the performance on these issues.

4. Summary of Results

The importance ratings lie in the range from 6.22 to 4.22 on a seven-point interval scale. Strategic issues are generally rated more important than technical issues. User involvement in system development (1) and aligning MIS with business goals (2) rank significantly higher than all other issues. Ranked next in importance are data quality (3), communications with top management (4), and the education of end-users (5). Increasing productivity, top management involvement in the definition of MIS objectives, long-range planning, and telecommunications are ranked on the positions six to nine.

The first ranked issue, user involvement, was not considered in previous studies. Longitudinal comparisons show that long-range planning (down from rank one to nine) and alignment of MIS (up from seven to two) are reversing their positions. Some issues, such as data quality and educating end-users gained importance while others dropped, such as educating top management, telecommunication, recruiting and training, efficient data use, integration of technologies, measuring effectiveness, software development, decision support systems, and office automation.

The best performance is achieved with user involvement in the system development process. The performance on the following six issues, data security, recruiting and training of DP staff, prioritization of system development, data quality, telecommunication, and the role of the MIS manager is largely in line with the assigned importance. However, the issues ranked eighth to fourteenth, communication with top management, alignment of MIS, increasing productivity, software development, education of end-users, long-range MIS planning, and top management involvement in the definition of MIS goals, are not living up to their assigned importance.

The importance ratings are generally higher than the performance ratings. Most of the major gaps originate with strategic, not with technical MIS issues. The largest deficiencies occur for alignment of MIS, educating top

management, and top management involvement in the definition of MIS goals. The next ranked gaps include educating end-users (4), data quality (5), and communication with top management (6). At the ranks 7 to 9 follow long-range MIS planning, increasing productivity, and user involvement.

The performance ratings are relatively uniform for companies of different industries and sales volume. However, a company's placement in the matrix of strategic impact has a major influence on the performance on most MIS issues. The average performance and the performance on strategic issues, is higher for companies which are critically dependent on the functioning of their current applications.

Twelve critical success factors are established in the second part of the study. Recruitment and training of data processing staff, end-user computing, and measuring effectiveness contribute to all three dimensions of MIS success. The other nine factors are related to user satisfaction and effectiveness. They include organizational learning and information system usage, information centers, data quality, integrating technologies, user involvement, alignment of MIS, efficient data use, software development, and the prioritization of system development.

However, long-range planning of the MIS department and related issues do not enhance MIS success at a significant level. This result concurs with the longitudinal analysis of the importance ratings which indicated a decreasing import-

ance of long-range MIS planning within the last eight years.

In contrast to the computer literature, but in line with general management literature, top management involvement in detailed MIS planning and the different ways to facilitate it, are not contributing to MIS success. Against the stated hypotheses charge-out of MIS costs, formal procedures of and written plans for system development do not enhance MIS success, either.

There is a major contrast between the importance ratings and the actual critical success factors. Three critical success factors are rated at the top three position while the others ranked very low, six even among the eight lowest ranked issues. The match between critical success factors and performance is somewhat better, with five critical success factors being in the top ten performing issues. However, there were also six issues among the nine lowest ranked issues.

5. Conclusions

The results of the importance ranking indicate that MIS executives view MIS as a strategic function oriented toward business objectives. MIS leaders, traditionally thought of as good technical leaders, portrayed themselves in the survey as a part of the corporate top management team. This strategic orientation of MIS leaders results from the

enhanced strategic impact of MIS on most companies. As the business success of the firms is increasingly dependent on existing and future applications of MIS, the support of business objectives and strategies is becoming the primary concern of MIS leaders.

The MIS department has to be flexible to accommodate changes of the information needs of the entire organization. Consequently, the former emphasis on long-range planning of MIS is giving way to the alignment of MIS with business objectives as the key MIS issue. The MIS function of most companies is currently in a state of transition towards an increased strategic role of MIS. Thus, the main problem areas of MIS management lie in the emerging key issues which are of strategic nature, such as alignment of MIS with business goals, educating top management, involving top management in defining MIS goals, educating end-users, and communications with top management.

The analysis of the critical success factors shows that currently the success of MIS is still largely influenced by technical factors. The performance on some of the factors, such as integrating technologies, efficient data use, and organizational learning and information system use is very disappointing in light of their pivotal role. To attain an optimal use of MIS, a significant improvement in these areas is required.

The influence of end-user computing and information

centers on the MIS success is generally underestimated by MIS managers. This may reflect the reluctance of MIS executives to increase the role of end-user computing since it undermines the influence of the centrally located MIS department. The measurement of MIS effectiveness is another critical success factor whose role is underestimated by both academic literature and practitioners. It provides an important feedback instrument to evaluate the adequacy of current systems.

Top management involvement in the definition of MIS objectives is not critical to MIS success. Top management has to concentrate on giving general guidelines and setting strategic objectives as for any other corporate department. To ensure a proper alignment of MIS with business goals it is not so important to involve top management in MIS. Rather, the involvement of the MIS manager in the process of business strategy formulation is to be increased. This yields several benefits for the organization: First, the MIS manager can offer advice on where and how MIS can be used to the firm's competitive advantage. Second, by incorporating the MIS manager in the setting of the business strategy, he acquires a better understanding of the objectives of the company and the strategic importance of specific applications. This simplifies the prioritization of system developments and the ascertainment of areas which require increased attention.

6. Areas for Future Research

This study concentrated on identifying the areas of critical importance for MIS success. Future research is required to identify ways to improve performance on the issues which are critical to MIS success.

In light of the strong support for the matrix of strategic developed by McFarlan, McKenney, and Pyburn (1983) it seems to useful to emphasize research in this area. It would be interesting to relate the strategic impact of MIS on the company to its critical success factors and to the specific ways of enhancing performance.

The problem of whether and how to charge out MIS costs to the user departments requires additional empirical research to determine whether MIS cost charge-out is beneficial. It might be useful to employ a contingency approach which incorporates Nolan's (1974) four stages of EDP growth as well as organizational variables.

Another promising field of research is to investigate firms in other countries where the development in information technology lags behind the United States. In these countries the strategic impact of MIS on business success should be lower and thus the importance of technical issues will be higher. This might give additional support to many results of this research.

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Appendix A1. Importance of 18 MIS Issues (Ball and Harris 1982)⁵

1. MIS Long Range Planning and Integration
2. Gauging MIS Effectiveness
3. Impact of Communications on MIS
4. The Developing Role of the Information Resource Manager
5. Decision Support Systems
6. Office of the Future Management
7. Employee Training and Career Path Development
8. Education of Non-MIS Management
9. Centralization vs. Decentralization of MIS Functions
10. Employee Job Satisfaction
11. Providing End Users with Their Own Development System
12. Problems of Maintaining Data Security
13. Impact of Software Engineering on MIS
14. Problems of Maintaining Information Privacy
15. Management Science and the MIS Environment
16. Professional Recruitment
17. MIS Ethics
18. Impact of Personal Computers on an Institutional Environment

⁵ Issues printed in bold are incorporated in the questionnaire.

Appendix A2. List of Key IS Management Issues (Dickson, Leitheiser, Wetherbe 1984)

1. Improved IS planning
2. Facilitation and Management of End User Computing
3. Integration of Data Processing, Office Automation, and Telecommunications
4. Improved Software Development and Quality
5. Measuring and Improving IS Effectiveness/Productivity
6. Facilitation of Organizational Learning and Usage of Information System Technologies
7. Aligning the IS Organization with That of the Enterprise
8. Specification, Recruitment, and Development of IS Human Resources
9. Effective Use of the Organizations Data Resources
10. Development and Implementation of Decision Support Systems
11. Planning and Management of the Applications Portfolio
12. Planning, Implementation, and Management of Office Automation
13. Planning and Implementing a Telecommunication System
14. Information Security and Control
15. Increased Understanding of the Role/Contribution of IS
16. Determination of Appropriate IS Funding
17. Effective Usage of Graphics
18. Impact of artificial Intelligence
19. Management of Data and Document Storage

Appendix A3. Issues of Importance to MIS Executives (Kanter 1986)

1. Communications with Senior Management
2. Tele-Communications
3. Long Range MIS Planning
4. Linkage of MIS/Corporate Plans
5. Security Back-UP
6. Education for MIS Personnel
7. Skills Mix of MIS Personnel
7. Education for End-Users/Management
9. Application Priority Process
10. Application Packages
11. Office Automation Systems
12. Decision Support Systems
12. Personal Computing
14. Steering Committees
15. MIS Charge Out

Appendix A4. Performance on MIS Issues (Kanter 1986)

1. Tele-Communications
2. Skills Mix of MIS Personnel
3. Communications with Senior Management
4. Education for MIS Personnel
5. Application Priority Process
6. Personal Computing
7. Application Packages
8. Security Back-UP
9. Long Range MIS Planning
10. Office Automation Systems
11. Education for End-Users/Management
12. MIS Charge Out
13. Steering Committees
14. Decision Support Systems
15. Linkage of MIS/Corporate Plans

Appendix 5. Ranked Importance of 23 MIS Issues (Herbert and Hartog 1986)

1. Aligning MIS with Business Goals
2. Data Utilization
3. Educating Senior Personnel
4. Software Development
5. Productivity
6. Planning
7. Integration of Technologies
8. Telecommunications Technology
9. Quality Assurance
10. Office Automation
11. Data Security
12. End User Computing
13. Recruiting and Training
14. Information Centers
15. External Data
16. Decision Support Systems
17. Centralization
18. Telecommunications Deregulation
19. Measuring Productivity
20. Fourth Generation Languages
21. Strategic Systems
22. CIM
23. Expert Systems and Artificial Intelligence

Appendix B. Performance for Different Industries

Industry	Manufacturing	Performance		Other
		Services	Trade	
User satisfaction	3.52	3.26	3.46	3.61
Effectiveness	3.68	3.70	3.69	3.39
Efficiency	4.06	3.96	4.00	3.89
Alignment of MIS	4.61	5.22	4.92	4.50
Efficient data use	4.48	4.13	4.46	4.50
Educating top management	3.84	4.04	3.69	3.89
Education of end-users	4.61	4.70	4.31	5.17
Recruit, train dp staff	4.87	5.26	4.92	5.11
Increasing productivity	4.58	4.78	5.00	4.72
Long range MIS planning	4.58	4.57	4.46	4.72
Integrating technologies	4.58	4.22	4.15	4.56
Telecommunications	5.10	4.78	4.92	5.17
Data quality	4.74	4.91	5.46	5.33
Data security	4.90	5.30	4.85	5.17
Office automation	4.55	4.39	3.69	4.67
End-user computing	4.29	4.61	3.85	4.83
User involvement	5.23	5.48	5.23	5.50
Top mgt. defining goals	4.81	4.22	5.31	3.94
Commun. with top mgt.	4.87	4.74	5.54	4.44
Information centers	4.10	4.43	3.85	5.28
Decision support systems	3.87	4.09	3.31	3.94
Priorit. system develop.	4.97	4.91	5.46	5.00
Measuring MIS effectiv.	4.32	3.83	4.08	4.22
MIS manager	4.87	4.61	5.23	5.39
Org. learning and IS usage	4.16	4.43	4.23	4.33
Software development	4.68	4.57	5.00	4.83
Average	4.50	4.51	4.50	4.62

Appendix C

Main Problems with MIS and Their Relationship to Critical Success Factors

1. How well do you feel your MIS meets the needs of its users?
☐ very well ☐ well ☐ adequately
☐ marginally ☐ poorly

Data processing support can be judged on effectiveness and efficiency:

2. Effectiveness deals with how well a job is done. Are IS services provided in a accurate, timely and easily understood manner? Are the right applications developed? How effective is the MIS department?
☐ very effective ☐ effective ☐ fairly effective
☐ somewhat ineffective ☐ very ineffective
3. Efficiency deals with the amount of resources used to do a job. Is the MIS of your firm cost efficient? Is MIS operating within the budget? How efficient is the MIS department?
☐ very efficient ☐ efficient ☐ fairly efficient
☐ somewhat inefficient ☐ very inefficient
4. Do you charge-out MIS costs to the users? ☐ yes ☐ no
5. The strategic impact deals with the effects MIS has on the competitiveness of a company. What is the strategic impact of MIS on your company?
☐ strategic (both existent and the development of new applications have high strategic impact on the competitiveness of your company)
☐ turnaround (existent applications have low, new applications have high impact)
☐ factory (existent applications have high, new applications have low impact)
☐ support (existent applications and new applications have low impact)

Please, indicate 1) how important the following issues are for the success of MIS of your company, and 2) how well the MIS department performed on each activity.

	Importance							Performance								
	irrelevant	useful					critical	poor	adequate				excellent			
<hr/>																
1. Aligning MIS with Business Goals	1	2	3	4	5	6	7			1	2	3	4	5	6	7
2. Efficient Data Utilization	1	2	3	4	5	6	7			1	2	3	4	5	6	7
3. Education of Top Management	1	2	3	4	5	6	7			1	2	3	4	5	6	7
4. Education of End-Users	1	2	3	4	5	6	7			1	2	3	4	5	6	7
5. Recruiting and Training of DP Staff	1	2	3	4	5	6	7			1	2	3	4	5	6	7
6. Increasing Productivity	1	2	3	4	5	6	7			1	2	3	4	5	6	7
7. Long Range MIS Planning	1	2	3	4	5	6	7			1	2	3	4	5	6	7
8. Integration of Technologies	1	2	3	4	5	6	7			1	2	3	4	5	6	7
9. Telecommunications Technology	1	2	3	4	5	6	7			1	2	3	4	5	6	7
10. Data Quality	1	2	3	4	5	6	7			1	2	3	4	5	6	7
11. Data Security	1	2	3	4	5	6	7			1	2	3	4	5	6	7
12. Office Automation	1	2	3	4	5	6	7			1	2	3	4	5	6	7
13. Management of End-User Computing	1	2	3	4	5	6	7			1	2	3	4	5	6	7
14. User involvement in analysis, design, and implementation of new systems	1	2	3	4	5	6	7			1	2	3	4	5	6	7

	Importance							Performance						
	irrelevant	useful					critical	poor	adequate				excellent	
<hr/>														
15. Top management involvement in the definition of MIS' objectives	1	2	3	4	5	6	7							
16. Communications with Top Management	1	2	3	4	5	6	7							
17. Information Centers	1	2	3	4	5	6	7							
18. Decision Support Systems	1	2	3	4	5	6	7							
19. Prioritization of System Development	1	2	3	4	5	6	7							
20. Measuring MIS Effectiveness	1	2	3	4	5	6	7							
21. Role of the MIS Manager	1	2	3	4	5	6	7							
22. Organizational Learning and IS Usage	1	2	3	4	5	6	7							
23. Software Development	1	2	3	4	5	6	7							
24. other _____	1	2	3	4	5	6	7							
25. other _____	1	2	3	4	5	6	7							

6. Do you and senior management have a mutually agreed upon set of criteria for deciding which applications or systems to implement first? ☐ yes ☐ no
7. Has top management a long-term funding commitment to provide stable funding for systems development activities? ☐ yes ☐ no
8. Does your company employ a steering committee as a vehicle to involve top management in strategy and policy decision making? ☐ yes ☐ no
9. Do you have a written overall plan for systems development which covers 1) the major functional areas of the business and 2) clarifies the interrelationship between applications? ☐ yes ☐ no
10. Are you using formal procedures for systems analysis, design and implementation? ☐ yes ☐ no
11. What is the sales revenue of your company?
☐ less than \$500 millions ☐ \$500 millions to \$1 billion ☐ \$1 to \$5 billions
☐ \$5 - \$10 billions ☐ over \$10 billions
13. The major business of your organization is:
☐ manufacturer of computer hardware/software ☐ banking and finance
☐ transportation ☐ manufacturing
☐ wholesaling/retailing ☐ other services
☐ other

Thank you very much for your valuable cooperation!