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Ali Farhoomand
The University of Hong Kong, ali@business.hku.hk

Don H. Drury
McGill University, drury@management.mcgill.ca

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Ali F. Farhoomand
School of Business
The University of Hong Kong
ali@business.hku.hk

Don H. Drury
Faculty of Management
McGill University
drury@management.mcgill.ca

IS DISCIPLINE

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Ali F. Farhoomand
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Don H. Drury
Faculty of Management
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drury@management.mcgill.ca

ABSTRACT

As the Information Systems (IS) field enters its fourth decade of evolution, the time is right to provide a historiographical examination of this discipline. Methodological and thematic trends are gauged through a quarterly analysis of 2098 IS articles published in eight leading journals and the ICIS Proceedings in the 12-year period between 1985-1996. The results of this study show that significant changes occurred in research strategies and themes employed by IS researchers. Even though a large proportion of IS studies are still non-empirical, we see significant upward trend in the proportion of empirical studies. The reliance on reference disciplines increased significantly over the years. Similarly, we see significantly increasing trends in organizational, environmental and educational themes. In contrast, technical issues show decreasing trends. The paper calls for collective efforts to unify knowledge necessary for progress of IS as a scientific field of inquiry.

KEYWORDS: Information systems, research methodology, thematic analysis, scientific status

I. INTRODUCTION

It is over 30 years since Ackoff [1967] outlined his concerns about the nature of Information Systems (IS). Concerns over scientific progress of IS -- or lack of it -- were further enunciated by Keen [1978] in his call for development of a cumulative research tradition. Since then, many others echoed these concerns. For example, Hamilton and Ives [1982b], Culnan [1986], Culnan and Swanson [1986], Culnan [1987], Holsapple et al. [1993] and Westin et al. [1994] examined the underlying foundation of the discipline, while Farhoomand [1987], Landry and Banville [1992], Pinsonneault and Kraemer [1993], and Grover et al. 1993] covered the methodological rigor of IS research. Structural development and scientific progress of IS also received ample coverage, among others, by Farhoomand [1987], Weber [1987], Banville and Landry [1989], Teng and Galletta [1991], Cheon et al. [1993], Swanson and Ramiller [1993], Holsapple et al. [1994], Bacon and Fitzgerald [1999], Hirschheim et al. [1996], Fitzgerald and Adam [1997], Mingers and Stowell [1997], and Weber [1997]. More recently, research diversity in the field was debated by Benbasat and Weber [1996] and Robey [1996].

These studies on the whole reached contradictory conclusions about the scientific growth of IS. For example, Culnan [1986] saw the decrease in the number of invisible foundation fields from nine to three as a sign of progress. Farhoomand [1987] and Weber [1987], on the other hand, used the work of Kuhn [1970a] to show that the IS discipline is fragmented and that in the absence of articulated theories little progress has been made. Banville and Landry [1989], in contrast, regarded the fragmentation of the field as a sign that the Kuhnian [1970a] approach is not appropriate for epistemological evaluation of IS. They used the term "fragmented adhocracy", to describe IS as a discipline with low political interdependence among its members, low level of conceptual coherence,

and a low level of coherence in terms of standardization of methods. Teng and Galletta [1991], in their survey of MIS researchers, concurred with the assessment that there is a need for development of original theories. In contrast, Grover et al. [1993] performed a citation analysis of MIS articles published in 1980s to conclude that IS is gaining identity as a mature and legitimate academic discipline. Cheon et al. [1993] reached a very different set of conclusions in a study of the trends in IS research types and empirical methods in the 1980s. In a recent academic exchange, Benbasat and Weber [1996] called for a moratorium on research diversity, while Robey [1996] argued for diversity in IS research.

Even though this body of work did not result in a consensus concerning the scientific status of IS, it was instrumental in helping the IS academic community delineate the boundaries of the field, question the methodological rigor of the ongoing research, and ultimately shape the foundations of the field as a viable scientific discipline. As IS enters its fourth decade of evolution, the present historiographical examination of the field should further help gauge the progress of IS as a scientific field of inquiry.

The objective of this paper is to survey IS literature to shed more light on the state of research and knowledge generation in the field. The results of a comprehensive survey of 2098 articles published in eight major academic journals and the Proceedings of the International Conference on Information Systems between 1985-1996 are used to examine methodological and thematic trends in IS research. The paper closes with a brief discussion of the current and future scientific status of IS.

II. EMPIRICAL STUDY

SAMPLE

To obtain a better understanding of the prevailing research practices in IS, 2098 articles published between 1985 to 1996 were examined. In addition to the

Proceedings of the *International Conference on Information Systems (ICIS),* eight journals were selected:

MIS Quarterly (MISQ)	Information & Management (I&M)
Communications of the ACM (CACM)	Management Science (MS)
Journal of Management Information Systems (JMIS)	Information Systems Research (ISR)
European Journal of Information Systems (EJIS)	Journal of Strategic Information Systems (JSIS).[1]

[1] For ISR, the period is between 1990-1996; for EJIS and JSIS the period is between 1991-1996.

These academic publications were rated as the top journals in IS in different surveys [Jackson and Nath, 1989], [Gillenson and Stutz, 1991], [Holsapple et al., 1993, 1994], [Walstrom et al., 1995]. The sample includes both European and North American publications. For CACM and MS, we used only the IS-related articles in these journals. Table 1 shows the number of articles in each journal used in the study.

Table 1. Number of Articles for Each Journal

Journal	No. of Articles	Percentage
Information & Management (I&M)	619	29.5
International Conference on IS (ICIS)	308	14.7
Journal of MIS (JMIS)	343	16.4
MIS Quarterly (MISQ)	305	14.5
Communications of the ACM (CACM)	133	6.3
Information Systems Research (ISR)	124	5.9
European Journal of Information Systems (EJIS)	120	5.7
Journal of Strategic Information Systems (JSIS)	96	4.6
Management Science (MS)	50	2.4

	Total	2098	100.0

IS articles published between 1985-1996 were classified into one of five research strategies (laboratory experiment, field experiment, case study, survey, and non-empirical) proposed by Hamilton and Ives [1982] and used in several other studies. In cases where a study relied on two strategies (e.g., case study and survey), we assigned a value of 0.5 to each strategy. The nine major categories in the *Information Systems Research Library* (ISRL) classification scheme proposed by Barki et al. [1988] were used to classify the sample articles to gain a more accurate picture of thematic shifts in the literature. For each article a total weight of 3 was employed. Based on the ISRL categories, whenever provided, the total weight was divided among the major themes. For example, if an article had used ISRL categories AM, EF07, EI0205 and GA01, then 1.5 was assigned to E (IS management), and 0.75 each to A (reference disciplines) and G (IS usage). For articles where ISRL was not available, the keywords or the abstract was used to classify them. If the article was primarily related to only one of the major themes, a total weight of 3 was assigned to that theme. If there were two or more major underlying themes in the article, we assigned a value of 1.5 or less to each theme.

Because we were particularly interested in learning more about the extent of dependence of IS research on reference disciplines, for each quarter we also made a frequency count of the number of articles that had relied on reference disciplines.

The classification was done by two research assistants who worked independently. Research strategies were identified by first reading the abstract. In situations where it was not possible to identify the research strategy from the abstract, then the body of the article was read. In cases where keywords for each article were provided by the journal (e.g. MIS Quarterly), those keywords were used for thematic classification of the articles. In cases where no keywords were provided, the classification was done based on reading of the abstract. If

an article could not be classified based on its abstract into one or more of the categories, then one of the authors of this paper would read the entire article for classification purpose. This last approach was required for approximately one tenth of the papers.

DATA ANALYSIS

We performed quarterly time series of data, where the independent variable is the quarter (t = 1 to 48) and the dependent variable is the percentage of articles using a particular research strategy (or theme) published in the quarter. To adjust for changes in the number articles over time, we used the percentages, instead of raw numbers, of articles using a particular research strategy (or theme) in each quarter and regressed them over time.

RESULTS

Research Strategies

Table 2 shows the breakdown of research strategies by journal. About 39% of the total IS literature surveyed is based on non-empirical studies. In the late 1970s, more than two thirds of IS studies used non-empirical approaches, which relied on secondary sources or authors' experiences to support conclusions [Hamilton and Ives, 1982a]. The percentage of non-empirical studies decreased to about 43% for articles published between 1977-1984 [Farhoomand, 1987] and to 40% for articles published between 1984-1990 [Lending and Wetherbe, 1992]. CACM led other journals for publishing non-empirical studies, which consisted of slightly over half of the published IS articles in this journal. MISQ, in contrast, devoted only a quarter of its space to non-empirical studies.

Surveys are still the dominant empirical research methodology, constituting 32% of published studies (over half of empirical studies) in this paper's 1985-1996 sample. In comparison, for the periods between 1977-1984,

and between 1984-1990, about 25% and 29% of published articles were based on surveys, respectively [Farhoomand, 1987], [Lending and Wetherbe, 1992]. The percentage of articles dedicated to surveys varies widely, ranging from 20% in CACM to 45% percent in MS.

Case studies are the second most popular empirical research strategy, constituting 17% of published studies (27% of empirical studies). Case studies were the most commonly employed empirical strategy in the 1970s [Hamilton and Ives, 1982a], decreased to about a quarter of the published articles by the mid-1980s [Farhoomand, 1987] and to about 18% by 1990 [Lending and Wetherbe, 1992]. Compared to the North American journals (as low as 4% in MS), the European journals devoted a much larger proportion (as high as 33% for JSIS) of their space to case studies.

Table 2. Breakdown of Research Strategies by Journal
(Percentages for Each Journal)

Journal	Field Experiment	Laboratory Experiment	Case Study	Survey	Non-Empirical	Total
I&M	1%	6%	14%	37%	41%	29.5%
ICIS	3%	15%	16%	29%	37%	14.7%
JMIS	4%	12%	9%	33%	43%	16.4%
MISQ	4%	10%	23%	38%	25%	14.5%
CACM	0%	7%	22%	20%	51%	6.3%
ISR	2%	21%	11%	23%	42%	5.9%
EJIS	0%	8%	28%	27%	36%	5.7%
JSIS	2%	2%	33%	23%	38%	4.6%
MS	5%	16%	4%	45%	30%	2.4%
Total	2%	10%	17%	32%	39%	100%

The percentage of studies based on laboratory and field experiments increased from a total of less than 6% in the mid 1980s [Farhoomand, 1987] to

12% in this study. There is a wide variation between journals, ranging from 4% for JSIS to 23% for ISR.

Table 3 shows summary results of the time series analyses of research strategies. There is no evidence of increasing or decreasing trend for research strategies based on experiments. On the other hand, both cases studies and surveys show significant, albeit small, upward trends over the 12-year period. There is also a significant, but downward, trend in non-empirical studies. Figures 1 through 5 show the regression lines corresponding to the five research strategies.

Table 3. Time Series of Research Strategies

Research Strategy	β_0	β_1
Field Experiment	2.285***	.000
Lab Experiment	7.417***	.085
Case Study	11.531***	.183***
Survey	28.502***	.159**
Non-Empirical	50.523***	-.445***

** < .05, *** < .01

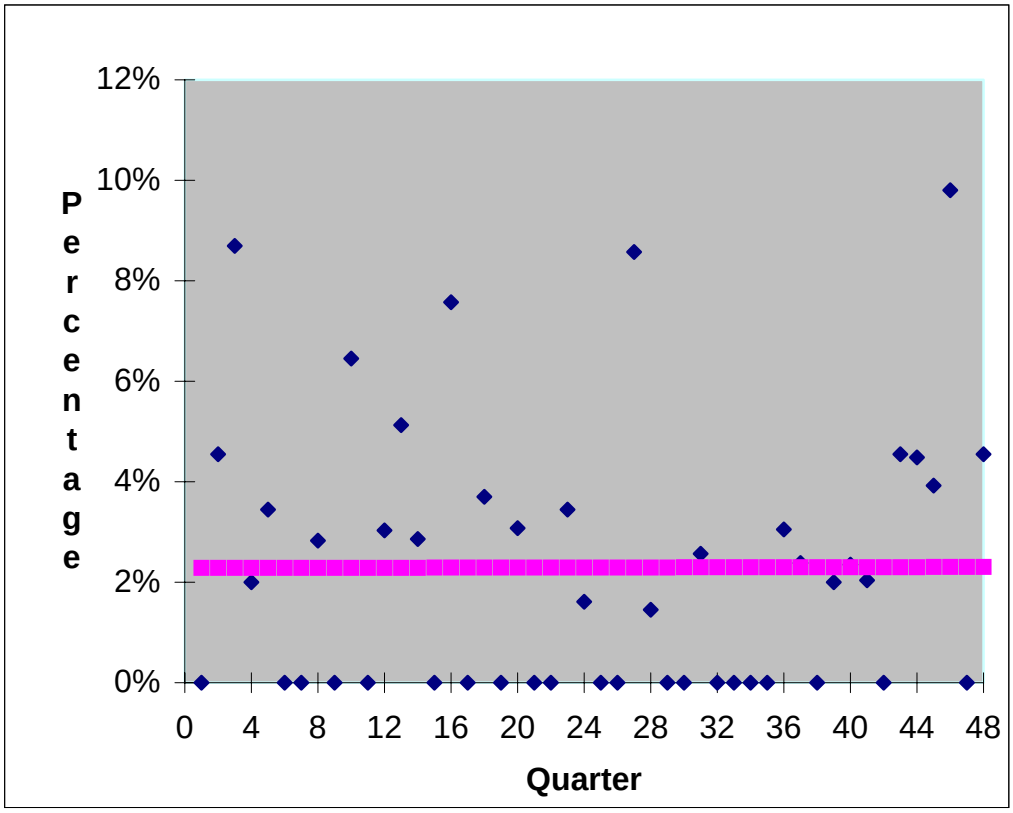

Figure 1. Regression Line – Field Experiment

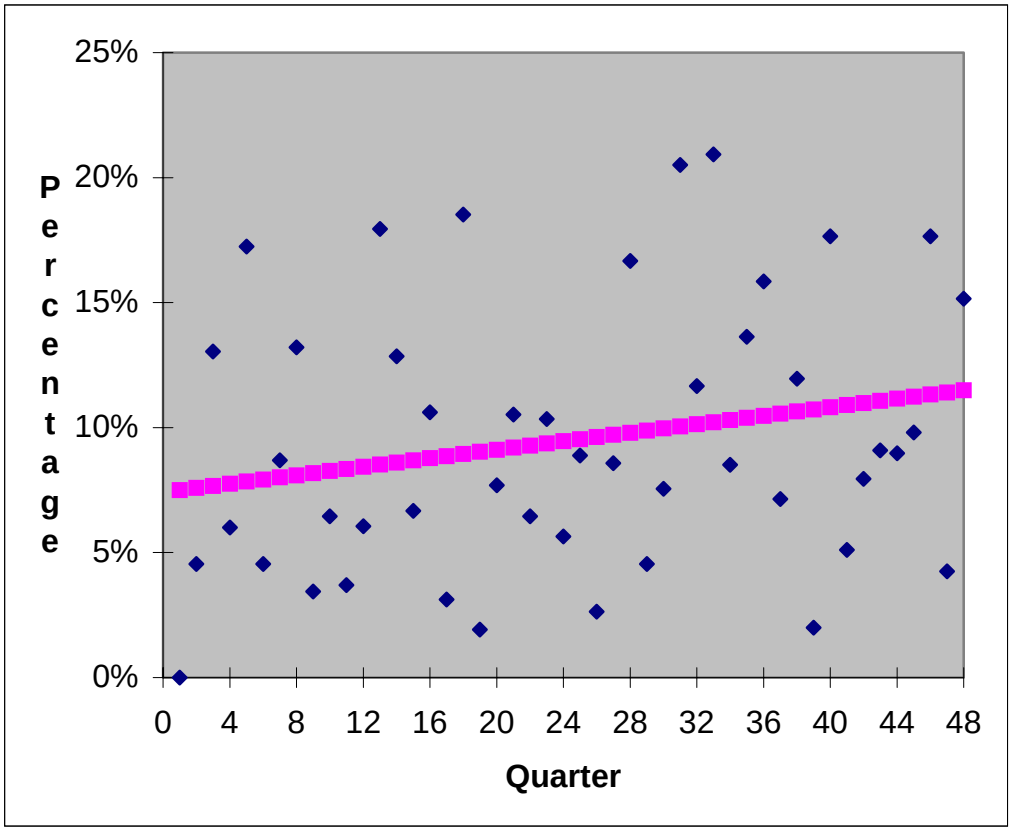

Figure 2. Regression Line – Lab Experiment

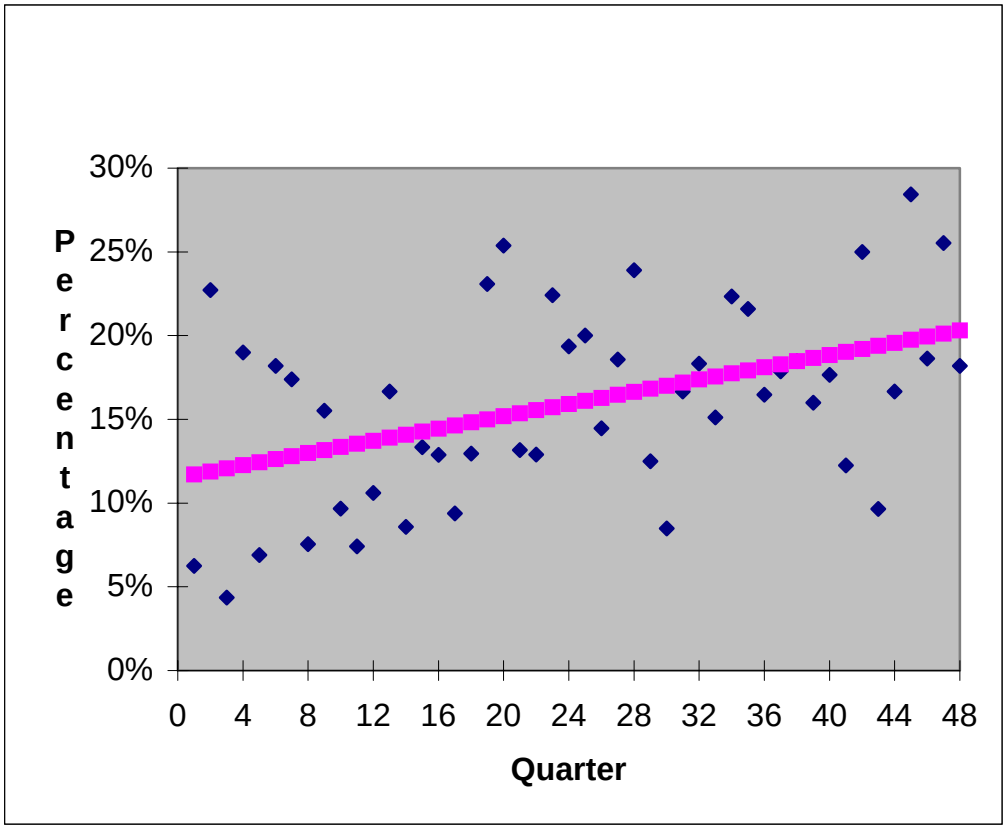

Figure 3. Regression Line -Case Study

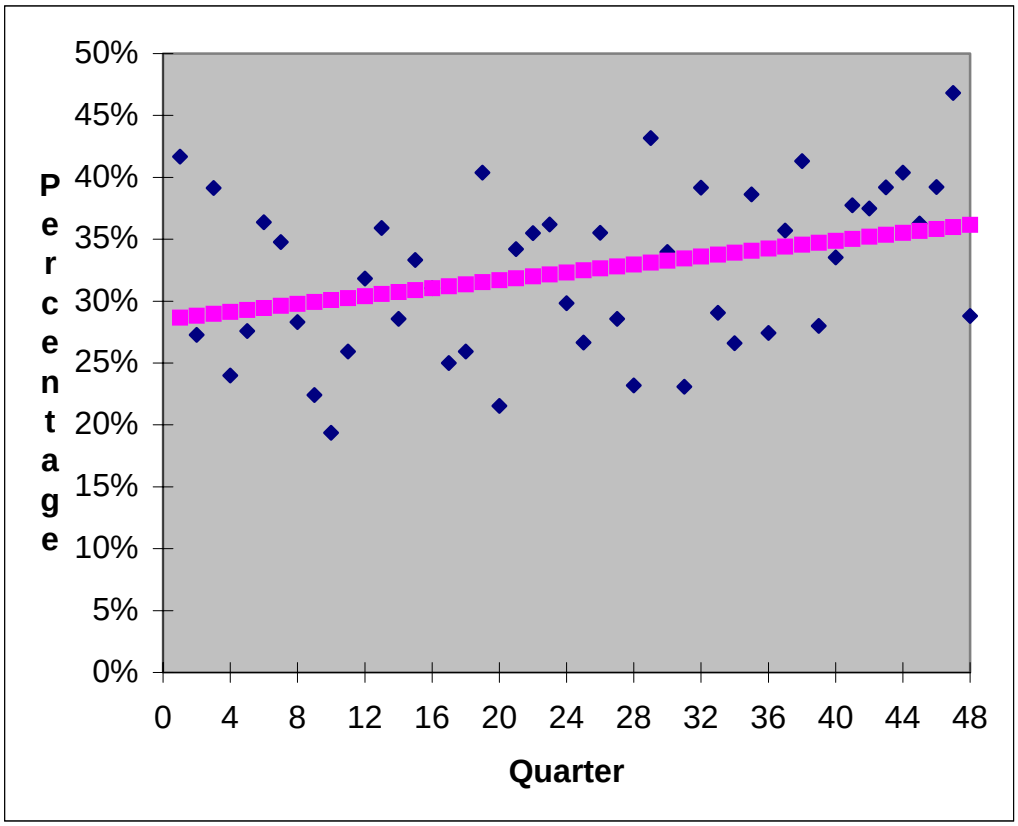

Figure 4. Regression Line - Survey

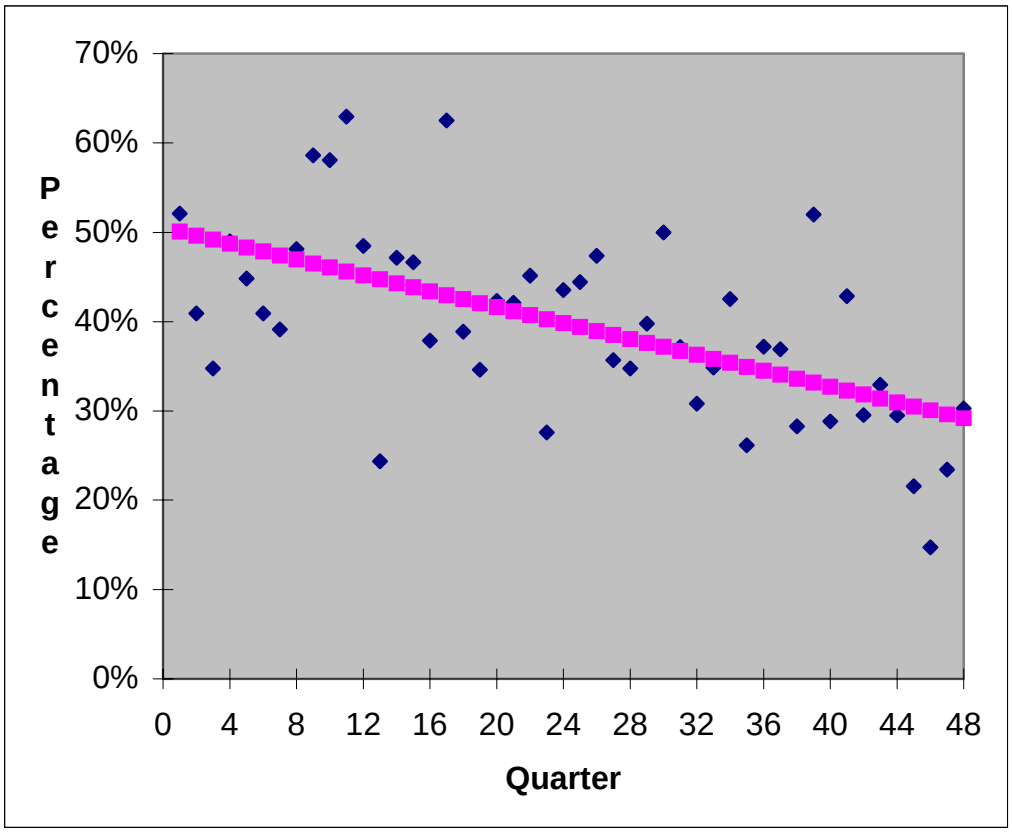

Figure 5. Regression Line – Non-Empirical

The fluctuations of research strategies over the last 12 years are shown in Figure 6. Because of small numbers and also for sake of clarity we combined the laboratory and field experiments.

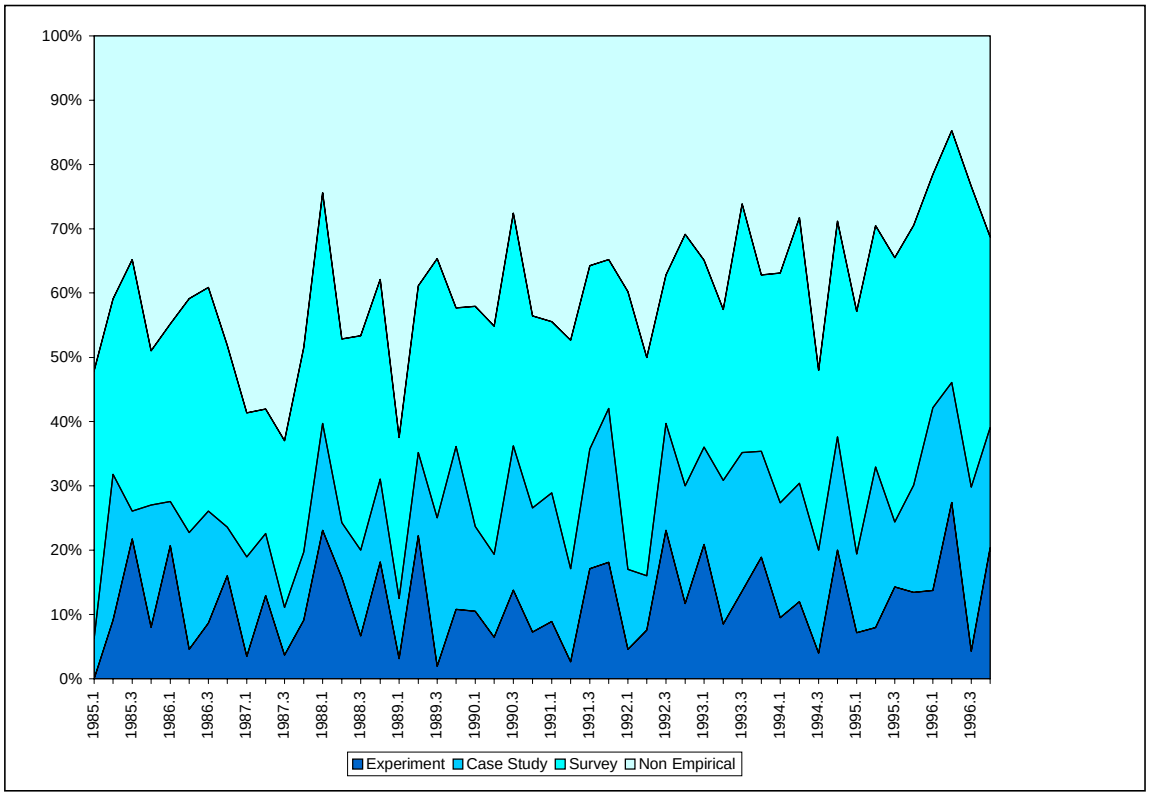

Figure 6. Research Strategy Trends for the Period 1985-1996
(Percentage of Articles over Time)

RESEARCH THEMES

Table 4 shows the breakdown of research themes by journal. The second column shows the proportion of articles based on reference disciplines. The third column, (A Freq) is derived by dividing the frequency of articles that used reference disciplines, by the total number of articles in each journal. This was done to find out the percentage of articles that actually rely one way or another on reference disciplines.

Table 4. Breakdown of Research Themes by Journals

Journal	A	A Freq.	B	C	D	E	F	G	H	I
I&M	26%	69%	5%	11%	9%	16%	14%	6%	13%	2%
ICIS	30%	90%	4%	4%	9%	12%	13%	11%	11%	5%
JMIS	23%	49%	2%	7%	10%	17%	13%	6%	18%	2%
MISQ	21%	54%	3%	5%	7%	26%	14%	7%	14%	2%
CACM	9%	4%	4%	17%	2%	27%	15%	5%	17%	3%
ISR	36%	75%	4%	8%	6%	17%	11%	6%	11%	3%
EJIS	27%	55%	4%	10%	15%	6%	13%	6%	14%	3%
JSIS	19%	85%	6%	11%	20%	12%	8%	8%	12%	6%
MS	27%	64%	2%	3%	12%	11%	15%	9%	18%	2%
Total	25%	66%	4%	8%	9%	17%	13%	7%	14%	3%

Where:

A = Reference disciplines
B = External Environment
C = Technological Environment
D = Organizational Environment
E = IS Management
F = IS Development and Operations
G = IS Usage
H = Information Systems
I = IS Education and Research

Almost 70% of the published articles relate to four research themes: reference disciplines (ISRL, A), IS management (ISRL, E), IS development and operations (ISRL, F) and Information Systems (ISRL, H).

ISR leads in allotting a significant portion of its space to reference disciplines (36%). In contrast, only 9% of IS-related articles in CACM relied on reference disciplines. It is important to note that overall 66% of all published articles relied on reference disciplines. Apart from CACM, a significant portion of articles published in other outlets, ranging from 49% for JMIS to 90% for ICIS, relied on reference disciplines.

CACM (27%) and MISQ (26%) devoted the largest parts of their space to IS management issues, while information systems and IS development and operations were covered widely by most journals. The lesser-researched areas are IS education and research (ISRL, I), external environment (ISRL, B), IS

usage (ISRL, G), technological environment (ISRL, C) and organizational environment (ISRL, D), comprising from 3% to 9% of all journals.

Table 5 shows summary results of the time series analyses of research themes.

Table 5. Time Series of Research Themes

Theme	β_0	β_1
A - Reference Disciplines	20.155***	.150**
B - External Environment	2.828***	.042*
C – Technological Environment	9.142***	-.025
D – Organizational Environment	5.50***	.129***
E - IS Management	19.526***	-.085*
F - IS Development & Operations	17.925***	-.166***
G - IS Usage	6.691***	.008
H – Information System	17.021***	-.105**
I - IS Education & Research	1.149**	.053*

* < .10, ** < .05, *** < .01

As indicated by coefficient β_1, four of the themes (reference disciplines, external environment, organizational environment, IS education & research) show significantly increasing trends, while three (IS management, IS development & operations, and information systems) show significantly decreasing trends. There is no evidence of increasing or decreasing trend for the other two research themes (technological environment and IS usage).

These results indicate that non-technical themes generally show an upward trend, while the technical themes show a declining trend. In other words, there seems to be a shift from technical themes towards non-technical themes over the period. Figure 7 shows trends in research themes for the period.

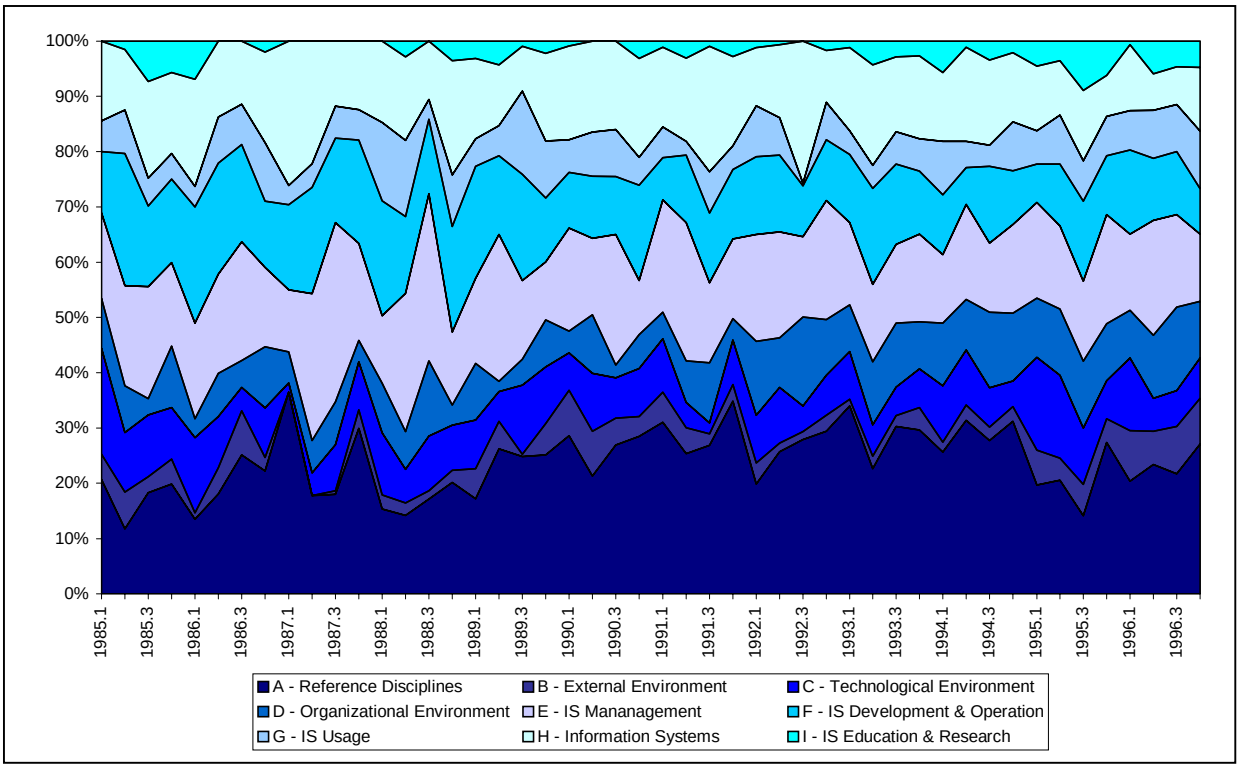

Figure 7. Research Themes Trends for the Period 1985-1996
(Percentage of Articles over Time)

III. DISCUSSION & CONCLUSION

Continual historiographical examination of a scientific field is instrumental in gauging its progress. Our examination of the IS research published over the last 12 years shows discernible shifts in both research strategies and research themes.

Compared to studies published in the previous decade, changes occurred in research strategies employed by IS researchers. A significant proportion of IS studies are still non-empirical, even though we can see a relatively large and significant downward trend in the proportion of non-empirical studies.

Surveys are still the most dominant research strategy, used in one-third of the IS studies reviewed. There seems to be a small, but significant, upward trend in the use of surveys over the 12-year period. An encouraging sign is in the type of surveys used. In examining the rigor of MIS survey research conducted in the 1980s, Grover et al. [1993] concluded that explanatory surveys have become more popular than descriptive surveys.

Even though the use of case studies decreased in the last three decades, our results show a small but significant positive trend for the period covered by this study. This small upward trend may be the result of some recent efforts such as a special issue of MISQ and a recent IFIP conference dedicated to case studies. The upward trend could also be attributed to the two European journals used in the study, which rely on case studies as the dominant empirical research strategy. Both these journals started publication in the second half of the period covered in the study.

Another important change relates to a steady increase in the use of experiments in IS research over the last 20 years. Even though we do not see a significant trend for the period covered in this study, some journals, notably ISR, devoted a great portion of their space to experimental research. As experiments are usually based on articulated hypotheses targeted at testing and developing substantive theories, the continual increase of experiments appears to be a healthy development.

Without closer examination of non-empirical studies, it is difficult to determine with certainty whether these studies facilitated or hindered scientific progress of the IS field. A similar study related to the period 1977-1985 pointed to a time-related shift from non-empirical to empirical studies [Farhoomand, 1987]. The results of the present study also indicate a downward trend in this type of research, ranging from 25% for MISQ to 51% for CACM. The decreasing trend in the use of non-empirical studies can be regarded as a bane or boon. On the one hand, if the majority of these studies are anecdotal, descriptive, and without substantive theoretical underpinning, then the progress of IS as a

scientific discipline is being seriously hampered by such studies. On the other hand, if these studies relate to theoretical development of the field, then non-empirical studies serve a valuable role in demarcating the boundaries of the field. Further work is needed to examine the impact of these studies.

Given that surveys are becoming increasingly explanatory and that a small shift has occurred from non-empirical studies toward experimental studies, we may be slowly moving in the direction of the theory-building and theory-testing processes involved in scientific inquiry [Schendel and Hofer, 1979].

Perhaps a more telling story can be gleaned from the examination of research themes. While a quarter of published literature, in terms of number of articles, is dedicated to reference disciplines, two thirds of all the articles (90% in case of ICIS) rely on reference disciplines in one way or the other. In the absence of any articulated theory in IS, this development appears to be healthy. Most young disciplines need to initially rely on their reference disciplines before developing theories of their own. Although reliance on reference disciplines helps shape the foundation of a new field of studies, by itself it is not a sign of maturity of the discipline, as contended by some authors, e.g. [Culnan, 1986], [Cheon et al., 1993]. Indeed, mature disciplines rely on specialized research publications rather than borrowing from other disciplines.

IS has been, and will continue to be, influenced by technological developments in a significant way. This fact is reflected in the high proportion of IS research dedicated to technology-related issues (e.g., research themes C, F and H account for 35% of all the studies). One of the major stumbling blocks facing IS researchers has been the rapidity of technological changes. Another difficulty seems to be related to complexities associated with computer-human interactions; the way technology affects our work. Understanding and supporting such changes are perhaps the most challenging and complex task ahead of IS researchers. On a positive note, IS seems to have made noticeable progress toward the entrenchment of its institutional position. The field enjoys having several respected academic journals, a professional association boosting over

one thousand members, numerous universities with doctorate degrees in the field, a close link with a burgeoning industry, and a healthy demand for its graduates [ITAA, 1996; USDC,1999]. If the developments of the past few decades are any indication, IS should continue to entrench itself institutionally even further in the future.

As King and Applegate [1999] point out, we are at the apex of one of the most exciting innovations in history. Carrying the academic torch of a discipline that lays claim to advancement of "… knowledge of how the use of information technology can lead to improved organizational performance and individual quality of work life", [AIS, 1999], is certainly a complex and daunting task. Part of the excitement about IS has been the changes that have occurred over the past thirty years. Indeed, few fields of endeavor have experienced the rapid changes that IS has encountered over a relatively short period of time. The exhilaration with the newfound field of intellectual and practical inquiry is clearly understandable. It has transformed every aspect of government, industry and education, at a worldwide scale.

The field that we are dealing with is, perhaps, the century's most significant accomplishment, with far-reaching and complex impacts. As such, worrying about scientific progress of the field incessantly is in not warranted. Nonetheless, it is useful to engage in a discourse to find ways that could further entrench the academic position of our discipline. Such discourse could take a political form where a set of normative principles of what the community should look like are advocated. Alternatively, we can try to clarify the disciplinary evolution and patterns of theory impact in our filed to shed light on its intellectual structures.

Sciences progress through a commitment to theory-driven programmatic research [Anderson, 1983] with a view to providing theoretical unity and coherence for a discipline [Weber, 1997]. As such, collective efforts are needed to unify knowledge necessary for progress of IS as a scientific field of inquiry. Articulated theories related to management, deployment, and usage of

information systems in organizations should help to consolidate the components of the disciplinary matrix of IS, simplify its complex patronage structure, and eventually entrench its scientific position within the academy.

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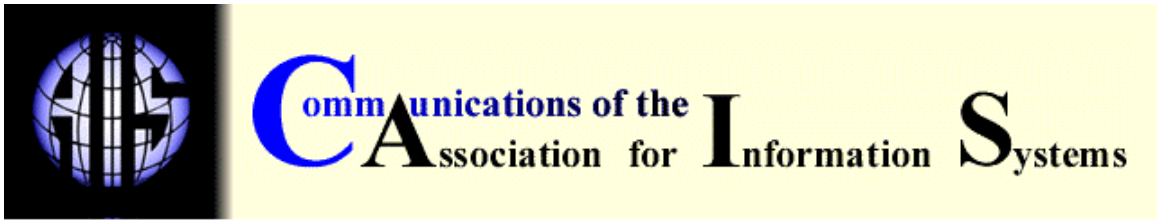
ABOUT THE AUTHORS

Ali F. Farhoomand is Associate Professor of Information Systems and Director of the Centre for Asian Business Cases at The University of Hong Kong. His publications have appeared in many journals including *MIS Quarterly, IEEE Trans. on Engineering Management, Organizational Computing and Electronic Commerce, Electronic Markets, INFOR, Information Systems Journal, Information & Management*, *Datatmation,* and *Data Base*. His research activities focus on IS assessment and international electronic commerce.

Don H. Drury is Professor of Accounting and Information Systems at McGill University in Montreal, Canada. His Ph.D. is from Northwestern University. He has published papers in *MIS Quarterly, Communications of the ACM, Management Science, Information & Management* and numerous other journals in management information systems. He has written four monographs on planning, costing, and control issues in information technology and is consultant to government and business organizations.



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