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MANAGEMENT INFORMATION SYSTEMS RESEARCH: WHAT'S THERE IN A METHODOLOGY?

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ABSTRACT

Management information systems (MIS) is both a young and unique field , constantly experiencing rapid change and turmoil. Consequently, MIS research faces dual changes of rigor and relevance. Many research methodologies exist that provide various combinations of rigor and relevance. The MIS researcher selects a methodology based on several factors including rigor, relevance, subject area, and personal preferences. In this article, we examine thirteen different methodologies as used by seven leading MIS journals during a recent five-year period. The results of this extensive analysis yielded some interesting results. Survey methodology consistently ranks at the top; while frameworks and conceptual models, laboratory experiments, and case studies also found significant use among the MIS community. Several trends were observed, one of them being a greater use of the case study method and other qualitative technologies over the years. Clear patterns also emerged based on the journal itself and the subject areas. At a macro level, this information should help authors in the choice of appropriate methodologies to use in specific subject areas and in targeting manuscripts to appropriate journals. It would also be helpful to journal editors in assessing the type of research and methods being used across journals and subjects, and whether they need to make any changes in the emphases of their own journals.

Keywords: Information systems research, research methodologies, MIS journals, meta analysis

I. INTRODUCTION

Compared to many disciplines in business and social sciences, management information systems (MIS) research is relatively young, having been in existence for only about 35 years. At the same

time, MIS research is unique in many respects. On the one hand, we expect more maturity in research given that we have had some time to build on the various "theories" and reflect on our experiences. On the other hand, Information Technology (IT), one of the primary drivers of MIS research, continues to leapfrog at a breathtaking pace. Changes in IT and its application are so rampant that researchers barely get to study one particular phenomenon with any level of rigor before moving on to new pastures. Such opposing forces are bound to have an impact on the investigation methods employed by researchers. It is therefore an appropriate time to study the nature of research methods in MIS – such a meta analysis allows us the opportunity for introspection, make an assessment of our field, and provide directions for future research.

The focus of this article is the “research methodologies” in recent use in published MIS research. At the outset, we define a research methodology as "the overall process guiding the entire research project". Another way to look at methodology is to call it the “primary evidence generation mechanism”. For example, one such methodology would be "survey research". Researchers, readers and different disciplines place different emphasis on different methodologies and regard them differently based on rigor, quality, and relevance. In fact, the MIS community engaged in this debate in recent years [Alavi and Carlson 1992; Davenport and Markus 1999; Lee 1999; Lyytinen 1999; Zmud 1996]. While, we do not engage in this debate ourselves, we will point to the characteristics and usage patterns of the various methodologies.

As the debate continues, interest in alternate methodologies grows. Many authors wrote about the different methodologies together with their pros and cons, as well as the author’s own experiences and preferences [Benbasat 1984; Kaplan and Duchon 1988; Klein and Myers 1999; Lee 1989; Markus and Lee 1999; Mason 1989; Pinsonneault and Kramer 1993; Walsham 1995; Zmud and Boynton 1991]. These essays are typically based on conceptual analysis. We were not able to find recent articles, which provided empirical results on the use of methodologies except for the publication by Vessey et al. [2002]. In this article, the authors examine several methodologies in the broader context of diversity in research, but do not conduct detailed analyses. The other published articles were either old or they provided data on a single or limited set of methodologies. For example, Ives at al. [1980] provided data on the various methodologies in use by examining 331 MIS dissertations. Kraemer and Dutton [1991] examined survey articles published in MIS since 1979 to about 1990. Pinsonneault and Kramer [1993] looked specifically at survey research in 14 journals. Alavi and Carlson [1992] analyzed 908 MIS articles from 1968 to 1998 in eight major journals and provided breakdown by empirical/non-empirical articles, field studies, laboratory experiments, case studies and field experimentation. Thus while interest existed in meta analysis, the efforts were either made a long time ago or focused on a limited set. This article reports results on a comprehensive set of methodologies employed in published articles of leading journals during the period 1993 to 1997.

II. RESEARCH METHODOLOGIES – MANY PATHS TO WISDOM

Many methodologies are available for MIS research. The choice of a single or multiple methodologies depends on several factors including the topic area, the research question, the researcher's background, and the intended audience. The use of multiple methodologies allows triangulation and is gaining wider acceptance, leading to greater confidence in the findings. While general consensus exists on the nature of most methodologies, variations exist and different people may label methodologies differently. Table 1 represents our compilation of the methodologies in use and applicable to MIS research.

Table 1: Methodologies in MIS research

Methodology	Definition
Speculation/commentary	Research that derives from thinly supported arguments or opinions with little or no empirical evidence.
Frameworks and Conceptual Models	Research that intends to develop a framework or a conceptual model.
Library Research	Research that is based mainly on the review of existing literature.
Literature Analysis	Research that critiques, analyzes, and extends existing literature and attempts to build new groundwork, e.g., it includes meta analysis.
Case Study	Study of a single phenomenon (e.g., an application, a technology, a decision) in an organization over a logical time frame.
Survey	Research that uses predefined and structured questionnaires to capture data from individuals. Normally, the questionnaires are mailed (now, fax and electronic means are also used).
Field Study	Study of single or multiple and related processes/ phenomena in single or multiple organizations .
Field Experiment	Research in organizational setting that manipulates and controls the various experimental variables and subjects.
Laboratory Experiment	Research in a simulated laboratory environment that manipulates and controls the various experimental variables and subjects.
Interview	Research in which information is obtained by asking respondents questions directly. The questions may be loosely defined, and the responses may be open-ended.
Secondary Data	A study that utilizes existing organizational and business data, e.g., financial and accounting reports, archival data, published statistics, etc.
Qualitative Research	Qualitative research methods are designed to help understand people and the social and cultural contexts within which they live. These methods include ethnography, action research, case research, interpretive studies, and examination of documents and texts.

While not exhaustive or necessarily identical to other lists, Table 1 represents the essence of most methodologies for MIS research. Most of the definitions in Table 1 are self-explanatory; we provide a brief discussion below. Benbasat [1984] provides a comparative discussion and analysis of many of the methodologies that we consider in this article.

The first category labeled as “speculation/commentary” refers to articles/research that are not really based on any hard evidence. They largely reflect the knowledge and experience of the authors. By definition, they tend to be somewhat visionary in nature. Typically, they signal the arrival of new trends and directions in the technology, its management or application. Examples are editorials pieces published in many journals [e.g., in MIS Quarterly- Issues and Opinions section, and Information Systems Research]. On some occasions, opinion pieces reflect debates that emerge on specific topics [e.g., the rigor vs. relevance debate in *MIS Quarterly* and the *Communications of AIS*].

"Frameworks and conceptual models" are especially useful for a discipline that generally lacks and defies attempts to develop theory. In lieu of theory, frameworks helped guide the work of many MIS researchers over the years. Some early noteworthy frameworks for the MIS discipline are by Gorry and Scott-Morton [1970], Mason and Mitroff [1973], and Ives, Hamilton and Davis (1980). Frameworks emerged even in sub-domains of MIS. For example, Sprague [1980] proposed a framework for Decision Support Systems, and Ein-Dor, Segev, and Orgad [1992] presented a work in the emergent area of global information systems.

The difference between library research and literature analysis needs some clarification. Library research (which is also part of most of the other methodologies) summarizes and synthesizes past research, and highlights some of the important conclusions. Some journals [e.g., *ACM Computing Surveys*, *Communications of the ACM*] would publish such work to provide a good synopsis of a certain area. However, literature analysis as we define it, examines many (perhaps all) past studies in a particular area and conducts a scientific meta analysis of the cumulative knowledge, in effect treating each study as one data point. An example of such research is by Alavi and Joachimsthaler [1992] where they conducted meta analysis of DSS implementation research.

Over the years, the "survey" method was extensively used in MIS research and is still in predominant use. It appeared to be suitable to descriptive studies characteristic of the 1970s and 1980s. While the method can attain high levels of external validity, it is known to suffer from lack of control and internal validity. It has come under attack and researchers were urged to use alternate methods. Pinsonneault and Kraemer [1993] conducted an assessment of survey-based studies based on 144 articles and identified five major weaknesses: single-method designs where multiple methods were needed, unsystematic and inadequate sampling procedures, low response rates, weak linkages between units of analysis and respondents, and over-reliance on cross-sectional surveys where longitudinal surveys were really needed. Kraemer and Dutton [1991] investigated three charges against survey research, i.e.,

- it is unable to yield cumulative knowledge,
- it is atheoretical, and
- it is ill-suited to address the subtleties of IT in complex settings.

Lyytinen [1999] contrasts the views of North American IS scholars with those of European scholars on such empirical research. Lyytinen [1999, pp. 26] states that "Too often North American IS researchers want to *work with specific research solutions* that are looking for problems… Few engage in systematic attempts to solicit problems…" Thus research based on survey methodology should be evaluated in light of the identified weaknesses and furthermore, researchers should take proper measures to ensure that survey methodology is not being used under inappropriate contexts.

"Case study" is a methodology that seems to be getting wider acceptance over the last decade. This inference was evidenced by the appointment of Allen Lee, a strong proponent of the case method, as the Editor-in-Chief of *MIS Quarterly*. Many of the articles published in the "Application" section of *MIS Quarterly* are in fact cases. *Information & Management* regularly publishes case studies. Many of the other leading journals also publish case studies. There is now even a new journal on case-based research: *Journal of Information Technology Cases & Applications*. Case studies allow the opportunity to study a single phenomenon in much depth, typically in an organizational setting. Generally, it is credited with much internal validity. Lee [1989] provides a succinct description of this "scientific" methodology and argues that case study research can have as much rigor as quantitative research. The difference between a case study and a field study is less clear, and some may use the terms interchangeably. For our purposes, a case study generally refers to the in depth study of a single phenomenon (e.g., one application, one technology) over time in a single organization. On the other hand, a field study can be broader, i.e., it may study several related phenomena or processes in multiple organizations and it may be cross-sectional or longitudinal.

Field experiments and laboratory experiments provide the element of control typically absent in surveys and case studies. Using these methodologies, some of the independent variables can be manipulated as well as the subjects. Thus they seem to provide more direct evidence, albeit on a limited number of variables. Field experiments are conducted in organizational settings (thus more difficult to conduct and exercise control) while laboratory experiments are performed in research settings (typically with students and providing more opportunities for control). Mason [1989] provides an overview of the experimental method in MIS research and discusses various issues and limitations. Specifically, Mason [1989] states that two dimensions define a knowledge domain: richness of worldly reality, and tightness of control. He argues that tightening the controls or preserving more reality can improve the knowledge yield of an experiment. Jarvenpaa, Dickson, and DeSanctis [1985] discuss methodological issues associated with experimental research. Some areas within MIS appear to be more appealing for this type of research, e.g., group decision support system research was largely conducted in specially designed decision room settings [Fjermestad, and Hiltz 1999].

We included "interviews' as a separate category although it is typically part of other methodologies, such as case studies and qualitative research. However, in our review of hundreds of articles, we found this method repeatedly mentioned over and over – either by itself or in combination with other methodologies – as the primary method of data collection. So, while there is duplication with other methodologies, we feel that the "interview" category is significant in and of itself to be listed separately.

The use of "secondary data" in MIS research is not in widespread practice, as in other business disciplines [e.g., in Finance where company financial performance data and stock market data are analyzed frequently]. A possible reason for the underutilization of this method is that MIS related data is less likely to be available in public repositories compared to accounting, financial, and marketing data. Sources of secondary data include: financial and accounting reports, annual reports, archival data, information in public domain, and commercial database services [e.g., Compustat, CompuServe and Dow Jones Information Service]. In recent years, company web sites became an attractive source of secondary data. An example of a recent article based on web site data is by Sakaguchi, Palvia, and Janz [2001].

The last methodology listed in our compilation is "qualitative research". Qualitative research is based on the premise that an in-depth qualitative examination in the organizational and cultural context is likely to provide greater insights. Actually, we use the term as a 'catch-all' category to collectively include several qualitative methods such as the case research method, ethnography, action research, examination of documents and texts, interpretive studies, and historical research. Earlier, case study was listed separately because it has enjoyed much wider use, thus deserving attention in its own right. Recently, Markus and Lee [1999] used the term "intensive research" to signal the variety of methods that are commonly called qualitative research or interpretive research. Given the constantly transforming nature of IT and MIS, the emphasis on qualitative research increased in recent years. While cast aside in earlier years, most journals now feature qualitative articles almost regularly. *MIS Quarterly* even devoted a whole issue [March 1999] to qualitative research. Given the recent introduction of this methodology into MIS, several authors provided principles and guidelines in using these approaches: e.g., historical research by Mason, McKenney and Copeland [1997], interpretive studies by Klein and Myers [1999] and Walsham [1995], and case research by Lee [1989].

III. RESEARCH METHOD FOR THIS STUDY

Extensive content analysis was conducted for this study. Articles published in selected leading academic MIS journals were read and coded to capture the relevant data. Table 2 lists the seven journals that were reviewed. Consistent with previous similar studies [Culnan and Swanson, 1986 and Gillenson and Stutz, 1991], these journals were selected primarily due to their high acclaim in the MIS field.

Table 2. Selected MIS Journals Used in the Study

• Communications of the ACM (CACM)
• Decision Sciences (DS)
• Information & Management (I&M)
• Information Systems Research (ISR)
• Journal of Management Information Systems (JMIS)
• Management Science (MS)
• MIS Quarterly (MISQ)

All articles, published between 1993 and 1997 in these journals, were screened. Following the procedure outlined by Grover, Lee and Durand [1993], MIS and related articles were selected by examining the title for information systems keywords. A total of 843 articles were selected, reviewed and coded using content analysis [Weber, 1990].

Six MIS doctoral students under the supervision of an MIS faculty member were involved in the data collection. To divide work and ensure uniform evaluation, each reviewer (coder) was assigned an equal number of articles to evaluate and was asked to code articles on a special coding sheet. This approach amounts to structured content analysis as described by Smith et al. [1991]. The enormity of the task was such that it took more than a year to code all of the 843 articles in the study.

Articles were coded according to the Barki, Rivard, and Talbot [1988] classification scheme. The classification scheme presents the most comprehensive classification of MIS topics and was used in previous studies [e.g., Alavi and Carlson, 1992]. The classification list contains seven levels. The first level represents the broadest topic classification while each lower level incrementally refines the topic. The three top levels of the scheme were selected as the base for the subject classification in this study. Continual developments in information technology broadened the scope of MIS to include subjects that were not listed in the Barki, Rivard, and Talbot classification. Accordingly, several topics were added to come up with the final subject classification list for this study (Table 3).

Each article may deal with multiple subjects and may employ multiple methodologies. Therefore, the coding sheet that each reviewer used allowed for up to three different subjects per article and up to two different research methodologies. The methodology classification shown earlier in Table 1 was adopted and used to code the methodologies for the articles. Because of possible multiple subjects and multiple methodologies per article, the total subject count was 1579 and the total methodology count was 1031.

To ensure uniformity of coding and to reduce coding ambiguity, the coders were trained in the coding method. In these training sessions coders met and discussed the subject areas and research methodologies to be used in the coding process. Each coder was then required to code independently the same set of articles. A discussion was held based on individual coding outcomes and a consensus was reached regarding the final coding scheme. The coders coded a second set of articles and the results were identical in each instance, achieving very high inter-rater reliability. This method ensured that the coders were properly trained in the coding method

Table 3: Subjects or Topics Classification

1. Theory of MIS
2. Artificial Intelligence (AI) /Expert System (ES) / Neural Networks (NN)/ Knowledge management (KM)
3. Global Information Technology (GIT)
4. Hardware
5. Software / Programming Languages
6. Networks / Telecommunications
7. Internet
8. Electronic Data Interchange (EDI)
9. Electronic Commerce (EC)
10. Multimedia
11. Databases / DBMS
12. Internal / External Environment
13. Organizational Design / Business Process Reengineering (BPR)
14. Innovation
15. Resource Management / IS Management issues
16. IS Planning
17. IS staffing
18. IS Evaluation / Control
19. Security
20. IS Development / Methods and Tools
21. IS Implementation
22. IS Usage
23. End User Computing (EUC)
24. Executive Information Systems (EIS)
25. Decision Support Systems (DSS)
26. Group Decision Support Systems (GDSS)
27. IS Function Applications
28. IS Education
29. IS Research

prior to embarking on coding the entire range of articles this study. The method ensured that they all had a common thread of understanding of the terms (i.e., the subject areas and the research methodologies) in the coding scheme, thereby significantly eliminating ambiguity from the coding process. Such high agreement between the coders was achieved because they were all advanced doctoral students in MIS and understood very well the content and the methodologies covered in the articles. Given this level of agreement and to contain the duration of the project, each article was then coded by only one coder. Still, it took more than a year to code all of the 843 articles.

IV. RESULTS

The results of our analysis on the use of the methodologies, trends in the use of the methodologies, appearance of methodologies in specific journals, and the use of methodologies by subject areas are presented below.

METHODOLOGY USAGE

Since up to two methodologies were coded for each article, they were categorized as primary and secondary methodologies. Thus three counts are shown in Table 4 for each methodology: the total number of times it was used, the number of times it was used as the primary methodology, and the number of times it was used as the secondary methodology.

Table 4: Rank of Research Methodology Based on Count and Percentage of Articles Using Specific Methodology

Rank by total	Methodology (Total)	Primary Methodology Count	Secondary Methodology Count	Total
1	Survey	218	29	247 (24.0%)
2	Frameworks and Conceptual Models	139	16	155 (15.0%)
3	Laboratory Experiment	113	16	129 (12.5%)
4	Case Study	92	15	107 (10.4%)
5	Speculation/commentary	64	4	68 (6.6%)
6	Mathematical Model	53	22	75 (7.3%)
7	Field Study	50	8	58 (5.6%)
8	Literature Analysis	40	25	65 (6.3%)
9	Secondary data	23	5	28 (2.7%)
10	Field Experiment	17	6	23 (2.2%)
11	Interview	17	21	38 (3.7%)
12	Library Research	16	14	30 (2.9%)
13	Qualitative Research	1	7	8 (0.8%)
	Total	843	188	1031

Among the journals studied and during the period studied, the survey method was the most widely used research methodology (24%). The second most commonly used methodology was frameworks and conceptual models (15%). Information systems is a relatively new research area compared to other disciplines and there are always rapid new developments in IT; both of these factors seem to contribute to the enthusiastic quest for new research models and frameworks. Similarly, due to the newness of many MIS phenomena, laboratory experiments (12.5%) were also frequently used, taking third place among the most commonly used research methodologies. Case study (10.4%) took fourth place; apparently the call for case studies made in the late eighties and early nineties seem to have had an effect.

Mathematical modeling, speculation/commentary, literature analysis, and field study share similar percentage at 7.3%, 6.6%, 6.3%, and 5.6 % respectively. These methodologies are less predominant in general. Interview, library research, secondary data, and field experiment are at 3.7%, 2.9%, 2.7%, and 2.2% respectively. More interestingly, the results show fewer articles utilizing qualitative research. Out of the 1031 total methodology count, only eight (0.8%) used

qualitative research. Moreover, qualitative research was more frequently used as a secondary methodology than the primary methodology.

METHODOLOGY USAGE TRENDS

Analyzing data year-by-year during 1993-97, we found some interesting trends. Overall, results show that survey, frameworks/conceptual models, and laboratory experiments are the most frequently used research methodologies. However, through the years, some methodologies become more frequently used while others fall in usage (Figures 1 and 2).

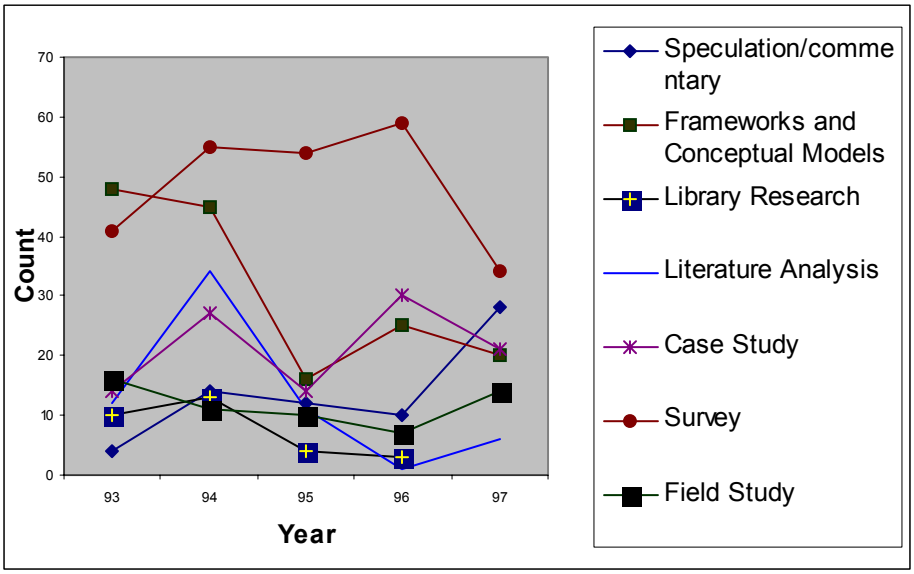

Figure 1. Methodology Usage Trends

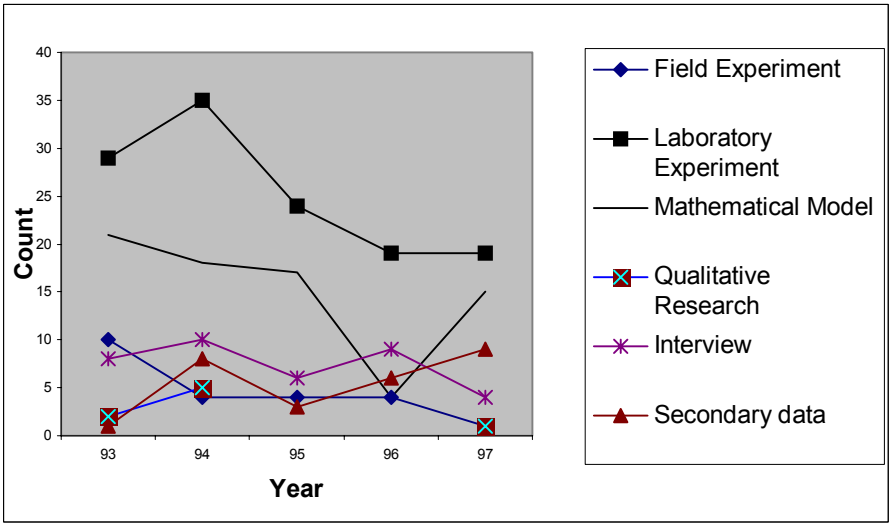

Figure 2. Methodology Usage Trends

Survey methodology holds its own and remained the strongest research methodology throughout. It is ranked 2nd in 1993 and then first from 1994 through 1997. Although it was not the top one in 1993, it had a high percentage of use nevertheless (19.0%). "Framework/conceptual model" based research declined continually. While it was the highest used in 1993, it dropped to second place in 1994, fourth in 1995, third in 1996, and finally sixth place in 1997. Apparently, journals wanted to publish actual research more than frameworks that guide research.

On the contrary, the case study method became popular over the years. Starting with sixth and fifth rankings in 1993 and 1994, it moved to second place in 1996 and third place in 1997. Another gain is in speculation/commentary, which came out strong, ranking second in 1997. These trends are perhaps a consequence of the constant inflow of emerging information technologies and a lack of theoretical groundwork to guide research in these new areas.

Laboratory experiments remained in the top three ranks except in 1996, when it dropped just slightly below to fourth place. When manipulation of the independent variables is desired, IS researchers favor the laboratory experiment methodology because of the control if affords. Library research, which is based primarily on literature review alone, became less predominant over the years. This trend shows that MIS research is moving towards maturity and that more sophisticated methodologies are being used increasingly.

Speculation and case study are being utilized more often in the later years of our study period. Once again, these trends are an indication of the newer technologies that spring up and the lack of attendant theories to study them. In general, library research, literature analysis, field experiments, laboratory experiments, and mathematical model are less frequently used. The trends of the high use of the survey method and lesser use of the field study method are generally stable over the years. Qualitative research was rarely used throughout these years.

MIS SUBJECT TRENDS

The most-written about MIS topic is Resource Management/IS Management issues, followed by Theory of MIS and IS Evaluation/Control in third and fourth places (Table 5). This finding is consistent with the views of many in the academic field that equate MIS to "Management of Information Systems" and focus primarily on management and control issues of Information Systems. In second place came IS development and in fifth place came networks/telecommunications, both of which have been (and continue to be) important issues for quite some time.

Subjects in the middle of the list in Figure 5 appear to be receiving at least a moderate amount of attention. What is interesting to note are the subjects near the bottom of the list. It seems that some important issues current then were not very well represented. For example, EIS, global IT, electronic commerce, and Internet were listed among the last. Of these, interest in EIS (Executive Information Systems) peaked and underlying EIS topics are being addressed by other areas, such as data warehousing, data mining, and Online Analytic Processing (OLAP). The subject of Global IT really became prevalent in the 1990s and there now seems to be a steady stream of research activity in it, especially with two journals devoted specifically to global IT topics.

Table 5: Appearance of MIS Subject Categories (1993-1997)

Subject Categories	Frequency
Resource Management/ IS Management Issues	152
IS Development /Methods and Tools	143
Theory of MIS	132
IS Evaluation/ Control	103
Networks/ Telecommunications	88
End User Computing	87
IS Functional Applications	87
Internal/ External Environment	86
IS Research	80
AI/ES (under types of sys)/ ANN/ Knowledge Management	68
DSS	67
IS Planning	61
Software/Programming Language	57
GDSS/ GSS/ Collaborative Systems	47
Organizational design/ BPR	44
IS Implementation	41
IS Usage	37
DBMS/databases	34
Innovation	30
IS Staffing	26
Security	19
IS Education	19
Global IT	14
EIS	14
Electronic Commerce	13
Hardware	12
Multimedia	11
Internet	7
Total	1579

The low number of articles in the Internet and Electronic Commerce speaks to the rapid changes in the IT industry. While today, the Internet and Electronic Commerce activities are ubiquitous and pervasive, the phenomena are only a few years old. For example, our review showed that Internet research was first conducted in 1996 (4 instances) and remained underexplored even in 1997 (3 instances). Other under-researched areas are hardware, IS education, and security. We expect interest is security issues to swell after the events of September 11, 2001.

Interesting trends can be observed in Table 6, which shows the appearance of the topics by each of the five years. Some topics became a mainstay of MIS. These include: resource management/IS management issues, IS development methods and tools, functional applications, IS planning, and software/programming languages. Heartening to note is increased research in IS evaluation and control which is a good sign of a developing field. Note that emerging trends in MIS resulted in more research into such areas as networking & telecommunications, global IT, and the Internet (while electronic commerce research had not appeared by 1997). Thus it seems that IS researchers tend to keep pace with technological developments. Some topical areas that seem to lose ground included decision support systems, artificial intelligence, expert systems, and group systems.

Table 6: Subject Trends between 1993-1997

Subject	1993	1994	1995	1996	1997	Total
Resource Management/ IS Management Issues	19	29	23	43	38	152
IS Development /Methods and Tools	35	33	16	22	37	143
Theory of MIS	14	46	38	15	19	132
IS Evaluation/ Control	19	12	13	27	32	103
Networks/ Telecommunications	7	30	9	12	30	88
EUC	20	16	25	14	12	87
IS Functional Applications	18	24	7	9	29	87
Internal/ External Environment	11	19	7	17	32	86
IS Research	11	23	15	11	20	80
AI/ES/ ANN/ Knowledge Management	20	14	17	11	6	68
DSS	24	16	10	8	9	67
IS Planning	11	21	4	12	13	61
Software/Programming Language	7	15	11	9	15	57
GDSS/ GSS/ Collaborative Systems	8	12	11	11	5	47
Organizational design/ BPR	6	13	1	11	13	44
IS Implementation	10	15	2	8	6	41
IS Usage	11	7	3	9	7	37
DBMS/databases	6	11	7	5	5	34
Innovation	2	8	1	6	13	30
IS Staffing	4	4	9	4	5	26
Security	5	3	3	3	5	19
IS Education	0	2	8	5	4	19
Global IT	3	5	1	1	4	14
EIS	2	0	6	2	4	14
Electronic Commerce	1	6	4	1	1	13
Hardware	3	3	1	3	2	12
Multimedia	0	3	3	1	5	11
Internet	0	0	0	4	3	7

SUBJECT BY METHODOLOGY

Insights can be obtained by examining the use of methodologies by subject areas. It was evident that some methodologies are used more heavily than others. Moreover, the chi-square (χ^2) test of independence between two factors was used to assess whether the differences in methodology usage across subjects are statistically significant. The χ^2 statistic (χ^2 = 826.12, p = .0000) was significant and therefore indicates that methodology use across subjects is not homogeneous. The differences are not random and are attributable to definite usage preferences.

To show the usage patterns clearly and prominently, we decided to select the top fifteen subject areas of research in IS based on the frequency ranking in r Table 5 and the subject areas that are comparatively more recent and are in early stages of development. The rationale was that it will allow us to examine research methodologies that are used in more mature subjects as well as in up- and-coming areas of interest. Table 7 shows the frequency of each methodology appearance by subject area. For easier interpretation, we also provide the top three methodologies for each subject area, listed as Roman numeral I, II, and III.

Some comments are in order. The following areas used survey research methodology the most: Resources management/IS management issues, IS functional applications, IS planning, IS usage, IS staffing, IS implementation, End-user computing, IS (meta) research, Internal/external

Table 7: Subject by Methodology

	Spec./ Comm.	Math Model	Qual. Res.	Interview	Sec. data	Frame /concept Model	Library Res.	Lit. Analysis	Case Study	Survey	Field Study	Field Exp.	Labora-tory Expt.
Resource Management/ IS Management Issues	10	9		13	5	(II) 29	6	10	(III) 23	(I) 53	15	3	12
IS Development /Methods and Tools	9	9	6	8		(I) 39	6	7	22	(II) 37	8	6	(III) 25
Theory of MIS	6	17		6	2	(II) 25	5	18	10	(I) 39	8	6	(III) 23
IS Evaluation/Control	5	11	2	6	5	(III) 13	1	6	(II) 16	(I) 34	12	1	9
Networks/ Telecommunications	9	5		3	2	(I) 24	2	4	(III) 13	(II) 23	7	1	12
EUC	7			7	3	(II) 16	2	6	5	(I) 43	5	4	(III) 14
IS Functional Applications	(III) 15	7	1	4	4	13	1	3	(II) 20	(I) 24	6	1	7
Internal/ External Environment	10	4	1	5	4	(II) 16	4	7	(III) 11	(I) 28	5		5
IS Research	(III) 17	2	1	5	3	10	5	(II) 18	1	(I) 25	3	1	7
AI/ES (under types of sys)/ ANN/ Knowledge Mgt.	5	(I) 20		3	1	(III) 11	3	3	(IV) 6	(II) 14	5	5	(II) 14
DSS	0	10		3	2	(II) 16		5	8	(III) 11		3	(I) 28
GDSS/GSS/Collaborative Systems	0	3	2	3		(II) 10	3		1	2	3	(III) 5	(I) 29
IS Planning	3	(III) 10		5	5	8		6	(II) 12	(I) 25	6		1
Software/Programming Language	(III) 9	(III) 9			2	(II) 12	1	1	6	6	7	2	(I) 15
Organizational Design/BPR	2	2		3		6	2	(III) 7	(I) 19	(II) 9	4		
IS Implementation	1	1	2	2		(III) 5	3	4	(II) 7	(I) 15	(III) 5	(II) 7	4
Global IT	0				1	(II) 3	1	(III) 2	(III) 2	(I) 7			
Electronic Commerce	0	(III) 1	(III) 1	(III) 1			(III) 1		(I) 6	(II) 4	(III) 1		
Internet	(III) 1					(III) 1			(I) 3	(II) 2			

- Spec/Comm: Speculation/ commentary, Math Model: Mathematical Model, QualRes: Qualitative Research, Sec. Data: Secondary Data, Frame /concept Model: Framework/Conceptual Model, Library Res.: Library Research, Lit. Analysis: Literature Analysis, Field Exp.: Field Experiment.
- Note: 1, 2, 3… represent the count of methodology per subject; I, II, and III represent the rank of the methodology for the subject

environment, and Global IT. A clear pattern emerges that IS management and organizational issues rely more on survey methodology.

Another observation is that laboratory experiment is the dominant approach in research into DSS, GDSS, and software/programming languages. Laboratory experiments allow researchers greater control over subjects and variables. Decision support processes and software/programming language issues can be captured in a simulated laboratory environment, whereas organizational and people issues are difficult to recreate in a laboratory setting.

Networks/telecommunications, IS development/methods and tools, and DBMS/database research favor the framework/conceptual model approach. In addition, theory of MIS also involves considerable research using this approach. It seems that this approach is more suitable for areas which are relatively new, where there is constant and rapid change in technology, and where there is not much theory developed.

The case study methodology is commonly used in organizational design/BPR, IS functional applications, and resource management/IS management. These areas deal with complex issues at organizational level and require in-depth studies to reveal the various nuances. Case studies are instrumental in providing such deep knowledge. While surveys are used extensively, the emergence and acceptance of the case method is encouraging for the MIS discipline.

Other Observations. Research in artificial intelligence and neural networks mostly use mathematical models primarily because the origins of AI and NN are from mathematics and computer science. Security research is under-represented in academic journals and there is not much sophistication or rigor in such research; most security research utilizes the speculation/commentary approach. Once again, as alluded to earlier, we hope this situation will change. IS (meta) research and IS functional applications are two other areas that also used the speculation/commentary approach to a greater extent. Interestingly, the more recent areas of research such as Global IT, Electronic commerce and the Internet show that IS researchers actively engage in diverse research methodologies. This diversity is commendable and in our view a healthy development in that the field is maturing in its ability to incorporate a diverse set of research tools.

METHODOLOGY USED IN JOURNALS

For each of the seven journals, we examined the methodology utilization patterns. To assess the statistical significance of the differences of the methodology usage in journals, the chi-square (χ^2) test was used to test the independence of the two factors: journals and methodologies. The χ^2 statistic (χ^2 = 706.51, p = .0000) was significant indicating that the methodology usage in journals is not homogeneous. There are significantly different usage patterns in different journals. The results show that particular types of methodologies are used more heavily in some journals than others. Table 8 summarizes these results. For each journal, the table shows the percent use of each methodology as well as ranks the methodologies by their use.

Based on methodology usage, journals can be broadly classified into three categories. Whether it is a conscious decision on the part of the journal editors or not, our data indicates that such methodology preferences exist among journals. The first “behavioral/empirical” category includes *MIS Quarterly, Information & Management,* and *Journal of Management Information Systems* which favor survey methodology (ranked first) over the other methodologies. In each of those three journals, survey methodology comprised more than 20% of the total count. In addition, other commonly used methodologies in those journals included case study (ranked second in *MISQ* and third in *I&M* and *JMIS*) and laboratory experiment (ranked 6th in *MISQ*, 5th in *I&M*, and 4th in *JMIS*). One interesting finding is that, qualitative research is ranked last in every journal except MISQ. This result indicates that MISQ gave qualitative research more attention during the study period than any other journal.

Another category, which is more “quantitative” and mathematically oriented, includes *Decision Sciences* and *Information Systems Research*, both of which favor laboratory experiments and mathematical models. Both journals place laboratory experiment at the top rank and

Table 8: Rank of Methodologies Used in Journals (1993 – 1997)

Methodology	MISQ		Information & Management		JMIS		Decision Sciences		ISR		CACM		Management Science	
	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%	Rank	%
Survey	1	22.10	1	31.50	1	26.60	2	24.80	3	16.50	3	16.30	2	17.50
Frameworks/Conceptual Models	4	8.60	2	15.80	2	18.40	4	6.70	4	12.80	2	19.00	1	23.80
Laboratory Experiment	6	7.90	5	7.30	4	11.60	1	25.70	1	21.10	5	11.60	3	12.70
Case Study	2	15.7	3	10.00	3	11.60	9	2.90	5	9.20	4	12.90	8	4.80
Mathematical Model	12	0.00	10	3.10	5	9.20	3	13.30	2	21.10	7	2.70	4	11.10
Speculation/Commentary	10	5.00	8	4.20	11	1.40	8	3.80	10	1.80	1	27.90	11	0.00
Literature Analysis	5	7.90	4	7.70	6	6.30	5	6.70	6	6.40	9	1.40	7	7.90
Field Study	3	10.70	6	6.50	7	4.30	7	4.80	9	2.80	8	2.70	6	7.90
Interview	9	5.70	7	5.40	8	3.90	11	1.00	7	3.70	10	0.70	9	3.20
Library Research	7	7.10	9	3.10	10	1.90	12	1.00	12	0.90	6	3.40	10	1.60
Secondary Data	13	0.00	12	2.30	9	2.90	6	5.70	8	2.80	11	0.70	5	9.50
Field Experiment	8	6.40	11	2.30	12	1.40	10	2.90	11	0.90	12	0.70	12	0.00
Qualitative Research	11	2.90	13	0.80	13	0.50	13	1.00	13	0.00	13	0.00	13	0.00

mathematical models at second or third rank. It is noteworthy that the survey method still comes in at a respectable second or third rank in both journals.

The third category termed "conceptual" includes Communications of the ACM and Management Science. CACM published predominantly research utilizing speculation/commentary methodology as well as frameworks and survey research. In a similar vein, Management Science publishes research that put more focus on developing frameworks and conceptual models, however it also publishes more quantitative research than CACM.

VI. DISCUSSION

LIMITATIONS

We first state some limitations of the study before discussing the results. The primary limitation of the study stems from the period (1993-1997) that was selected for the study. Whether articles published in other periods exhibit similar trends cannot be stated conclusively. However, this time-period is recent and the usage patterns of methodologies over this period should at least have a reasonable degree of correlation with the present. Especially, the time trends should tell us about the direction we are moving.

Another limitation is that we targeted only seven journals in the field. Although highly acclaimed by IS professionals and some of the best research being published in these journals, there are other specialty niche journals such as *Decision Support Systems*, *Journal of Global Information Technology Management,* and the various *IEEE Transactions*. These journals have their own preferences in topics and methodologies.. Thus our remarks should be generalized to the entire MIS research with some caution.

Finally, a methodological concern of this study is that each article was coded by only a single coder. But, given the caution, care, and formal procedures used by the coders, this limitation does not diminish the findings or the value of the study significantly.

THE RESULTS

Despite the limitations, one heartening conclusion that can be drawn is the significant maturity of the MIS field. Over the years, researchers in MIS used a variety of research tools to investigate the diverse phenomena that arose because off the complex interplay between the rapid developments in IT and the changing business environment. In this study alone, we were able to investigate the use of thirteen different methodologies for 29 different IS subject areas.

Among the thirteen different methodologies, survey research was found to be the most-widely used. This outcome is not totally surprising; survey methodology was probably employed to maximize the generalization of results at the cost of lower realism of context and precision of measurement [Scandura and Williams, 2000]. As in a new field, there may be a tendency to find external conclusion validity of a particular theory rather than the refinement of that theory in greater depth or in a particular context. Consequently, studies based on surveys should be evaluated based on the appropriateness of the context as well as how effectively the researchers addressed the weaknesses that accompany this type of research. Frameworks and conceptual models took second place. The newness of the field and lack of formal theory most likely motivated researchers to develop frameworks/conceptual models to anchor the basic concepts and guide further research. In addition, the second position of framework and conceptual models (in lieu of theories) also bodes well in comparison to more mature and well-established sister disciplines such as management where formal theory also takes second place [Scandura and Williams, 2000]. Laboratory experiments and case study took 3rd and 4th positions respectively. It will be interesting to see how case study and other qualitative methodologies will fare in the long run given the current broadening interest in this methodology.

Between 1993 and 1997 methodology evolved. In 1993, framework/conceptual was ranked 1st but by 1997 it dropped to 5th position. Survey methodology continued to maintain its lead starting from 1994 all the way through 1997. Case study which was ranked 6th in 1993 took second position in 1997 as the preferred methodology. These findings are significant in that while theory building (framework/conceptual models) declined some, theory grounding and refinement (through case study) became a dominant research methodology by 1997. This change again points to a maturating field where researchers find it more comfortable and rewarding to build and refine their theories as well as seek generalization by using survey methodology. Once again, this trend in theory building and refinement is consistent with sister disciplines as in management [Scandura and Williams, 2000]. Only qualitative research (which excluded the case study method) exhibited consistently low ranking (13th in 1993 and 12th in 1997) as a methodology. This finding may be to the result of the novelty of methods such as interpretive studies, ethnography, action research, that are part of qualitative research. It could be that as many IS researchers who reported results between 1993 and 1997 were are not trained in using these methodologies and therefore reluctant to use them. As MIS doctoral granting institutions pay more attention to these newer methodologies, we expect further evolution in the use of qualitative methodologies.

Our results show what topics were being published in the seven journals during the time period selected. Once again, we acknowledge that our sample excludes specialty journals and less well-known journals. However, the "subject trends" provide some keen insights. For example, some topics emerged as core topics in MIS research, such as resource management/IS management issues, IS development methods and tools, functional applications, IS planning, and software/programming languages. The increased research in IS evaluation and control points to a field which advanced significantly on the growth curve. Finally, given the rapid change and turmoil in IS, some topics remain transient. For example, areas that seem to have lost ground over the years include decision support systems, artificial intelligence, expert systems, and group systems.

Our analysis of methodology usage by subject areas, for example, showed the preponderance of the survey method and increasing acceptance of the case study for studying managerial and organizational issues, and the use of laboratory experiments for more technical areas. The patterns should help guide doctoral students as well as new researchers in choosing methodologies in conducting research in a specific subject area. Moreover, the rankings could also assist seasoned researchers at least to assess the appropriateness of a methodology in light of the prior work. There is another implication of the patterns observed. Some methodologies were used sparsely in some areas. Perhaps a "group think" or a "domino" effect, biases the choice of a methodology. Researchers may want to consciously consider selecting an underutilized methodology in an area, especially if it makes sense and provides new insights. In any case, the choice of multiple methodologies provides a higher level of triangulation – the sign of a maturing field. Nevertheless, utilizing multiple methodologies involves a tradeoff. While the use of multiple methodologies helps to offset weaknesses, at the same time it takes considerably more resources to conduct the research.

It is noteworthy that the MIS journals placed different levels of emphasis on each of the thirteen methodologies investigated in this study. As discussedin Section V, the orientation of *MISQ, I&M,* and *JMIS* are behavioral-survey based*; Decision Sciences* and *ISR* are quantitative orientation, and *CACM* and *Management Science* are more conceptual. Vessey et al. [2002] also observed that the top journals exhibit considerable diversity in terms of reference discipline, level of analysis, topic, research approach, and research method. For example, *JMIS* and *ISR* publish articles with the greatest diversity, and *MISQ* and *Decision Sciences* publish articles on subsets of the field [Vessey et al., 2002]. It is to be acknowledged that what is published in these journals is (1) to some degree by design, (2) is influenced by the expressed or "implicit" editorial policies, and (3) the preferences of the editor-in-chiefs, subject area coordinators, associate editors, and guest editors. Whether such preferences should exist or whether editorial offices should have much control over published research is a larger debate in and of itself. In any case, the analysis such as in this article should be enlightening to the editors and they may want to reexamine their editorial policies.

In spite of the different levels of diversity in journals, it appears that most journal editors maintained a good balance among the top methodologies (i.e., survey, frameworks and conceptual models, case study and laboratory experiment) between 1993 and 1997. For example, MISQ showed a healthy balance between survey (22.1%), case study (15.7%), field study (10.7%) and frameworks and conceptual models (8.6%) among the articles published between 1993 and 1997. Similar trends can be seen in the case of *JMIS*. In addition, journals such as *ISR* maintained a sound equilibrium among such methodologies as laboratory experiment (21.1%), mathematical model (21.1%), survey (15.5%), and frameworks and conceptual models (12.8%). Thus while journals seem to exhibit methodological preferences, they are not exclusive to any single methodology. God research can be published anywhere irrespective of the methodology employed. This is again a sign of a maturing field in that it can appreciate and tolerate diverse research 'lenses' for investigating important and interesting problems.

VII. CONCLUSION

The continual self-introspection by any field is useful for it to mature and thrive. This is particularly true in MIS due to the youngness of the field and the explosive growth in the technology itself. Our analysis of publication patterns and trends in leading MIS journals in the years 1993 to 1997 provide but one snapshot of the state of MIS research. It is evident that similar efforts need to be undertaken in MIS not only to establish and verify research trends but also to verify the cumulative findings and their relevance to the practice of MIS.

Besides knowing the current state of research methodologies in use, there are some immediate implications of this study for both authors and journal editors. Authors are made aware of what methodologies and what subject domains are in wide use and the preferences of journals for the two. At least at a macro level, this information should help authors in the choice of appropriate methodologies to use in specific subject areas. It should also help them in targeting existing or future manuscripts to appropriate journals. Hopefully, the editors are aware of the journals' methodological and subject preferences; our study should give them corroborating evidence. It is expected that these preferences are by explicit editorial design and not by accident. In any case, if the evidence does not match the design expectations, the editors should be able to take corrective action.

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