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TRENDS IN... A CRITICAL REVIEW

REVIEW OF MANAGEMENT INFORMATION SYSTEMS RESEARCH: A MANAGEMENT SUPPORT EMPHASIS

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Abstract—This article organizes, describes, and evaluates MIS research from 1981 through 1985 in order to provide an understanding of what constitutes MIS research and to indicate potentially rich areas for future research. The review emphasizes information systems research in support of management decision making as opposed, for example, to research into the management of information resources or the development of strategic information systems.

Preliminary work includes developing a definition of MIS, adopting an organizing framework, and choosing journals for review. Once this foundation is laid, MIS research content and methodology up to 1980 are summarized based upon the findings of the First International Conference on Information Systems. Finally, MIS research from 1981 to 1985 is described and evaluated in terms of content and methodology.

It was found that more progress has been made in identifying appropriate research questions than in answering those questions. Significant progress in generating answers may be made in the future due to a healthy shift in the choice of methodologies (shift from more speculative-conceptual to more theory-based/theory-generating empirical). However, progress toward developing a global notion (theory) of MIS seems relatively slow. This lack of progress seems to be a symptom of:

- Lack of progress in defining the product of MIS (information).
- Too much research focus upon *what* relationships exist instead of focusing upon *why* relationships exist.
- Underlying problems in the natural sciences paradigm currently associated with MIS research.

1. INTRODUCTION

A Management Information System (MIS) is generally thought of as an integrated, user-machine system providing information to support operations, management, and decision-making functions in an organization [1]. This article organizes, describes, and critically evaluates MIS research being pursued in schools of business. It is directed toward scholars unfamiliar with MIS research. The purpose is to provide an understanding of what constitutes MIS research and to indicate potentially rich areas for future research.

This review differs from other recent MIS reviews in terms of purpose as well as in depth and breadth of literature coverage. Culnan [2] performed a cocitation analysis of the MIS literature from 1972 to 1982. Her analysis identified intellectual subfields in MIS and the reference disciplines within which these subfields are grounded. Culnan and Swanson [3] examined articles from 1980 to 1984 in order to assess the emergence of MIS as an independent scholarly field of study—as differentiated from the referent fields of computer science, management science, and organizational science. Elam, Huber, and Hurt [4] examined the decision support systems literature from 1975 to 1985 in order to identify trends in research methodology, information systems topics (e.g., design process, system features), and application areas (marketing, finance, etc.).

These reviews are more macro in nature. Attention is paid to breadth of coverage rather than to depth of coverage: detailed descriptions of actual research being pursued and methodologies employed are not included. These reviews identify general notions of where the MIS field is and where it is going. In contrast, there have been recent reviews of a more micro nature, looking in depth at relatively small research areas. For example, Ives and Olson [5] examined research associated with user involvement in the development process, and Jarvenpaa, Dickson, and DeSanctis [6] addressed methodological issues associated with experimental MIS research. These more micro works typically present detailed descriptions of a specific area of research in order to provide insight into the area's theoretical and methodological strengths and weaknesses.

This article provides scholars unfamiliar with MIS research with an understanding of what constitutes MIS research. This article thus fits in between the macro and micro reviews just described. Some depth of coverage is sacrificed in order to provide a broader view than the more micro works. In addition, some breadth of coverage is sacrificed in order to provide enough detail in the descriptions to be meaningful to scholars unfamiliar with MIS research. The inevitable result is that rather arbitrary decisions are made as to topics to cover, journals to review, and the level of descriptive detail.

In order to reduce the arbitrariness (or at least bring the arbitrariness to light) of these decisions, the following three preliminary steps are undertaken. First, a working definition of MIS research is developed; MIS research is defined in terms of direct management support, which reduces the potential of straying into related research areas such as computer science, management science, and organizational psychology. Next, a framework is adopted to help describe and organize MIS research. Finally, specific journals are chosen as a focus for review; these journals are regarded by the MIS community as being high in terms of perceived contribution to the MIS field and as having an academic research orientation.

Having built this foundation, MIS research to 1980 is summarized, based on findings of the First International Conference on Information Systems in December 1980 in Philadelphia, PA. Current (post 1980) research is then described and evaluated, and suggestions for future research directions are proposed. An outline of this paper is presented in Table 1.

Table 1. Outline of the review

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1.1 *Working definition of MIS research*

As Dickson, Benbasat, and King [7] note, the conceptual foundations of MIS as an area of academic pursuit were first expressed in an article by Leavitt and Whisler [8]. This 1958 article described the combined use of computer technology, operations research techniques, and artificial intelligence to enhance organizational management. Since that time, research in MIS has grown both in quantity and in the variety of problems addressed.

Unlike research in areas such as computer science, MIS research is relatively heterogeneous, drawing from many diverse reference disciplines and focusing on managerial, technical, and/or behavioral issues concerning the development, use, management, and operation of MIS. It is thus difficult to define boundaries of MIS as an academic research discipline. This difficulty is compounded by the proliferation of names for this discipline. For example, in addition to MIS, titles such as computer-based information systems (CBIS), decision support systems (DSS), management support systems (MSS), and executive support systems (ESS) have been used to identify research in this area. The generation of names such as these seems to be more an attempt to dissociate researchers from stagnant research areas than to provide helpful research distinctions [7].

Given this diversity and ambiguity, it is important to form reasonable boundary definitions of MIS research. Without such boundaries, a review is not tractable. We begin by examining a research framework suggested by Ives, Hamilton, and Davis [9], which focuses on the content of MIS research. This framework includes and extends the frameworks of Mason and Mitroff [10], Chervany, Dickson, and Kozar [11], Lucas [12], Mock [13], and Gorry and Scott Morton [14].

The Ives–Hamilton–Davis framework provides a comprehensive taxonomy of environmental variables, information system variables, and process variables. Environmental variables identify resources and constraints that dictate the scope and form of each information system; these variables represent the external, organizational, user, systems development, and operations environments. Information system variables describe the content, form, and timeliness of information system applications. Process variables describe interactions between the information system variables and the environmental variables; such interactions are associated with the development, operations, and use processes. This framework is a comprehensive list of potential MIS research areas. Its comprehensiveness has been validated by its ability to classify over 300 MIS doctoral dissertations [9].

However, there are problems with employing this framework to guide this review process. First, it is too inclusive: the framework does not provide an ability to discriminate between MIS research and other (e.g., engineering) information systems research. If MIS research is truly different from other areas of information systems research, then some scheme must be developed to help differentiate it from these other areas. Second, the framework does not distinguish between more important and less important research problems. Such guidance would be helpful in identifying important future research areas.

To address these two problems, a variation on the Ives–Hamilton–Davis framework is proposed. This variation assumes that management information systems research is a subset of information systems research that is concerned specifically and directly with the support of management in organizations. For example, although programmer productivity research can be included in the Ives–Hamilton–Davis framework, it is not *specifically* and *directly* concerned with information systems that support *management*. Thus, in general, programmer productivity research is not considered here as part of the MIS research domain. (Note, however, that productivity issues surrounding the user-manager as a programmer through fourth generation languages can fit within the proposed MIS research domain.)

With this management support emphasis, the Ives–Hamilton–Davis framework can be altered, forming a more specific basis for defining MIS research. The provision of MIS support can be viewed as the result of two corporate information production functions: systems operation and systems change. Systems operation involves the physical operation of the information system, and produces information support. Systems change involves the alteration of the current information system and produces changes in information support. (Relatively major changes are often called new system development; relatively minor changes are often called system maintenance or enhancement.) As described next, this reorientation of the Ives–Hamilton–Davis framework allows for a more explicit delineation of MIS research.

Using the foregoing criteria of *specific* and *direct* concern with management support, MIS research should focus on the effectiveness rather than the efficiency of information production. Although increased efficiency of both the systems operation and systems change functions may free resources and allow new information systems to be built, this potential will not be realized without an effective systems change function. Additionally, research into the effectiveness of the systems operation function is not of primary interest because the output of the systems operation function is defined and constrained by the systems change function. It is, thus, systems change function effectiveness that is of primary interest for MIS research.

The systems change function can be separated into three subfunctions: the first identifies the information system problem and associated solution (information requirements analysis), the second operationalizes the information system solution (system design and programming), and the third implements the solution (systems implementation). If we assume that any technically feasible MIS can be developed, the impact of system design and programming is largely in terms of efficiency. Thus, the effective change of information systems depends primarily on information requirements analysis and systems implementation. It is the effectiveness of information requirements analysis and systems implementation that are of primary MIS research importance.

In sum, it is proposed that, when viewed in terms of management support, more important MIS research areas are those that focus on factors impacting the effectiveness of MIS change, specifically through information requirements analysis and systems implementation. Constraining the definition of MIS research to these areas will help keep the review focused on critical issues and will reduce the potential of encroaching on other research domains such as computer science, management science, and organizational psychology.

A major problem with such a narrow management support focus is the potential for missing areas that are commonly thought of as MIS research. For example, an information system research colloquium held at the Harvard Business School in 1983 included areas such as management of the information systems resource as well as information systems technology and corporate strategy [15]. In addition, it has been suggested that MIS research should include public policy implications of information systems technology such as privacy issues, acceptable levels of intrusion, and unacceptable monopolies [16].

For us to understand better this more encompassing view of MIS, areas typically associated with current computer and information systems research in business schools, but omitted from further discussion in this article, are briefly described as follows.

Management of the Information Systems Resource. Although research involving the management of MIS change is included in this review, many other information resource management issues are examined by business schools. These excluded issues include the organization of data processing departments and data processing personnel roles [17–23], managing the satisfaction, stress, and turnover of data processing personnel [24–27], managing projects [28–31], data processing function control [32], and managing software maintenance [33–37].

Information Systems Technology and Corporate Strategy. With the decline in the cost of information technology, information systems are being seen as a strategic means for changing the competitive balance of an organization by developing new channels of product distribution, providing the bases of new products, and affording the opportunity for major changes in operations [38–42]. Such uses of computers are not typically for direct management support, and thus are not included in this review.

Analysis, Design, and Programming. Analysis and design approaches and methods that are not specifically oriented toward information requirements analysis or implementation are not covered in this review. This includes articles on the systems design lifecycle [43–46], on the choice of systems development approaches and methods [47–49], and on the determination of database design [50–52]. Research on programming, other than end user programming, is excluded [53–55]. Also, research on how data processing affects information quality [56], and how changes in editing procedures can change error rates [57] are excluded.

Office Automation. Office automation is the application of computer and communications systems to office procedures with the purpose of increasing productivity [58,59]. The main thrust of this research is clerical and secretarial work, which is excluded from this review. However, office automation is starting to include aspects more directly in support of management, such as computer and video conferencing [60,61].

Model Management Systems. Work on model management systems has begun to enable the creation, manipulation, and access of models in order to enhance decision support system capabilities and ensure integrity, consistency, currency, and security of model bases [62]. Approaches for the design of such systems include the use of artificial intelligence logic [63,64], semantic inheritance networks [65], frame representations [66], and relational models [67]. This research is aimed at computer architecture rather than at direct support of management decision making, and thus is excluded from the review.

Information Retrieval. Research on information retrieval focuses on the effective storage and retrieval of textual information. Recently, work in this area has begun to examine retrieval problems associated with business and government in addition to its traditional emphasis on library-related problems. Examples of this work include efforts to evaluate and better understand the effectiveness of text retrieval systems [68–70], efforts using artificial intelligence techniques to enhance text retrieval effectiveness [71,72], and efforts focusing specifically upon office issues [73]. Although information retrieval issues are important for management support, research in this area has not directly addressed this concern, and is thus excluded from the review.

1.2 *Framework for organizing MIS research content*

Implications of this management support focus for MIS research classification are illustrated in Fig. 1. Here, two mutually affecting entities are depicted: the MIS change function produces changes in management information support that affect the external, organization, and user environments. Conversely, the environments impose constraints on the MIS change function in the form of available technology, organizational policies, user

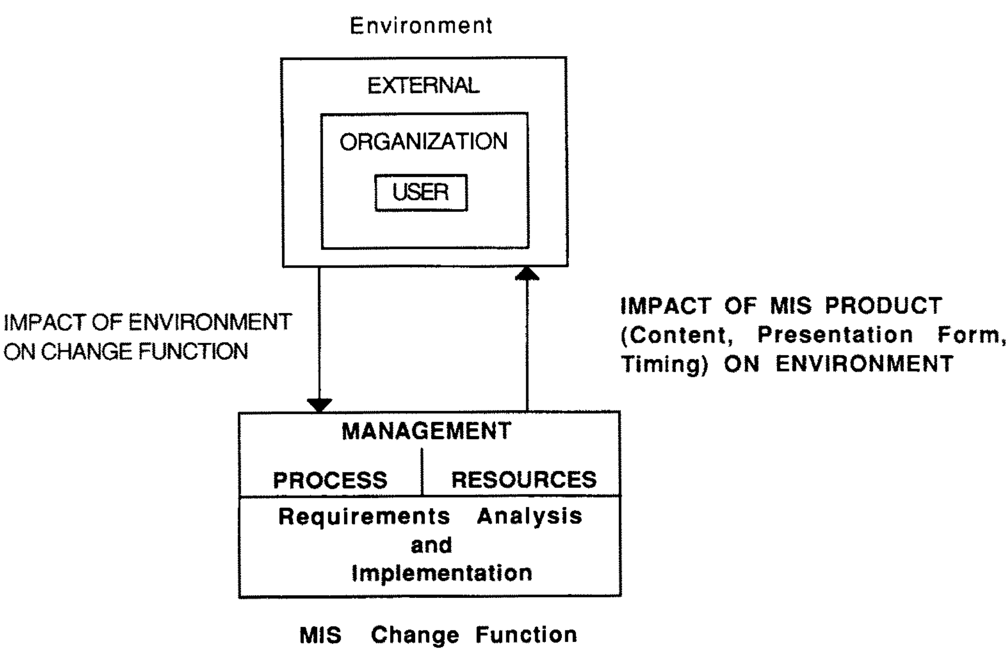

Fig. 1. MIS research content focus.

capabilities, etc. From the perspective of this review, the environments are considered fixed (or at least slow to change – see [9]); the focus is thus on the ability of the MIS change function to provide appropriate MIS support within such constraints. An organization of the literature based on this framework emphasizes an MIS product effectiveness orientation. That is, MIS research is interpreted based on the assumption that it will ultimately be useful in developing appropriate information system products for MIS environments. Thus, for example, research addressing the quality of working life of users might be considered only to the extent that it directly impacts the effectiveness of the MIS within a given environment.

The resulting framework employed to organize the MIS literature considers the following characteristics (taken from [9]). For both information requirements analysis and systems implementation, the MIS change function includes the following characteristics: (1) resources used – personnel, computer hardware, and software; (2) processes employed – procedures and methodologies; and (3) management – planning, organizing, staffing, directing, controlling within the MIS change function and their impact on the appropriate choice of the following MIS product characteristics: (1) content – accuracy, source, age, types of data/models; (2) presentation form – media, format, features; and (3) timing – online versus offline, reporting interval, processing delay given the following environmental characteristics: (1) external environment – legal, social, political, cultural; (2) organizational environment – organizational goals, tasks, structure, management philosophy/style; and (3) user environment – user's experience, cognitive style, tasks, goals, organization.

This framework addresses the *what* of MIS research. It is additionally helpful to identify the *how* of MIS research, that is, to categorize MIS research in terms of a methodological taxonomy. Such a framework is proposed in Section 1.3.

1.3 *Framework for organizing MIS research methodology*

The methodological taxonomy proposed as a starting point for this review is described below. This framework was developed by Vogel and Wetherbe [74] and extends work by Van Horn [75]:

a. Theorem proof – captures applicable areas from fields such as computer science that otherwise would not be identified.
b. Engineering – captures MIS research, such as Monte Carlo simulation, dealing with the application of science and mathematics.
c. Empirical – captures the essence of research relying on observation.
   1. *Case study* examines a single organization with no experimental design or controls.
   2. *Survey* examines one or more organizations with an experimental design but no controls.
   3. *Field test* examines one or more organizations with an experimental design and controls.
   4. *Laboratory experiment* is a laboratory study of computer-organizational problems with an experimental design and high degree of control.
d. Subjective argumentative – captures creative MIS research based more on opinion and speculation than on observation.

This taxonomy is used to describe and compare current to past research methods and enable speculation concerning the effectiveness of these methods for future MIS research. As described later, such speculation includes suggestions for expanding this taxonomy to include futures research, phenomenological research, and action research methods.

1.4 *Choice of journals for review*

The emerging management information systems field intersects established fields such as behavioral sciences (psychology, sociology, etc.), computer science, and management science. Interdisciplinary communication is thus required to encourage unification of the field. The interdisciplinary nature of MIS has meant that research findings have been published in a variety of journals, resulting in a fragmented and unfocused body of literature [76].

Based on a survey of 110 MIS experts, Hamilton and Ives [76] found that the following journals ranked high in terms of perceived contributions to the MIS field and had an academic research orientation:

Communications of the ACM
Computing Surveys
Information and Management
Management Science
MIS Quarterly
Sloan Management Review
Transactions on Database Systems

An examination of these journals found that articles in *Computing Surveys* and *Transactions on Database Systems* were not oriented toward the MIS research focus in this review. That is, they did not address the effectiveness of management information requirements analysis or MIS implementation. This review will thus focus on MIS research published in the 5 other journals listed above, and on research referenced by MIS articles published in these 5 journals.

This selection of journals represents a small subset of MIS publication outlets. For example, Hamilton and Ives [76] identify 37 journals with the potential for publishing MIS articles. As a result, many MIS articles will be missed by this review. It is hoped, however, that the major MIS research streams will be adequately represented in the 5 journals selected, and thus reported in this article.

2. SUMMARY OF MIS RESEARCH UP TO 1980

In December of 1980 the First International Conference on Information Systems was held in Philadelphia, Pennsylvania. This conference was the first major gathering devoted exclusively to issues of teaching and research in MIS [77]. A large part of the conference provided an assessment of MIS as a field of study including evaluations of MIS research content and methodology, as well as suggestions for future research strategies. These evaluations and suggestions are summarized as follows, providing a foundation for the evaluation of current MIS research.

Using the First International Conference on Information Systems as a starting point results in the omission of some significant early MIS history [78]. For example, many pioneering works by researchers such as Steven Alter, Robert Anthony, Herbert Simon, Paul Strassmann, and Thomas Whisler are not included. In addition, the results of earlier conferences (e.g., the ONR sponsored conference at Carnegie in 1968: [79]; the NSF sponsored conference at Pennsylvania in 1973: [80]) are not explicitly addressed. However, given the nature of the First International Conference, it is hoped that the spirit of these earlier works is included in this review.

2.1 *MIS research content*

Observations regarding MIS research content in the First International Conference stressed the lack of research examining how the MIS change function can appropriately match MIS products with the environment and upon the inadequate conceptualization of information. For example:

- Little research has been done on performance variables specifically developed to measure the processes involved in appropriately matching MIS products with the environment. Most of the MIS research that does include a process variable only measures the outcome of the process. For example, the level of user satisfaction is measured. Questions about the use process itself, such as how and why the user is satisfied, are seldom asked [9].

- When we discuss impacts of changes in information systems on the organization or individual, we have little to measure. We have no concept of information comparable with that of information economics, information theory, or even accounting. Concepts of office automation, decision support systems, MIS, information, information system success, etc. lack any coherence ([81], [9]).

Although there were few suggestions concerning how to improve MIS research content, much was said about the need for such improvement:

- Too much effort is devoted to exploring environmental and MIS product characteristics; these variables generally are important merely as influencing performance. In addition, many of the environmental resources and constraints are slow to change and are fixed in the short run. Hence, they frequently do not represent controllable activities for the purpose of influencing performance. This need for performance measures was highlighted in the SHARE study recommendations for data processing in the 1980s [9].
- Problems with defining and measuring information, which is the key to MIS research, has severely restricted the potential for an MIS theoretical base [81].

2.2 *MIS research methodology*

Criticisms regarding MIS research methodology tended to focus on the lack of theoretical foundation and upon poor implementation quality. For example:

- The main methodologies seem to be naïve experiments, narrative cases, and atheoretical questionnaires plus atheoretical regression or factor analysis [80]. There has been far too much atheoretical exploratory research. This is evidenced by top-of-the-head hypotheses that seem logical at the time of statement [7]. In place of models, MIS researchers frequently rely on data analysis methods to reveal patterns in the data that then suggest causal explanations. Without the aid of testable hypotheses to guide the analysis, it is too easy to rationalize findings on the basis of plausible explanations [82]. There is no clear theoretical base and no match between theory and method [80].
- Research results are confounded by poor operationalization of variables, omission of key variables, and overuse of surrogates ([81], [82]).

There was also dissatisfaction concerning the choice of methodology that predominated MIS research. Using Vogel and Wetherbe's methodological framework, MIS research up to 1980 did not typically include theorem proof, engineering, or field test methodologies. Instead, the lack of a theoretical base for MIS resulted in the vast majority of MIS research consisting of naïve case studies, subjective argumentative (frameworks and untestable assertions), ad hoc experiments, and surveys ([87], [9]).

Addressing MIS research methodological problems, researchers suggested that outside referent disciplines be used to help overcome the lack of MIS theoretical foundation.

- Theoretical grounding can come from within MIS, or from an outside referent discipline [7]. A referent discipline, such as information economics, can demonstrate how to approach the issue of defining information and can present an analytic strategy for developing and applying theory [80].

Referent disciplines can also be used to help improve research quality.

- If the research does not have a clear referent discipline, it is likely to be confused and ill executed. The standards of the referent discipline should be used; if a piece of MIS research is judged poor in terms of its referent discipline, then it is poor [87].

Note, however, that one referent discipline for all MIS research is not appropriate.

- Since MIS is a fusion of behavioral, technical, and managerial issues, there is no obvious or single reference discipline. For example, microeconomics, operations research, and computer science are not always suitable; they are highly convergent and require precision. MIS research at present must often be divergent and broad in scope and will have to work towards rather than from theory [87].

Finally, there was a call to move away from the preponderance of subjective argumentative research.

- Too much MIS research is at the conceptual level well beyond the point when such work is required. It is time to test, enhance, and embellish these frameworks with empirical research results [7].

3. CURRENT MIS RESEARCH CONTENT

This section examines the current (1981–1985) streams of MIS research. Based on the MIS change function framework presented earlier, the focus is on the impact of resources used, processes employed, and management on the appropriate choice of MIS product characteristics within an environment. Except for "resources used," each category is addressed separately as follows. References to resources in MIS literature are typically in terms of data processing professional and user roles; thus, resource discussions are contained within the management section.

3.1 *Processes employed*

Processes for determining management information requirements and for implementing MISs are concerned with three major issues. The first issue addresses the methods employed in order to aid analysts to determine a user's information requirements effectively. Such methods include critical success factors and the use of prototyping. The second issue concerns how far users should be involved in the development process. This involvement can impact the effectiveness of both requirements determination and MIS implementation. The third issue deals with user resistance to MIS implementation. An understanding of the bases of this resistance can help developers choose appropriate information requirements determination methods and appropriate levels and types of user involvement, as well as appropriate implementation approaches.

3.1.1 *Information requirements determination methods.* There is some research being done that attempts to provide guidance for choosing which information requirements determination methods are appropriate in particular contexts. For example, Davis [83] and Naumann, Davis, and McKeen [84] develop contingency approaches for method selection. These approaches translate the uncertainty surrounding the problem, the user's knowledge, and the analyst's ability into an uncertainty index. This index is then used to choose the appropriate requirements determination methods.

However, most of the research in this area addresses the information requirements determination methods themselves. For example, two information requirement methods currently receiving a lot of attention are critical success factors and prototyping.

Critical success factors. Critical success factors (CSF) is an information requirements method proposed by many authors (e.g., King [85]), and formalized by Rockart [86]. The foundation of CSF is the notion that the success of a manager or a firm is dependent on a few key areas or factors. These factors are critical and should thus be continually monitored to enable appropriate planning and control. The CSF method uses structured interviews to identify the manager's (firm's) goals and the processes necessary to achieve the goals. The interviews are then used to determine measures that reflect the performance of these processes, and reports are designed to track these performance measures.

Case studies indicate that application of the CSF method provides useful results for individual managers [87–90] and for information systems planning at the firm level [91,92]. Two key CSF strengths contribute to much of its success [97]. First, the intuitive appeal of the method generates user acceptance at the senior management level. Second, the method facilitates a structured, top-down analysis allowing an evolving design that can be continuously examined for validity and completeness.

However, Davis [93] has raised some concerns. For example, given human information processing biases such as representativeness, availability, and inappropriate causality [94], the CSF method may result in information requirements that do not accurately represent the context. Further research is required to determine if these problems significantly degrade the method [91].

Prototyping. Textual descriptions and/or graphical models (e.g., SADT) are typically used to facilitate communication of MIS requirements between the user and analyst. Both methods suffer in that they are very abstract, and thus may not convey a realistic sense of the proposed system [95]. Alternatively, prototypes can be used to present a much more realistic view of the system, but at a much higher cost. Some prototypes completely automate a subset of important system elements, whereas others include humans as part of the prototype "software" to help the system appropriately respond to user interaction [96].

To be effective, prototyping should be supported by online interactive systems, database management systems, very high level languages, generalized input and output software, and an accessible modeling facility [97]. Proponents suggest that prototyping should be employed when user needs are not static or well defined, or when development experience with similar applications has not been extensive [98].

Although prototyping is common in hardware development and engineering, prototyping for information systems development is relatively new, and practical experience and published empirical studies are limited. With few exceptions [99], discussions of prototyping benefits have been based on case studies [98] and analogical reasoning [100]. This weak empirical base does not effectively support proposals that prototyping leads to efficient and effective systems. In fact, there is evidence that the flexibility and quick system changes allowed by prototyping can lead to serious problems by promoting sloppy, unplanned analysis [100].

Some recent work in prototyping comes from a psychological referent and attempts to determine the appropriate characteristics of MISs based on predictive models of user acceptance and performance. For example, Davis's [101] model relates MIS characteristics to user perceptions of MIS usefulness and ease of use. This model can be employed to evaluate user acceptance of alternative MIS prototypes. There are additional models that can be used to predict the effect of prototypes in terms of human factor characteristics such as keystroke requirements [102]. A survey of these models is contained in Anderson and Olson [103].

3.1.2 *Extent of user involvement.* Research surrounding the extent of user involvement addresses the impact of increasing or decreasing user participation in the development process. Such impact can be felt in the efficiency and effectiveness of development, as well as in the ultimate acceptance and use of the system. Research on end-user computing takes user involvement to the extreme, virtually eliminating involvement of data processing professionals in MIS development. As with less extreme user involvement, end-user computing affects both requirements determination and implementation.

User involvement. It is almost an axiom of the MIS literature that user involvement is a necessary condition for successful development of MIS [5]. Such involvement is expected to improve MIS quality by providing a more accurate and complete assessment of user requirements [104,105]. In addition, user involvement is expected to facilitate implementation by fostering realistic expectations of system capabilities [106], by leading to system ownership and commitment by the users [105,107], and by maintaining the existing distribution of power [108]. There are, however, potential problems associated with extensive user involvement: project delays due to dealing with multiple groups, difficulty in developing a system specification understandable to users, and exacerbation of political problems [109,110]. In fact, decreased user participation may be called for when the systems projects include cost reduction through employee elimination [111] or when the system results in extensive changes to the organization power structure [108].

In addition to these potential problems with user involvement, the benefits have not been empirically verified [112]. For example, a review by Ives and Olson [5] found that of 22 studies, 8 claim to demonstrate a positive relationship between user involvement and MIS success, 7 present mixed results, and the rest indicate negative or insignificant results. Ives and Olson propose that these mixed results are due to research that is poorly grounded in theory. For example, a very simplistic model of user involvement is typically employed, which ignores the type of user involvement and control [5]. In fact, involvement can range from consultative (the design team is influenced by the user's needs) to representative (the user is represented on the design team) to consensus (all users are involved with the design) [113].

Ives and Olson [5] also suggest that the mixed empirical results are due to methodological problems associated with measurement and experimental design. These problems include the measurement of user involvement and of the resulting MIS success. User involvement is usually ascertained via questionnaire, which results in user perceptions of involvement rather than of actual behavior. Measures of MIS success are typically in the form of satisfaction with the MIS rather than task-oriented success measures. These problems are compounded by the fact that user involvement and success measures are typically ascertained after the MIS has been completed, which confounds perceptions of involvement and success.

An interesting recent line of user involvement research examines the dynamics of the user–analyst interaction. Such research is valuable from two perspectives. It serves as a means of developing a stronger theoretical basis for user involvement studies, and it provides examples of experimental designs and measurement schemes that do not have the problems associated with the typical post hoc questionnaire research. Franz and Robey [114] conducted a longitudinal study that looked at the development process from both rational and political perspectives. Collecting data over a two-year period from members of an insurance company, Franz and Robey found that political interests seemed to be of basic importance, whereas rational actions serve as façades to mask political motives and to legitimize self-interest. De Brabander and Thiers [115] used laboratory experiments to focus on the effectiveness of user–analyst communication. They found that effective communication is hindered when there exists an asymmetry in sanctionary power and semantic gaps. Asymmetry in sanctionary power refers to the ability of the analyst to make viable threats of punishment or promises of side payments to the user. This asymmetry leads to incomplete information exchange and less than a mutual user–analyst agreement regarding the development of an MIS. Information exchange problems associated with sanctionary power asymmetry are exacerbated by the different world views (semantic gap) held by users and analysts.

End-user computing. End-user computing currently accounts for about 50% of the computing resources used in some companies [116]. This is the response of users to large data processing backlogs, project delays, and the failure of data processing to meet user requirements [117]. Although people with little or no formal data processing training are developing and using their own computer applications, little is known about the types of applications developed, the applications development process, or the impact of the development and use of their applications on end-user productivity [118]. A survey of 10 large companies determined that users thought that end-user computing applications such as financial modeling, statistical data analysis, query applications, and graphics preparation have resulted in significant productivity gains [118]. Timeliness was found to be the most frequently mentioned advantage, although many end users felt it was also too time consuming [118]. A laboratory study using a simulated business setting has been used to evaluate the impact of end-user computing on decision making effectiveness [119]. In this study, MBA students were provided with the ability to build decision-aiding models (defined as end-user computing) or merely to use canned programs. The model builders significantly outperformed the canned program users in terms of their simulated firms' stock price, market share, and return on assets.

Unfortunately, end-user computing may have significant problems. For example, there is a rising concern over the accuracy of user developed applications. Davis [120] notes that the fact that many users do not apply quality assurance to their applications may result in poor decisions. This has already become evident with the use of spreadsheet programs. Firmin [121] reports that error rates of at least 20% have been reported by a Fortune 500 company, and that several oil company executives who recommended an acquisition based on an erroneous spreadsheet have been fired. Clearly, end-user computing must be carefully managed. Such management must consider hardware and software acquisition; development, testing, and documentation standards; data integrity and security; and the appropriate level of corporate support [122,123]. As a step in this direction, Meador and Mezger [124] offer a methodology for purchasing an end-user programming language.

3.1.3 *Dealing with user resistance.* Users may resist MIS implementation for various reasons. An understanding of the bases of this resistance can help developers choose appropriate information requirements determination methods, appropriate levels and types of user involvement, as well as appropriate implementation approaches. Markus [107] proposes three alternative theories of user resistance. Resistance may be due to factors internal to the user, such as cognitive styles, personality traits, or human nature. Resistance may be due to MIS characteristics, such as lack of user friendliness, poor human factors, or inadequate technical design. Resistance may be due to the sociotechnical or political environment of the organization. With the first two alternatives, resistance is destructive and can be reduced by proper attention to the individual and the MIS design process and product. Viewed from the last alternative, resistance is a constructive clue to existing problems; it can be used to help develop solutions.

It is proposed that resistance resulting from factors internal to the user or resulting from poor MIS design may be reduced through increased user involvement. For example, involvement of the user in the development process is expected to facilitate implementation by fostering realistic expectations of system capabilities [106], providing an arena for bargaining and conflict resolution [125], decreasing user resistance to change [126], leading to system ownership and commitment by the users [105,107], and by maintaining the existing distribution of power [108]. However, as described in the user involvement section above, such benefits have not been empirically verified, and additionally there may be significant costs associated with such involvement.

It is also proposed that environmental conditions may increase the potential for implementation problems. These conditions include extensiveness of the MIS, organizational norms not valuing the MIS or fostering its frequent use, conflict between data processing and the managers, and a more dramatic degree of change [127]. The chance of successful implementation under these conditions may be enhanced if implementation processes are guided by organizational design theories of change, such as those of Lewin/Schein and Argyris [127]. In addition, the employment of user surveys to assess and help control the realism of user expectations may be of use (unrealistic expectations are suspected of leading to implementation problems [128]).

3.2 *Management*

Management is typically defined in terms of the following five activities [129]:

1. Planning—deciding which objectives or goals to pursue, when they will be achieved, and how resources of personnel, equipment, and time will be devoted to their achievement.
2. Organizing—establishing an intentional structure of roles by identifying and listing the activities required to achieve the purpose of the enterprise, the grouping of these activities, the assignment of such groups of activities to a manager, the delegation of authority to carry them out, and provision for coordination of authority and informational relationships horizontally and vertically in the organization structure.
3. Staffing—manning and keeping manned the positions created by the organization structure, and thus defining personnel requirements for the job to be done and

inventorying, appraising, and selecting candidates for positions; compensating; and training or otherwise developing both candidates and incumbents to accomplish their tasks effectively.
4. Directing—orienting subordinates, clarifying their assignments on an ongoing basis, guiding them toward improved performance, and encouraging them to work with zeal and confidence.
5. Controlling—measuring and correcting activities of subordinates to assure that events conform to plans.

In the context of managing change, the MIS literature focuses on planning, organizing, and controlling.

3.2.1 *Planning.* Bowman, Davis, and Wetherbe [130] propose that effective MIS planning involves four difficult processes:

1. Strategic MIS planning—alignment of the MIS plan with the overall strategies and objectives of the organization. If the plan is based solely on "bottom up" proposals by users, it will reflect existing computer use biases rather than reflecting the overall needs of the organization.
2. Organizational information requirements analysis—design of an information system architecture for the organization as a framework within which applications are to be developed. This structure includes the applications for the various levels of management as well as management activities and is very difficult to ascertain.
3. Resource allocation—allocation of information system development and operations resources among competing applications. Problems with this process include the replacement of rational allocation with organizational dynamics such as the relative power of an application's supporter.
4. Methodology selection—selection of one or more planning methodologies for performing the above three processes. There is little guidance in the literature for proper selection.

Focusing on methodology selection, Bowman, Davis, and Wetherbe suggest the following methodologies for the first three processes:

1. Strategic MIS planning—strategy set transformation [131].
2. Organizational information requirements analysis—business systems planning [132], critical success factors [86], business information analysis and integration technique [133], ends/means analysis [134].
3. Resource allocation—return on investment, chargeout [135], zero based budgeting [136].

Although formal MIS planning seems to be widely practiced [137], such planning does not seem to be consistently applied. Pyburn [138] surveyed eight organizations and identified three approaches to MIS planning, none of which was universally successful. He found that more formal approaches such as those listed above were more successful in three contexts: in complex information system environments, when the top management style is more formal, and when the data processing department is located further away from top management. More informal approaches were found to be more effective in rapidly changing business environments.

Further evaluation of current MIS planning practice has been done by Sullivan [139], who surveyed several firms in order to evaluate the effectiveness of organizational information requirements analysis methods. He found that the success of methods such as critical success factors depends on the level of information system diffusion and infusion in the organization. Here, diffusion refers to the degree to which information technology has been disseminated or scattered throughout a firm; infusion refers to the degree to which information technology has penetrated a firm in terms of importance, impact, or significance. It was found that, rather than adopting single methodologies in high diffusion/high infusion contexts, firms tended to adopt more eclectic methodological strategies.

The need for further research is clear. Many formal MIS planning systems are being implemented, and the danger exists that the declining marginal returns of these systems may outweigh their benefits (King [137]). King thus suggests that evaluations of these planning systems be performed within individual firms to comprehensively identify the associated costs and benefits. In addition, there is a need for studies across firms in order to identify systematic relationships between this formal planning and firm effectiveness.

3.2.2 *Organizing.* Organizing for change is typically dealt with in terms of the roles necessary for the successful employment of analysis, design, and implementation methods and approaches. For example, successful user involvement depends on the existence of a committed senior person acting as a sponsor or champion, a facilitator who is usually an outside consultant, and the possibility of a third party to intervene on the user's behalf [104,115,140].

In addition, there is some work focusing on the overall organizational structure necessary for successful assessment and adoption (diffusion) of MISs. El Sawy [141] suggests three stages that affect the roles of data processing professionals and users. In the first stage, the data processing staff matches user needs with the emerging technological possibilities. This is followed by a cultural infusion stage, where the technology is infused into the work activities of a small user group. The final stage, inside-out diffusion, depends on the small group of users to champion the new technology in other organizational groups; users assume major responsibility and data processing responsibility diminishes. Huff and Munro [142] identify two major approaches for assessment and adoption. The issue-driven strategy is a top-down approach closely geared to the corporate planning process. The technology-driven strategy is a bottom-up approach that results when relatively low-level individuals identify interesting technological opportunities. In practice, however, Nuff and Munro found that an unplanned, opportunistic approach predominated, where assessment and adoption were not consistently managed. They identified six assessment and adoption phases (awareness, interest, evaluation, trial, implementation, and diffusion) as well as six roles (users, influencers, deciders, gatekeepers, planners, and sponsors).

3.2.3 *Controlling.* Nolan's stage model [143] is the most widely cited model of computing evolution in organizations and has become accepted as a description of how changes in organizational information systems take place over time [144]. Insights from the stage model include an ability to align data processing control systems in order to encourage effective current and future use of computers without incurring excessive inefficiencies.

The model began with work by Churchill, Kempster, and Uretsky [145], which described computer development based on a survey of computer users. This description hypothesized four stages focusing on the application of computer technology. Nolan [146] and Gibson and Nolan [147] expanded this descriptive model to include normative guidelines that reflected the appropriate mix of data processing accessibility and control; specifically, guidelines concerning data processing personnel specialization, data processing organization and control, and application development were offered. Briefly, the model stages:

Stage 1: Initiation—user data processing knowledge is limited. Data processing planning and control is lax: development priorities are assigned by first-in-first-out and there is no chargeout of computer or development resources.

Stage 2: Contagion (or expansion)—data processing planning and control is still lax, intended to engender experimentation, user learning, and applications development. The data processing manager is moved up in the organization and systems analysts and programmers are assigned to work in the various functional areas.

Stage 3: Formalization—strong planning and control systems are put into place to contain a runaway budget: data processing is centralized, a steering committee and a chargeout scheme are set up , and new system development is curtailed.

Stage 4: Integration (or maturity)—a new willingness to undertake new "revenue-oriented" applications as precipitated by strong user knowledge and desires. To support this new development thrust, current applications and files are integrated. With the proper control systems, this stage serves as a springboard for revenue enhancing (rather than cost reducing) data processing systems.

Later work by Nolan [143] extends the model to six stages, hypothesizing a firm's potential response to new technological developments such as sophisticated database management tools.

Since its proposal, several attempts have been made to validate the stage model. Based upon these works, King and Kraemer [144] believe that the model rests on a number of important claims that seem implausible. For example,

1. The classification scheme Nolan developed for benchmarking the stages—consisting of technology, application portfolio, data processing organization, data processing planning and control, and user awareness—is questioned by Drury [148].
2. Model predictions have not been supported. For example, Goldstein and McCririck's [149] study of 273 organizations failed to confirm the model's prediction that data administration would be more formalized in mature data processing departments.

In addition, King and Kraemer question whether the model is useful due to its intuitive power or practicality. For example,

1. That technological change is the primary driving force behind the growth of computing through the stages is probably overstated. Other important factors which influence the growth of computing come from the demand side: (a) institutionalized demand created by the need to maintain and upgrade existing systems adds to computing costs, (b) computing used as a political resource increases demand, (c) computing as a status-increasing technology increases demand.
2. The model assumes that increased external and internal knowledge will lead to effective and efficient control over computing. There are, however, many competing theories about how best to exploit computing. The processes by which knowledge is brought to bear on problems are not explained in the model, and there is no specification for how the appropriate policies are found and applied. (See Kling and Iacono [150].)

In sum, empirical support for the model is unconvincing and some of the major assumptions seem too simplistic or implausible. However, as Benbasat, Dexter, Drury, and Goldstein [151] note, Nolan's work has played an important part in moving the MIS field toward a sounder scientific footing through its coherent explanation of interrelated phenomena. The assertion of testable hypotheses has stimulated empirical studies that built on and referred to each other in a manner similar to the series of Minnesota laboratory experiments in the behavioral area (see Dickson, Senn, and Chervany [152]).

3.3 *Choice of MIS product characteristics within an environment*

There are two principle research thrusts that are concerned with the choice of MIS product characteristics within an environment. The first includes the development of tools and methods to help measure the impact of an MIS on its environment. Such research is valuable for evaluating existing MISs and choosing future MISs. The second thrust concerns itself with describing the actual impact of an existing MIS on its environment. Summarizing and classifying such specific impacts can provide practitioners with important guidance concerning the appropriate fit of an existing or future MIS within its environment.

3.3.1 *Tools to determine MIS impact.* The most common environmental impact described in the literature is in terms of overall MIS effectiveness. MIS effectiveness is ideally assessed in relation to an information system's contributions to the accomplishment of organizational objectives, such as profit [153,154]. However, the difficulty of measuring such effects, has led to the extensive (possibly unjustified—Chismar and Kriebel [155]) use of surrogates. As Srinivasan [156] notes, these surrogates typically take the form of measuring actual system usage (reports requested, connect time) or measuring user perceptions of MIS usefulness (satisfaction, perceived quality). Arguments supporting the employment of the system usage surrogate maintain that managers will only use an MIS intensively if it contributes to their goals [157]. Arguments supporting the employment of user perceptions of MIS usefulness include the notion that an MIS must be used to be effective and that a user's sense of satisfaction with an MIS is directly connected to MIS use [158]. In addition, Ginzberg [159] notes that when viewing an MIS as a service rather than as a product, user perceptions are a better indicator of MIS effectiveness than is mere MIS use.

Whether MIS use or user perceptions are more appropriate effectiveness surrogates seems to be contingent on the organizational context. As Ives, Olson, and Baroudi [154] note: "If users consider the system to be unreliable or its data inaccurate, their usage will reflect those doubts. If usage is voluntary, the system will be avoided. Since there are motivations for using the system other than its objective utility in decision making (e.g., mandate from management, political motivation, self protection for justifying poor decisions), either or both objective and perceptual measures may be appropriate. . . ."

This contingency issue may play a part in the confusing and conflicting results of research in this area. Research designs that lack control over these contingencies and that employ measures of use and perceptions unique to particular studies have made generalizations difficult (Ives, Olson, and Baroudi [154]). Although it is consistently argued that user satisfaction is correlated to information systems utilization and systems success, research results are not convincing [158]; for example, Srinivasan [156] found that users who spent more time using an MIS tended to be less satisfied with the MIS.

If surrogates for MIS effectiveness—such as MIS use and user perceptions—are to be employed, there is a need to derive standard, theoretically justified notions of these variables. In addition, there is a need to develop valid instruments with which to measure them. After such work, research into the validity of the various alternative variables as surrogates for MIS effectiveness can be productive. Work along these lines has, in fact, begun [154,156].

3.3.2 *Impact of MIS on its environment.* Research into the impact of MISs on their environment takes two forms. The first consists of a microevaluation focusing on how an MIS attribute affects the decision process or the decision effectiveness of an individual. The second form consists of a macroevaluation of the impact of a complete information system on the user or organization. The results from research in both these forms can be useful in developing a contingent notion of the appropriate MIS for specific contexts.

Microevaluation. Current microevaluation research follows from a long line of such work typically associated with the University of Minnesota [152]. In these studies, information display attributes (tabular versus graphic, CRT versus hard copy, color versus black and white, summary versus detail) are manipulated in a computer-simulated management problem such as inventory control decision making. The effects of such manipulation on decision performance (response time, decision optimality) are then measured in order to identify a systematic response of managers to various types of information displays. Because differences between individual users may play a mediating role, most studies include one or more cognitive styles as experimental factors. (Cognitive style refers to the process behavior that individuals exhibit in the formulation or acquisition, analysis, and interpretation of information used for decision making [160]. Thus, for example, tabular versus graphic display may have different effects on decision response time depending on whether the user has a systematic or a heuristic cognitive style.

The results of these studies have been varied and conflicting [161]. For example, some research shows that systematics prefer more information than heuristics whereas other research shows just the opposite; this conflict is also true for research comparing preferences for summarized versus detailed data by systematics and heuristics [162]. Similar problems have been shown for color versus black and white [163], tabular versus graphic [164], and CRT versus hard copy [165]. Explanations for these conflicting results cite both theoretical and methodological problems. Jarvenpaa, Dickson, and DeSanctis [6] claim that a lack of theoretical grounding has contributed to conflicting results by not providing a common ground for developing experimental hypotheses and interpreting results. In addition, they cite methodological problems associated with the use of numerous unreliable and unvalidated measuring instruments as well as inappropriate research designs (designs that are highly simplistic or are lacking experimental control). The use of cognitive style as a mediating variable in such studies is similarly brought to task. Huber [160] concludes that the currently available literature on cognitive styles is an unsatisfactory basis for such studies and that future research into cognitive style is unlikely to change this situation.

There have been a few attempts to provide theoretical (rather than ad hoc experimental) bases for determining the effect of information attributes on decision making. Greer and Kropp [166] develop a microeconomic model that provides a better understanding of the relationship between the benefits and costs associated with more timely information. In addition, Cooper [167] uses a microeconomic framework to examine the costs associated with producing decisions in order to identify appropriate MIS attributes in specific contexts. However, a major difficulty that needs to be addressed is the development of a theoretically justified and useful notion of information [168].

Macroevaluation. A few macroevaluation studies have examined large-scale MISs (e.g., Buchanan and Fennell's [169] description of a federal court information system) or the impact of an organization's information system on users and the organization [170–172]. Most recent attention has been directed via survey or case study methodologies at determining effective decision support system (DSS) features in various environments. For example, based on the development of a DSS in the public sector, Henderson and Schilling [173] found that a decision process support aid is more important than a DSS that provides answers. El Sawy [174] surveyed chief executive officers to determine the appropriate support of their strategic environmental scanning activities. He found that a DSS in support of such activities should be customized and personalized with a very loose link to the organization's information system, and should be adaptive enough to accommodate the constantly changing frame of reference.

The support of group decision making has also been getting recent attention. Four major approaches have been used to make meetings more efficient and effective: nominal group technique, delphi technique, teleconferencing and video conferencing, and group decision support systems (GDSS). The need for GDSS is the consequence of the clash of two forces: the environmentally imposed demand for more information sharing in organizations and the resistance to allocating more managerial and professional time to attend meetings [175]. When using GDSS, the nature of meeting interaction changes from communications concerning what members' views are (e.g., preference orderings) to communications concerning why members hold their views; this occurs because their views are readily apparent via the system [175]. Kersten [176] has found that support of negotiation and compromise is a valuable GDSS capability. In addition, flexibility and communication requirements of the group planning process require a GDSS with flexible architecture that enables horizontal communication and resolution for changing problems [177].

In general, most studies support the notion that successful group and individual DSSs are adaptable, flexible, and have a simplified human–machine interface. Comprehensive interviews of DSS users in 18 large organizations [178] indicate that DSSs that support all decision-making phases and support both individual and group decision making tend to increase the number of alternatives evaluated, increase user confidence, and speed up decision making. In addition, Hill and Wallace [179] observe that a DSS, with its associated conceptual simplicity, can serve as a first step to having users accept more complex optimization systems. Questions still arise, however, concerning what environmental factors will lead to DSS success or failure. For example, Sanders and Courtney [180] were unable to find any relationship between more general environmental attributes (problem structure, task interdependence) and DSS success.

A recent line of research closely associated with DSSs is that of artificial intelligence (typically expert systems). These systems are differentiated from DSSs in that DSS models tend to be causal in nature—typically used in support of decision making—whereas expert system models are judgmental and can potentially make decisions [181]. Although expert systems have been developed for business applications (e.g., investment portfolio management [182], analyzing the financial health of a company [183], and personnel assignment [184]), few are actually being used. Reasons for the slow transfer of this technology into the management domain include the typical lack of structure of management problems and the current lack of technical interface between expert systems and existing DSSs [181].

In line with this DSS–expert system technology transfer is work aimed at using artificial intelligence approaches to help build more appropriate DSSs. This research is in its formative stages and focuses on the decision-making process (and the attendant human information processing limitations) in order to build intelligent DSSs. Building DSSs with artificial intelligence organizing components is proposed to help integrate assorted DSS tools in order to provide the most appropriate DSS for a given context or problem [185–187].

Finally, a line of economic research examining the impact of information technology on the firm should be noted. Although some work has been done in terms of computer system or information systems function evaluation [188–190], of more interest here is research focusing on the impact of information technology on firm management and administration. Examples of this research are typically based on the concept of technical efficiency formulated by Farrell [191]. From this viewpoint, firms (or administrative units) are compared in terms of information technology's contribution to efficient firm operation. The comparison is relative, where one firm's efficiency is contrasted with that of the most efficient firm(s). Such analyses can be based on the development of a parameteric frontier production function (e.g., Cobb-Douglas [192]) or a nonparametric frontier production function (e.g., data envelopment analysis: [155]) from which relative efficiencies are measured.

3.4 *Summary*

MIS research up to this point may more easily de described by the questions it has generated rather than the answers it has provided. The following are examples of research questions noted by Mason [193] and Rockart [194] as a result of the 1983 Harvard Business School colloquium on information systems research:

PROCESSES EMPLOYED

Information Requirements Determination Methods

What are the unique characteristics of decision support and executive or organizational support systems?

How are task-specific and manager-specific tools different from each other?

As the technology changes, how should the human–computer interface change? Is there an ideal interface? What are the primary elements of "user friendliness"?

How do individuals and groups filter the information coming to them? How should they? What are the implications for information overload and the paucity of relevant information?

What is the process of organizational decision making (as opposed to individual decision making)? How is supporting an individual different from supporting a group?

What are the most significant roles general managers play, and how can these roles be supported?

How greatly do individual managers differ in their needs for various types of support? What causes these differences?

Extent of User Involvement

What types of support are necessary for effective use of decision support, executive support, and data support systems? How much of the support should come from within the user group and how much from the information systems department?

Dealing with User Resistance

How does one catalyze organization-wide acceptance of MIS products? How does one manage MIS acceptance, especially during periods of rapid change (such as the current personal computer inundation)?

Why are some organizations more resistant to the introduction of MIS than others?

MANAGEMENT

Do executives, professionals, or middle management most warrant support? Should some work be done for each? Top executives have more personnel support available to them, yet their activities have greater impact on the organization. Alternatively, professionals are given less support and have a clear need for analytic tools. How do information systems managers choose to allocate MIS development among these groups?

Should the communication process, in which managers appear to spend a significant amount of time, be a major focus of MIS effort?

What is the value of the MIS group being proactive? Should it seek out and attempt to prioritize opportunities for effective MIS support? Or should it merely react to user-stated needs?

Is there a proper tempo for MIS-induced organizational change? Can it be too slow? Too fast? How does one manage it? What are the risks?

CHOICE OF MIS PRODUCT CHARACTERISTICS WITHIN AN ENVIRONMENT

Tools to Determine MIS Impact

What are the success measures for MISs? Is there a generic set?

When, if at all, is traditional cost-benefit analysis applicable?

What are the appropriate means of assessing the "value" of MISs in qualitative terms? How can one communicate this evaluation to senior line executives?

What are the measures for quality of work life? Individual perception or actual performance?

Impact of MIS upon Its Environment

How are MISs changing decision processes?

How are MISs changing the ways work is carried out, including the roles of particular individuals?

What is the effect of MISs on the quality of work life? Does it enrich or deplete jobs? Is this a matter of choice—that is, dependent on various design options—or is it predetermined?

What happens to communication interactions? Is there more horizontal networking? More vertical networking? An increase or decrease in volume of communications?

What are the *overall* impacts of MIS on organizations in terms of structure, roles, educational levels needed, and other generalizable characteristics?

How do MISs affect patterns of authority, responsibility, and accountability? Does it lead to flatter organizations? More matrix organizations with increased horizontal communication in a vertical bureaucracy? How is control redistributed? Who benefits?

Although progress has been made in identifying appropriate research questions, little progress has been made in generating answers to these questions. Kwon and Zmud [195] note that a major reason for the limited success of MIS implementation research is a lack of common perspective among researchers: no core set of constructs exists; most studies focus on small pieces of the MIS implementation puzzle without considering larger issues. It is thus very difficult to build a cumulative, cohesive body of work. These problems apply equally to MIS requirements determination research.

This lack of common perspective may be due to problems with conceptualizing the output of MIS: information. Viewed from this review's MIS production framework, information is the product of MIS Change and Operation functions. In typical manufacturing contexts, without knowledge of the product, production processes cannot be built and potential impacts on the environment cannot be estimated. By analogy, it is very important to identify the product of MISs that is provided by data processing departments.

In addition, slow MIS research progress may be due to the continued emphasis on examining "what." For example, what are the relationships between the use of critical success factors or the use of prototyping and the resulting MIS quality? What is the impact of various levels of user involvement upon MIS quality and usage? What is the effect of end-user computing on user productivity? What is the relationship between MIS friendliness and user resistance? What MIS planning strategies are currently being used? What is the effect of changing an information attribute on the productivity of a user? What are the characteristics of a DSS deemed successful by users?

It may be time to turn to a much harder, but potentially more fruitful question: "why." In order to develop a deeper understanding of the MIS change function, and its ability to develop appropriate MISs for given environments, researchers must begin to ask why the relationships found by the current "what" research exist. Why do critical success factors result in better quality MIS? Why do different levels of user involvement affect MIS quality and usage? In a more global sense, why do certain information requirements analysis and implementation processes interact with change function management and result in appropriate/inappropriate MISs for various environments?

Such "why" research was suggested by Ives, Hamilton, and Davis [9] and Benbasat [196]. Current MIS research has started some movement in this direction. For example, as part of the user involvement literature, De Brabander and Thiers [115] and Franz and Robey [114] examine the dynamics of user-analyst interaction, focusing on the effects of sanctionary power as well as on the rational and political motivations.

Some authors, however, believe that this reorientation from what to why will not be enough to substantially increase the progress of MIS research. They believe that the lack of progress may be a symptom of methodological problems. Such problems are examined next.

4. MIS RESEARCH METHODOLOGY

As described earlier, criticisms of MIS research methodologies in the 1970s typically concerned the lack of theoretical foundation, poor implementation of empirical studies, and poor choice of methodology. There has been mixed progress along all three of these dimensions.

4.1 *Theoretical foundation*

In some of the older lines of MIS research, stronger theoretical foundations are appearing. User resistance research is beginning to adopt sociotechnical, political, and organizational design referents for theoretical guidance [107,127]. In microevaluation research, Greer and Kropp [166] and Cooper [167] have developed microeconomic-based models that provide a better understanding of the relationship between the benefits and costs associated with various information attributes.

In addition, researchers in some of these more established areas are recognizing and becoming more critical of their atheoretic work. Ives and Olson [5] propose that mixed results of user involvement research are due in part to poor theoretical grounding. Research on MIS impact determination tools has suffered from the lack of a theoretically justified and validated definition of MIS use [154,156]. Jarvenpaa, Dickson, and Desanctis [6] claim that a lack of theoretical grounding has contributed to conflicting results of microevaluation research by not providing a common basis for developing experimental hypotheses and interpreting results. Huber [160] concludes that a currently used microevaluation referent—cognitive styles—is an unsatisfactory foundation.

However, the research in relatively new MIS areas does not seem to reflect this new interest in stronger theoretical bases. Critical success factors, prototyping, end-user computing, and DSS research seem to be based more in intuitive, atheoretic exploratory research rather than in strong theoretic referent disciplines.

4.2 *Implementation of empirical studies*

MIS research implementation was criticized in 1980 as confounded by poor operationalization of variables, overuse of surrogate variables, and omission of key variables. These problems still tend to exist. In user involvement research, Ives and Olson [5] note problems with operationalization of variables:

> Problems surround the measurement of user involvement and resulting MIS success. User involvement is usually ascertained via questionnaire, which results in user perceptions of involvement rather than actual behavior. Measures of MIS success are typically in the form of satisfaction with the MIS rather than task-oriented success measures. These problems are compounded by the fact that user involvement and success measures are typically ascertained after the MIS has been completed, which confounds perceptions of involvement and success.

Research developing MIS impact determination tools has problems with over-use of surrogate variables:

> Though MIS effectiveness is ideally assessed in terms of an information system's contributions to the accomplishment of organizational objectives—such as profit [153,154]—the difficulty of measuring such effects has led to the extensive use of surrogates. As Srinivasan [156] notes, these surrogates typically take the form of measuring actual system usage (reports requested, connect time) or measuring user perceptions of MIS usefulness (satisfaction, perceived quality).

The Minnesota-oriented microevaluation research has been cited for problems with both operationalization of variables and omission of key variables. Jarvenpaa, Dickson, and De Sanctis [6] note the use of numerous unreliable and unvalidated measuring instruments as well as inappropriate research designs (designs that are highly simplistic or are lacking experimental control).

As with the theoretical problems mentioned earlier, these implementation problems may be reduced in the future due to the increased attention they are receiving from MIS researchers. This is evidenced by the more recent attempts at solving some of the implementation problems. For example, problems associated with the use of post hoc questionnaires in user involvement research are being addressed through longitudinal studies [114]. Another example is in the research on MIS impact determination tools. Here, there is a need both to derive a standard, theoretically justified notion of user perceptions that can be used as a surrogate for MIS effectiveness and to develop a valid instrument to obtain such perceptions. Work along these lines has, in fact, begun [154,156].

4.3 *Methodological choice*

According to Hamilton and Ives [197], over 60% of MIS research from 1970 to 1980 was conceptual, based on opinion and speculation, as opposed to empirical work such as case studies, field studies, surveys, and laboratory experiments. In contrast, the 1981-1985 MIS research reviewed for this article reversed this emphasis, with more than 70% of the articles being empirical (Table 2). This move away from conceptual toward more empirical research is in accord with the methodological choice suggested in 1980 [7], and seems to reflect a healthy shift to theory testing and empirically based theory reconstruction. However, Baroudi and Orlikowski [198] have found problems with current MIS empirical work. The average power (the ability to detect treatment effects) of this work is unacceptably low and can result in important effects going unnoticed.

In addition to the problem with experimental design power, the quality and value of MIS research seems to be lacking due to an inappropriate choice of methodologies for research problems [199]. In a survey of MIS publications by Jenkins, fewer than one-third of the papers clearly chose the appropriate methodology. The choice of methodology should be based on the theoretical view imposed on the problem being examined. Because researchers see what they expect to see, an appropriate methodology should be whatever methodological choices compensate for the restricted theoretical views (e.g., rationality) that MIS researchers impose on the problem [200]. Examples of the restrictiveness of different theoretical views is provided by Kling [201].

Table 2. Comparison of research methods: 1970s vs. 1980s

Research Method	1970-1980[a]	1981-1985[b]
Empirical		
Case study	13%	25%
Field study (survey)	9%	32%
Field test	5%	2%
Laboratory experiment	6%	13%
Conceptual (Subjective-argumentative Theorem proof engineering)	67%	28%

[a]These numbers are slightly different from Hamilton and Ives [197] since reviews and tutorials are ignored here.
[b]Does not include tutorials or reviews.

Recent works by Benbasat [196], Jenkins [199], and Galliers [202] provide detailed guidance for choosing appropriate methodologies. The following is from Galliers [202]:

Case Study
- Major Purposes: Improving efficiency, improving effectiveness, MIS failures, MIS development approaches, impact on organizations.
- Key Features: An attempt at describing the relationships which exist in reality, usually within single organizations.
- Strengths: Capturing reality in even greater detail than is possible using the survey approach and dealing with an even larger number of variables than in surveys.
- Weaknesses: Restriction to a single event/organization. Difficulty in acquiring similar data from a statistically meaningful number of organizations. The large number of variables and particular circumstances pertaining to individual situations. The different interpretations which can be placed on reality by individual researchers.

Survey
- Major Purposes: MIS failures, MIS development approaches, impact on individuals, impact on organizations, impact on society.
- Key Features: Obtaining "snapshots" of practices, situations, views at a particular point in time via questionnaires and/or interviews from which inferences may be made via quantitative techniques regarding the relationships of variables in the past, present and/or the future.
- Strengths: Greater number of variables may be studied than in field tests or laboratory experiments. Description of real-world situations.
- Weaknesses: Little insight is usually obtained regarding the causes or the processes behind the phenomena being studied. Possible bias in the respondents (especially those responding to questionnaires since they will be self-selecting), in the researcher, and in the moment in time that the research is undertaken.

Field Test
- Major Purposes: Improving effectiveness, impact on individuals, impact on organizations.
- Key Features: Extension of the laboratory experiment approach to real organizations.
- Strengths: The isolation and control of variables for study in real-life situations.
- Weaknesses: Finding organizations prepared to be experimented on. Achieving sufficient control to enable the replication of situations with only the study variables being altered.

Laboratory Experiment
- Major Purposes: Improving efficiency, improving effectiveness, impact on individuals.
- Key Features: Identification of the precise relationships between variables via a designed laboratory situation using quantitative analytical techniques in the hope of making generalizable statements applicable to real-life situations.
- Strengths: The isolation and control of a small number of variables which may then be studied intensively.
- Weaknesses: The limited extent to which identified relationships exist in the real world due to oversimplification of the experimental situation and the isolation of such situations from most of the variables which are found in the real world.

Some authors feel that the appropriate matching of research problems to these traditional methods will not solve some critical MIS problems. For example, Vitalari [203] suggests that longitudinal research designs are necessary in order to examine time-dependent phenomena such as learning, adaptation, and evolution.

Other authors believe that change in the basic research paradigm is necessary. (A research paradigm consists of shared assumptions that enable communication and agreement about good research.) For example, Klein and Lyytinen [204] suggest that the current patterning of MIS research after that in the natural sciences is bound to fail. Although natural sciences research is characterized by repeatability, reductionism, and refutability, these characteristics are problematic when doing MIS research due to the potential for different interpretations of social phenomena, the impact of the scientist on the social system being studied, and the confounding associated with human intention [202]. An example of problems associated with using the natural science paradigm involves the construction of information systems as primarily technical artifacts; this leads to misinformation systems because it ignores the subjective and intersubjective dimensions of the creation of meaning and knowledge in a social action case [204].

Methodological pluralism, which allows MIS research from multiple paradigms, thus seems appropriate [205]. Such pluralism includes methods from the natural as well as the social sciences. Three new approaches that attempt to break out of the natural scientific tradition are Futures Research [206], Phenomenological Research [207], and Action Research [208,209]. The following is from Galliers [202]:

Futures Research
Major Purposes: Improving effectiveness, impact on individuals, impact on organizations, impact on society.
Key Features: A variety of approaches can be attempted, e.g. scenario building using
-the delphi method
-identification of strengths, weaknesses, opportunities and threats
-identification of facts, "heavy trends" and issues.
Strengths: In changing economic and political environments, existing relationships may well not hold true in the future. The forward looking nature of futures research avoids such problems and attempts to deal with the rapid changes taking place in information technology and their impacts on individuals, organizations and society in general.
Weaknesses: The complexity of the variables under study and the lack of real knowledge concerning changing relationships. Scenarios built using a variety of methods are not true pictures of the future but are designed merely to enable organizations to understand what may be required to be done given different futures.

Phenomenological Research/Hermeneutics
Major Purposes: Improving efficiency, improving effectiveness, MIS failures, MIS development approaches, impact on individuals, impact on organizations, impact on society.
Key Features: An attempt at describing the relationships which exist in reality which also emphasizes the role of the researcher and his/her interpretation of the topic of study.
Strengths: Recognition of the fact that the researcher will interpret what is being studied in a particular way. A means of describing the interrelationship of many factors found in real-life.
Weaknesses: Despite making the prejudice of the researcher known, this could still cloud the interpretation of reality and thus make the research conclusions subjective. In addition the relationships observed may only exist for that particular point in time when the research is undertaken.

Action Research
Major Purposes: Improving efficiency, improving effectiveness, MIS failures, MIS development approaches, impact on individuals, impact on organizations, impact on society.
Key Features: Applied research where there is an attempt to obtain practical results of value to groups with whom the researcher has allied him/herself while at the same time adding to the body of theoretical knowledge.
Strengths: Practical as well as theoretical research aimed for the most part at emancipatory results.
Weaknesses: This approach places a great deal of responsibility on the researcher who must be aware that in certain circumstances (s)he is aligning him/herself with a particular grouping whose objectives may well be at variance with other groupings. The ethics of the researcher must therefore be an issue of paramount importance: i.e. a potential weakness in the wrong hands.

5. CONCLUSION

The purpose of this article was to organize, describe, and evaluate MIS research from 1981 through 1985 in order to provide an understanding of what constitutes MIS research and to indicate potentially rich areas for future research. Preliminary work included developing a definition of MIS, adopting an organizing framework, and choosing journals for review. Once this foundation was built, MIS research content and methodology up to 1980 were summarized based on the findings of the First International Conference on Information systems. Finally, MIS research from 1981 to 1985 was described and evaluated in terms of content and methodology.

It was found that more progress has been made in identifying appropriate research questions than in answering those questions. Significant progress in generating answers may be made in the future due to a healthy shift in the choice of methodologies (shift from more speculative-conceptual to more theory-based/theory-generating empirical). However, progress toward developing a global notion (theory) of MIS seems relatively slow. This lack of progress may be a symptom of:

- Lack of progress in defining the product of MIS (information).
- Too much research focus on *what* relationships exist instead of focusing upon why relationships exist.
- Underlying problems in the natural sciences paradigm currently associated with MIS research.

It is thus suggested that:

- More effort be devoted towards defining information.
- More effort be devoted towards determining *why* certain information requirements analysis and implementation processes interact with change function management and result in appropriate/inappropriate MISs for various environments.
- A methodological pluralism be adopted that allows the use of methods from multiple paradigms.

Finally, issues concerning the bias of the framework used in this review should be addressed. Because of the diversity and ambiguity associated with MIS research, a substantial portion of this article was devoted to defining MIS research and developing an organizing framework. The result is a relatively narrow view of MIS research—a management support view that includes only research involved with the effectiveness of managers' information requirements assessment and with the effectiveness of MIS implementation. This narrowness enabled a review that did not stray into areas such as computer science, management science, and organizational psychology and provided the potential for evaluating MIS research areas.

One problem with such a narrow view is the potential for defining away interesting research problems. For example, the review framework treated the user, organization, and external environments as fixed and only of interest as constraints. Within this view, data processing departments produce a good that is then used by managers. A different perspective that treats the output of data processing as a service instead of a good would include the environments as potentially manipulable. In this case, an MIS is the joint creation of users and data processing professionals, and the management of user capabilities through hiring, education, etc. is an appropriate MIS research topic. In addition, the definition of the MIS product is drastically changed [159,210], which can have a substantial impact on the effectiveness of MIS production processes. This potential for defining away interesting MIS problems must be kept in mind.

Another problem with such a narrow view is the potential for missing areas which are commonly thought of as MIS research. As described in the introduction, areas currently being researched in business schools such as management of the information systems resource, information systems technology and corporate strategy, office automation, model management systems, information retrieval, and analysis, design, and programming were not included in this review.

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