Information Systems is Not a Reference Discipline (And What We Can Do About It)

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IS Research Perspective

Not
Information Systems is ^ a Reference Discipline
(And What We Can Do About It) [1]

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Abstract

A number of recent papers have proclaimed that the IS field has approached the status of a reference discipline. The paper draws on citation data from 33 IS and non-IS journals over 12 years to test this assertion. Analysis of this data suggests that the IS field has left a modest imprint on other sub-fields of management. Based on this evidence, the paper concludes that IS is not yet a reference discipline, but has the potential to become one. We propose number of measures to enhance the external influence of the field that may, in time, lead to it becoming a true reference discipline.

Keywords: IS research relevance, reference discipline, citation analysis, multiple degrees of separation

Introduction

> *An objective of the MIS Quarterly…is to establish our academic MIS field*
> *as a reference discipline for other academic management fields.*
>   Allen Lee (1999), Inaugural Editor's Comments, p. 3

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[1] Detmar Straub was the accepting senior editor. This paper was submitted on April 24, 2004, and went through three revisions.

> *The IS discipline is no longer just emerging, but has fully emerged as a discipline in its own right. We suggest the intriguing scenario that IS can now serve as a reference discipline for others, even for those fields that previously served as reference disciplines for IS. In a sense, the tables have turned.*
>
> Baskerville and Myers (2002), p.1

> *An interesting finding is that IS itself emerged as a key reference discipline in the late 1990s.*
>
> Vessey, Ramesh and Glass (2002), p.130

The adoption and use of information technologies (IT) by organizations have increased steadily, even dramatically, over the past three decades. The growth in organizational IT has been mirrored by the growth of the information systems (IS) field within academe (Nambisan, 2003). The IS field has successfully appropriated research from other areas, established distinct research areas, and developed its own research perspectives. IS has its own well regarded journals, its own professional societies, its own conferences, and its own place within many (if not most) business schools. Baskerville and Myers (2002) argue that the field has matured into a distinct academic discipline with a cohesive mix of developing subfields and strong cumulative traditions. Based on this and other evidence, Baskerville and Myers confidently declared in 2002 that the IS field was ready to attain the status of a reference discipline (see second quote above).

This paper does not dispute the progress that the IS field has made, nor the sophistication it has achieved. Indeed, its evolution over 35 years has been remarkable. Maturity is a necessary condition for a field to become a reference discipline; yet, we argue that it is not a sufficient one. This paper adopts the simple yet compelling argument that in order for a field to be considered a reference discipline, it must first be referenced by other disciplines.

In this paper, we present evidence indicating that the IS field has left a decidedly modest imprint on other fields within the management disciplines. Unfortunately, the IS field remains toward the end of the intellectual food chain (Webster and Starbuck, 1988). This evidence challenges the conclusion that IS is ready to become a reference discipline, and draws into question the field's influence on other areas of management research. At the same time, there are indications that the field is well respected and that its external influence is increasing. This paper outlines a number of strategies that the IS field may pursue to further this process, and perhaps, in time, to achieve Baskerville and Myers' worthy goal of being a reference discipline.

Intellectual Framework of the Concept of Reference Discipline

> *To prove this point, conduct a quick experiment at your own desk. Pick up any copy of an IT journal, say Information Systems Research or the MIS Quarterly. Choose a random article and examine its references. The odds are that you will find at least one reference to an article published in an organization studies journal, perhaps the Administrative Science*

> *Quarterly, the Academy of Management Journal, Organization Science, or Organizational Behavior and Human Performance. Now, reverse the experiment: pick a paper at random from any issue of the latter journals. Most likely you will find no reference to papers published in IT journals or to books dealing with issues of systems design or IT infrastructures.*
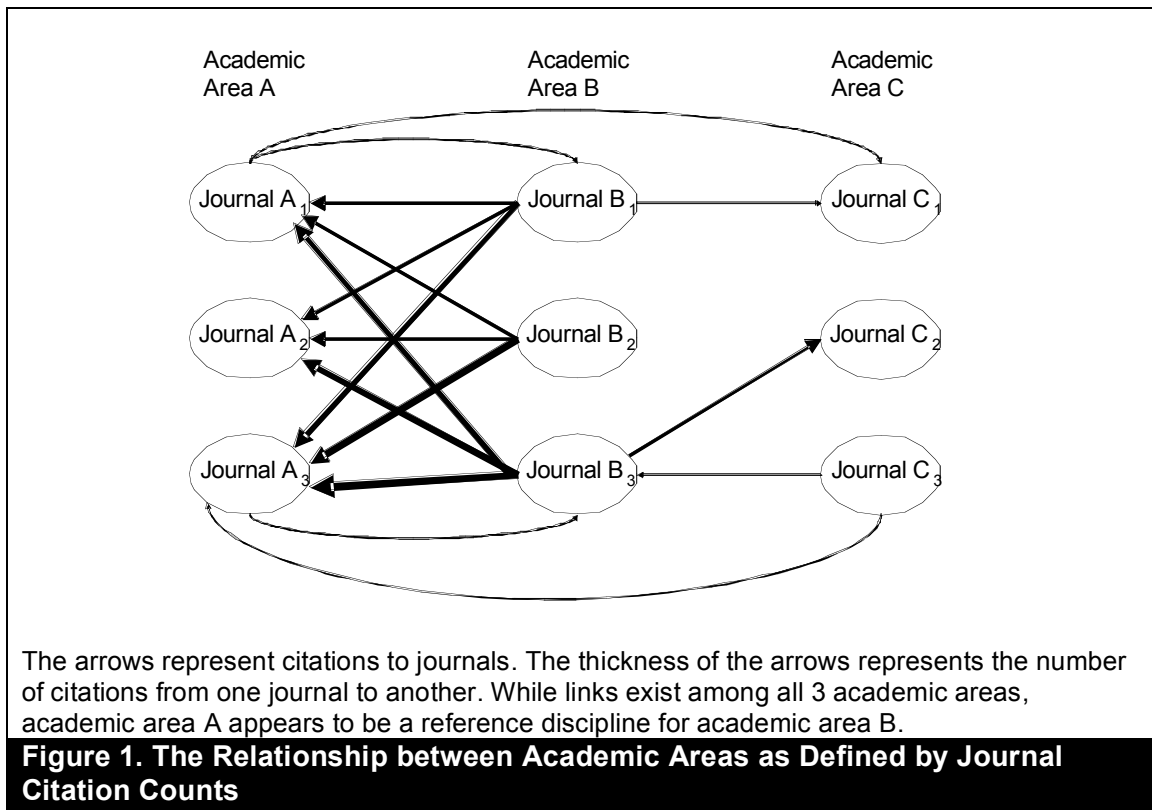> Orlikowski and Barley (2001), p.146

How do we know when a field becomes a reference discipline? The answer to this question wholly depends on how one defines a *reference discipline*. How much, in other words, must a field be referenced in order for it to be considered a reference discipline? This question is not straightforward to answer (Westin, Roy, and Kim, 1994). Indeed, there is no formal methodology or statistical test to determine whether a field is, or is not, a reference discipline. It seems to us that, at minimum, a reference discipline should be one that is extensively cited by other disciplines. A more inclusive definition might require a reference discipline to provide a conceptual foundation for another field. For example, Computer Science, Economics, and Psychology have been mentioned as possible reference disciplines for the IS field (Keen, 1980). IS researchers have drawn on these fields for theories, ideas, methodologies, and the like. Yet, few studies have tested whether these fields are, indeed, reference disciplines for IS (Culnan and Swanson, 1986). The imprecision with which a reference discipline is defined makes proclaiming a field as being one relatively easy, and disproving it rather difficult.

A useful way to measure the extent to which one field draws on another is to compare citation patterns between research journals in one field and journals in another (Culnan, 1987; Eom, 1995, 1998; DeSanctis, 2003; Pasadeos, et al., 1998). Citations represent a means by which knowledge is transferred among scholars both within a field and between fields. Citations are the foundational building blocks upon which scientific traditions are formed and advanced. They serve to place a piece of work within the cumulative development of a stream of research.

If one field frequently cites a second, then that second field may approach the status of a reference discipline for the first. The strength of a relationship between journal A and journal B, for example, can be established through citations from articles published in A to articles published in B, and vice versa. The more A cites B and B cites A, the stronger the link between the journals. For example, one can expect the links between journals within a management discipline (e.g., IS) to be stronger than those between journals that belong to different disciplines (i.e. Finance and IS) (Culnan and Swanson, 1986). In the hypothetical example shown in Figure 1, academic area A may be defined as a reference discipline for academic area B.

Citation analyses are not new within the IS field. Some IS studies have used citation analysis to identify themes and intellectual sub-fields (i.e. Culnan, 1986). Others have used citations to track the development and evolution of the field (i.e. Farhoomand, 1987). Still others have drawn on citations to rank journal prestige and quality (i.e. Lowry et al., 2004). Relatively few studies, however, have used citation analysis to examine the fundamental question of whether or not IS is a reference discipline (Cheon, et al., 1991; Holsapple, et al. 1993). One notable example of a paper that does explore this question is Culnan and Swanson (1986). Culnan and Swanson used citation analysis to examine papers from MIS, Management Science, Computer Science, and Organization Science from 1980 to 1985 to ascertain whether or not the MIS field was a discipline in its own

The arrows represent citations to journals. The thickness of the arrows represents the number of citations from one journal to another. While links exist among all 3 academic areas, academic area A appears to be a reference discipline for academic area B.

Figure 1. The Relationship between Academic Areas as Defined by Journal Citation Counts

right. They found that MIS had emerged as a distinct field with its own themes and cumulative traditions. However, Culnan and Swanson failed to find any evidence that the MIS field had become a reference discipline for the other three fields studied. In fact,they ominously prognosticated that "as MIS becomes more established, it may instead tend to fractionate from its foundational base…and (risk) eventual stagnation resulting from intellectual in-breeding and isolation" (p. 300).

A replication of Culnan and Swanson's study was conducted by Cheon et al. (1991) using ten years of data, from 1980 to 1989, and a wider set of journals. This later study supported a more optimistic vision of IS's position. IS was recognized as a distinct discipline by Management Science and Computer Science. IS articles, however, were rarely cited by the Organizational Sciences, and the results for this area were not significant. This finding is rather shocking, since Cheon et al., in replicating the procedures of Culnan and Swanson, chose to include only those articles in related fields that were, in their estimation, related to IS topics. As such, they selected only a small set of articles from these fields, and those were tipped very much in favour of the IS field. Thus, there is mixed (and somewhat dated) evidence in the literature on the question of whether or not IS has become a reference discipline.

Data and Methodology

In this paper we will attempt to determine whether the IS field exhibits the characteristics of a reference discipline by comparing citation patterns between IS journals and journals from other management sub-fields. The dataset for this analysis comes from the *Financial Times* list of research journals. In an effort to rank the research productivity of

business schools, the *Financial Times* newspaper developed a list of journals that constituted, in their estimation, the highest quality journals in each academic sub-field of management.

We recognize that the *Financial Times* list of journals is an imperfect tool for analysis. Some important journals are not on this list, including niche journals that publish high quality papers in specific sub-areas. However, the FT31 set is generally understood to include the highest quality research outlets in each sub-field of management research. The list was compiled in consultation with top research institutions worldwide. Due to their visibility, these journals tend to be highly cited within functional areas as well as across disciplines. As such, they represent a useful, albeit imperfect, indication of cross-functional influence.

Data were available for 31 of the 40 Financial Times journals shown in Table 1. We retrieved titles, authors, abstracts, citations, and bibliographies for all papers published in these journals for 12 years from 1990 to 2001 from the Web of Science (ISI). Nine journals were not included in the analysis because they either did not exist or were not captured by ISI in 1990. In total, we indexed just over 70,000 citations from 20,290 papers.

We divided the journals in Table 1 into categories representing different sub-disciplines of management. Since the *Financial Times* does not differentiate among subject areas, we made our best efforts to categorize the journals, but our list may be subject to some interpretation. Two journals from the IS field are included in the list: *MIS Quarterly (MISQ)* and *Information Systems Research (ISR)*. Since the IS field has fewer journals represented on the list than many other management sub-fields, we included two additional well respected IS journals in the analysis: the *Journal of Management Information Systems (JMIS)* and the *Communications of the Association for Computing Machinery (CACM)*. In the remainder of the paper, we will term this set of journals the "FT31+."[2]

Is Information Systems a Reference Discipline?

In the following sections of the paper. we used data from the FT31+ set to ascertain the level of external influence attained by the IS field. These analyses are summarized in Table 2. First, we applied citation analysis to examine the extent to which other sub-disciplines of management cite IS, and are themselves cited. Second, we hypothetically removed journals to track the changes in citation patterns of other journals in the FT31+ set. If the removal of a journal resulted in a negligible change among the remaining journals, then the influence of that journal was deemed to be modest. Third, we explored second degree citations. This analysis tracks not just direct citations, but also citations to the papers that cite the original article. Fourth, we examined citation patterns over the 12 years of data in the dataset to uncover longitudinal trends. We present these analyses to provide an extensive and multi-faceted examination of internal and external disciplinary influence.

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[2] We use the contraction 'FT31+' rather than 'FT31' to recognize the addition of the two non-FT IS journals: JMIS and CACM.

Table 1. The Financial Times Journals			
Area	**Short**	**Journal Name**	**1st Issue**
Accounting	AOS	Accounting, Organisations and Society	1976
Accounting	AR	The Accounting Review	1926
Accounting	JAR	Journal of Accounting Research	1936
Accounting	JAE	Journal of Accounting and Economics	1979
Economics	AER	The American Economic Review	1911
Economics	ECON	Econometrica	1933
Economics	JPE	Journal of Political Economy	1893
Economics	JASA	Journal of the American Statistical Association	1906
Economics	RJE	The Rand Journal of Economics	1970
Entrepreneurship	JBV*	Journal of Business Venturing	1986
Entrepreneurship	JSBM*	Journal of Small Business Management	1963
Entrepreneurship	ETP*	Entrepreneurship Theory and Practice	1976
Ethics	JBE	The Journal of Business Ethics	1982
Finance	JF	Journal of Finance	1946
Finance	JFE	Journal of Financial Economics	1937
Finance	RFS*	Review of Financial Studies	1988
General Management	AMJ	Academy of Management Journal	1948
General Management	AMR	Academy of Management Review	1976
General Management	OS*	Organization Science	1990
International Business	JIBS	Journal of International Business Studies	1970
International Business	MIR*	Management International Review	1961
IS	**MISQ**	**MIS Quarterly**	**1977**
IS	**ISR**	**Information Systems Research**	**1990**
Marketing	JM	Journal of Marketing	1937
Marketing	JCR	Journal of Consumer Research	1974
Marketing	JMR	Journal of Marketing Research	1964
Management Science	MS	Management Science	1955
Management Science	OR	Operations Research	1953
Management Review	HBR	Harvard Business Review	1922
Management Review	SMR	Sloan Management Review	1960
Management Review	CMR	California Management Review	1958
Management Review	AME*	Academy of Management Executive	1987
Management Strategy	SMJ	Strategic Management Journal	1980
Management Strategy	LRP	Long Range Planning	1968
Operations Management	JOM*	Journal of Operations Management	1983
Organizational Behavior	JAP	Journal of Applied Psychology	1916
Organizational Behavior	OBHDP	Organizational Behavior and Human Decision Processes	1914
Organizational Behavior	ASQ	Administrative Science Quarterly	1956
Organizational Behavior	HRM	Human Resource Management	1962
Organizational Behavior	IJHRM*	International Journal of Human Resource Management	1990
* Not included in the sample			

Table 2. Summary of analyses and findings		
Analysis tool	What this tool tells us	Summary of findings
Citation analysis (Table 3)	How many times journals are cited internally within a field (i.e. MISQ cites ISR), as well as externally from outside the field (i.e. HBR cites ISR). Also includes citation percentages and citations per article.	The IS field lags most other management sub-areas on all measures including citations per article and citations from external fields.
Citation analysis: Selective removal (Table 4)	Analysis tool whereby journals are hypothetically 'removed' to see the effect on the remaining journals. Useful for determining magnitude and extent of external influence.	The external influence of the IS field is concentrated on a few management sub-areas. For many areas, the change when IS journals are removed is negligible.
Second degree citation analysis (Table 5)	Shows the extent of external influence beyond a single citation, thus providing a more sophisticated picture of knowledge dissemination. Also provides an indication of knowledge re-absorption.	The extent of second degree influence of the IS field is relatively weak. About half of the ideas that leave the field are later reabsorbed into it.
Citation analysis over time (Figures 3,4)	Examines citation patterns over a period of 12 years, and thus provides an indication of longitudinal performance.	Gross number of citations to IS journals has increased over time, but the number of citations per article has fallen.

Table 3 summarizes citations from journals in a functional area to journals in other areas. Many areas of management follow the 80/20 rule, in that around 80% of citations to journals in a particular field come from other journals in that field. Information Systems follows this trend. According to data from the FT31+ set, 85% of citations to IS journals came from other IS journals. The remaining 15% of citations to IS journals came from other, non-IS journals in the FT31+ set. Fields such as Marketing, Finance, and Economics fall into the same 80/20 pattern. Some fields, such as Accounting and Ethics, tend to be less cited externally, with most citations coming from within the field. Other fields are highly cited by journals outside their field. Perhaps not surprisingly, this is true for journals in Management Strategy, General Management, and Management Review. On a percentage basis, General Management and Management Review are cited more often from outside their areas than from within them. Clearly, these fields have a relatively high level of external influence and may be considered reference disciplines to other areas.

Table 3 also shows the average number of citations per article originating in the FT31+ set for each field. There is considerable variance on this measure across the areas. The average General Management article, for instance, is cited more than eight times by

Table 3. Cross Functional Influence of Management Areas as Measured by Citation Counts						
	Number of times area journals are cited by other journals in the FT31+ set (#)	Percentage of citations coming from other journals within the same area (%)	Percentage of citations coming from journals outside the area (%)	Citations from FT31+ set per article (#)	Citations per article from other journals in same area (#)	Citations per article from journals outside the area (#)
Accounting	6003	86.0%	14.0%	4.473	3.845	0.628
Economics	7544	73.0%	27.0%	1.644	1.200	0.443
Ethics	3950	94.3%	5.7%	2.739	2.584	0.155
Finance	8335	78.6%	21.4%	6.093	4.789	1.304
Intl. Bus.	1527	60.3%	39.7%	3.502	2.112	1.390
General Mgt.	7733	39.0%	61.0%	8.244	3.213	5.031
IS	**3479**	**85.3%**	**14.7%**	**1.311**	**1.119**	**0.192**
Marketing	6729	79.6%	20.4%	5.418	4.310	1.108
Mgt. Science	4489	64.8%	35.2%	1.842	1.193	0.649
OB	11774	50.9%	49.1%	3.994	2.032	1.962
Mgt. Review	4166	20.4%	79.6%	2.746	0.560	2.186
Strategy	6187	52.7%	47.3%	4.152	2.188	1.964
TOTAL/AVG	**71916**	**64.3%**	**35.7%**	**3.210**	**2.063**	**1.147**

other journals in the FT31+ set. More than half of these citations are from journals outside the field of General Management. By contrast, the average Management Science article is only cited 1.8 times, and two thirds of these citations come from other Management Science journals. Information Systems, with 1.3 citations per article originating from the FT31+ set, is among the lowest fields according to this measure (the average for all journals is 3.2 citations per article). Further, most of the citations to IS come from within the field. On average, only one in every five IS articles is cited by a non-IS journal in the FT31+ set (0.19 citations per article). The IS field does not excel by this measure, but it is also not the worst. The field of Ethics fares worse, and Management Science, Economics, and Accounting are not far behind.

Another way to analyze the citation data is to remove certain journals and see the extent to which the citation patterns among all other journals changes. Table 4 shows how the citations from the FT31+ set of journals change when journals from individual functional areas are removed. If the change is small, then the influence of the 'removed' journals is minimal. If the change is substantial, then the influence of the removed journals is large.

Based on this analysis, the field that would be most 'missed' following its removal is General Management. This field consists of two journals: *Academy of Management Review* and *Academy of Management Journal*. Citations from all non-General Management journals would drop an average of 42% if AMR and AMJ were to disappear. If the IS journals were to disappear, the total citation count from all other journals would drop by less than 5% (3% on average). The fields of Accounting, Ethics, and Economics fare similarly poorly on this measure.

Table 4. Cross Functional Influence of Management Areas As Measured by Percentage Changes in Citations when Journals are Removed

Citations to . . .	Citations from . . .	ACT	ECO	ETH	FIN	INT	MGT	MIS	MKT	MSC	ORG	REV	STR	Citations from FT31 journals, excluding those from within the area	Area average
ACT	AOS	14	0	1	0	0	0	0	0	0	0	0	0	3	
	AR	21	0	0	1	0	0	0	0	1	0	0	0	2	
	JAR	23	0	0	1	0	0	0	0	1	0	0	0	3	
	JAE	21	0	0	3	0	0	0	0	0	0	0	0	5	3
ECO	AER	1	23	0	4	1	0	0	1	2	1	1	1	12	
	ECON	0	17	0	3	0	0	0	0	2	0	0	0	5	
	JASA	0	28	0	0	0	0	0	1	1	0	0	0	2	
	JPE	1	16	0	6	0	1	0	0	1	1	0	1	11	
	RJE	1	7	0	1	0	0	0	0	1	0	0	1	5	7
ETH	JBE	0	0	72	0	1	1	1	0	0	1	1	0	5	5
FIN	JF	6	4	0	50	2	1	0	0	2	0	0	2	18	
	JFE	4	2	0	31	1	1	0	0	1	0	1	2	11	14
INT	JIBS	0	0	1	0	38	2	0	1	0	1	1	3	10	10
MGT	AMJ	1	0	2	0	8	21	3	1	2	12	4	10	43	
	AMR	1	0	8	0	8	19	4	2	1	7	4	8	42	42
MIS	CACM	0	0	0	0	0	0	17	0	1	0	1	0	4	
	ISR	0	0	0	0	0	0	14	0	1	0	1	0	3	
	JMIS	0	0	0	0	0	0	10	0	1	0	1	0	2	
	MISQ	0	0	0	0	0	0	20	0	1	0	2	0	4	3
MKT	JCR	0	0	0	0	1	0	0	28	1	1	1	0	4	
	JM	0	0	2	0	6	1	1	26	2	1	5	2	20	
	JMR	0	0	1	0	1	0	0	22	2	1	2	1	9	11
MSC	MS	1	1	0	0	3	3	8	4	38	2	4	4	29	
	OR	0	0	0	0	0	0	0	0	27	0	0	0	1	15
ORG	ASQ	1	0	1	0	3	14	2	2	3	12	5	10	40	
	HRM	0	0	0	0	0	1	0	0	0	2	0	0	2	
	JAP	0	0	2	0	1	8	2	1	0	33	0	0	15	
	OBHDP	1	0	1	0	0	3	2	3	2	19	0	0	12	17
REV	CMR	0	0	1	0	2	1	2	1	1	0	11	2	11	
	HBR	1	0	3	1	3	3	5	3	2	2	27	8	31	
	SMR	0	0	0	0	1	1	5	1	2	1	17	2	14	19
STR	LRP	0	0	0	0	1	0	1	0	0	0	1	6	4	
	SMJ	1	0	1	0	16	18	2	3	3	3	8	38	56	30
Total		100	100	100	100	100	100	100	100	100	100	100	100		

Perhaps more worrying for the IS field is the fact that the data indicates that its influence on other fields is concentrated in a few areas. Sixteen of the journals in the FT31+ set showed a zero percent change in citation counts when IS journals were removed, and three journals showed a change of 1% or less. This result suggests that not only are IS journals not heavily cited by other management areas, but any influence is concentrated within particular fields – in this case, Management Review and Management Science. As an example, the *Journal of Mark*eting referenced *ISR* an average of once every 100 articles, and the *Journal of Finance* did not reference *ISR* at all.

Maybe the Information Systems Field isn't a Reference Discipline, But Is It a Contributing Discipline…?

Based on the data presented above, it would be difficult to conclude that the IS field is a reference discipline. This does not mean to suggest, however, that the IS field has no external impact whatsoever. In fact, it is perhaps not surprising that IS is not a reference discipline, given the youth of the field. Similarly youthful fields such as International Business and Ethics also struggle for external recognition, as the data above show. A field, perhaps, needs time to reach an appropriate level of internal maturity before it can be expected to exert a significant influence on other fields.

Some have argued that not all fields need to become reference disciplines at all. Lee (2001) makes the point that it may be inappropriate for an applied field such as IS to become a reference discipline. Instead, he proposes that the IS field should aspire to become a contributing discipline. The difference between these two concepts is largely in the degree of external influence. [3] Clearly, the IS field has some influence on other academic fields - Tables 3 and 4 show this. But exactly how influential is it? To approach this question, we will analyze the citation data in a different way.

Using a now famous analogy, social network theory contends that any one person is related to any other person on earth by an average of six or fewer degrees of separation (see Figure 2) (Milgram, 1967). To elaborate on the concept, if person A knows person B, then there is one degree of separation between the two. If person C knows person B but not person A, then there is one degree of separation between B and C and two degrees of separation between A and C. One key contribution of this literature is to highlight the importance of a few people who make up a disproportionally large contribution to a network. These people are the connectors that form the critical links within networks.

We can draw on social network theory to explore the links between academic fields. Research papers, as noted earlier, can be linked though networks of citations. Papers that are heavily cited carry the largest amount of influence. This influence may be internal or external, or both. Papers that are cited heavily within a relatively closed system (within an academic field, for instance) have a strong internal influence on that field. Papers that are heavily cited outside the field have a high external influence. Papers do not necessarily have to have both high internal and external influence, although these measures often correlate highly. While papers with high internal influence can serve an important function in the development of a field, by promoting a cumulative tradition for example, it is the papers with external influence that serve as links to other disciplines.

It is possible to map the external influence of journals and academic areas using more that one degree of separation. Instead of tracking citations to and from articles, journals, and areas as we did earlier in this paper (one degree of separation), we can track two

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[3] We use the term 'influence' in place of 'relevance'. The latter term has come to be associated with relevance to practice, as in the question - is our research useful to real managers in real companies? Various researchers have debated the IS field's relevance in this regard (Benbasat and Zmud, 2003; Lyytinen, et al, 1999; Sambamurthy and Zmud, 1999; Westfall, 1999; Westfall, 2001).

degrees of separation. Put another way, it is possible to check whether the papers that cite a certain piece of research are themselves heavily cited. Papers that exhibit a citation profile that increases with each degree of separation enjoy wide influence. Papers with rapidly shrinking citation profiles have a narrower influence. For example, a paper may be cited by another, but if that second paper is not, itself, cited, then the trail of influence dies at the first degree of separation.
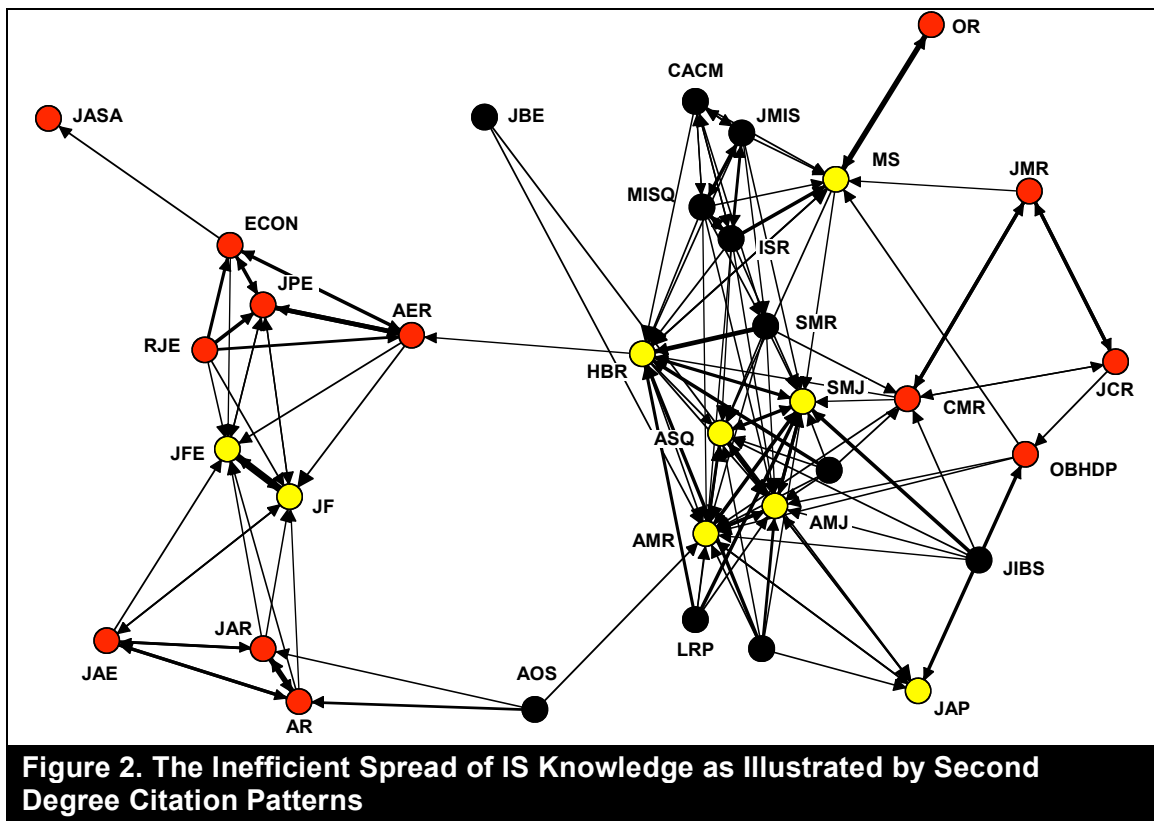
Multiple degrees of separation can be used to evaluate external influence. If a paper is cited by another paper in a journal outside the field of origin (say an *ISR* article is cited by a *Journal of Marketing* article), then its influence has left the field – in a sense it has formed a link to another field. If that *Journal of Marketing* article is, itself, cited by papers from journals in other fields, then the second degree of influence becomes very broad. Table 5 shows that this is the case for some fields. For example, in the field of Marketing, 86% of second degree citations are from non-marketing journals. A similar effect can be seen for Management Review (97%) and Management Science (95%) articles. The field of Economics provides an interesting exemplar for the usefulness of second degree citation analysis. Earlier in the paper, Table 2 suggested that the external influence of Economics was very small (less than 0.5 external citations per article). By contrast, Table 5 shows that 86% of second degree citations originate from outside the field, thus confirming the Economics field's position as influential within management research (if not a reference discipline).

Table 5. Second Degree of Separation Influence of FT31+ Articles					
	Number of second degree citations	Number of second degree citations from within a field	Number of second degree citations from outside a field	Percentage of Citation "Re-absorption"	Rank
ACT	3846	696	3150	18.1%	5
ECO	6731	946	5785	14.1%	4
ETH	890	435	455	48.9%	11
FIN	5972	1555	4417	26.0%	8
INT	2364	647	1717	27.4%	10
MGT	17573	4089	13484	23.3%	8
MIS	1449	811	638	56.0%	**12**
MKT	2842	393	2449	13.8%	3
MS	6594	314	6280	4.8%	2
OB	24402	4411	19991	18.1%	5
REV	13664	433	13231	3.2%	1
STR	15180	4100	11080	27.0%	9
Average	8459	6890	1569	23.4%	7

Table 5 indicates that Information Systems, once again, is among the bottom of the management areas for second degree influence. In fact, it is the only field where more than half of the second degree citations come not from external journals, but from IS journals. To illustrate, an article in *Management Science* cites an article in *MISQ* (one degree of separation). Then the *Management Science* article is cited by two other papers (two degrees of separation). It turns out that in the case of IS, one of those two

second degree citations is from an IS journal. This finding suggests that ideas that are generated in the IS field are not being spread efficiently — a substantial number of them are leaving the field only to be reabsorbed back into it. Vessey et al. (2002) recognized this effect after an exhaustive review of diversity in the IS field revealed that IS had become a reference discipline - but only to its own research!

Figure 2 provides a graphical illustration of second degree citations between journals in the FT31+ set. We used a spring embedding algorithm to generate the graph. The thicknesses of the arcs (from one to three pixels) are representative of the number of citations that flow between the journals (arcs representing a standardized citation frequency of less than 5% are not shown). For example, the arc from *ECON* to *JASA* means that *ECON* cites *JASA*, i.e., information flows from *JASA* to *ECON*. The nodes (journals) in the graph have been color-coded according to how much they are cited per citation made. To be classified as an information generator (yellow) a journal needs to receive four citations per three made (about one standard deviation above the mean for the first degree of separation data). Information sinks (black) consume four citations per three made. Journals that are neither generators nor sinks are colored red.

Figure 2. The Inefficient Spread of IS Knowledge as Illustrated by Second Degree Citation Patterns

As expected, journals show up in clusters according to academic sub-disciplines. As Figure 2 shows, the IS field is very eclectic in the extent to which it draws on research from other fields. However, the black color of the nodes (journals) combined with the lack of arrows pointing to the field, suggests that knowledge is not leaving the field, or, that it is being absorbed back into it. In the words of Nambisan (2003), IS is more a consumer of ideas (imported from other fields) than a producer of ideas (exported to other fields).

Is the Information Systems Field Headed in the Right Direction?

As a young field, Information Systems is still in the process of building a reputation for research. *ISR*, for instance, has only been published since 1990. Thus, even if the field has not exerted a major influence on other fields over the 12-year period considered in this paper, it would be encouraging if there were an upward trend over time. Figure 3 shows the trend for two measures of cross-functional influence over the period 1990-2001: number of citations and citations per article. Number of citations is an aggregate measure of the number of citations from non-IS journals to IS journals for each given year. Figure 3 shows that citations from non-IS FT31+ journals to IS journals grew rapidly in the mid-1990s and reached a peak in 1997, before falling in recent years. Overall, the trend shows a modest growth in number of citations over time.

As more articles are published, however, the total number of citations to IS journals would be expected to rise – thus this measure is biased toward more recent dates. A more time-independent measure of cross-functional influence is the number of citations per citable article. [4] Figure 3 shows a downward trend for this measure. Thus, while the total number of citations has increased over time, the rate of citations per citable paper has fallen.

Figure 3. Citations to IS Journals over Time
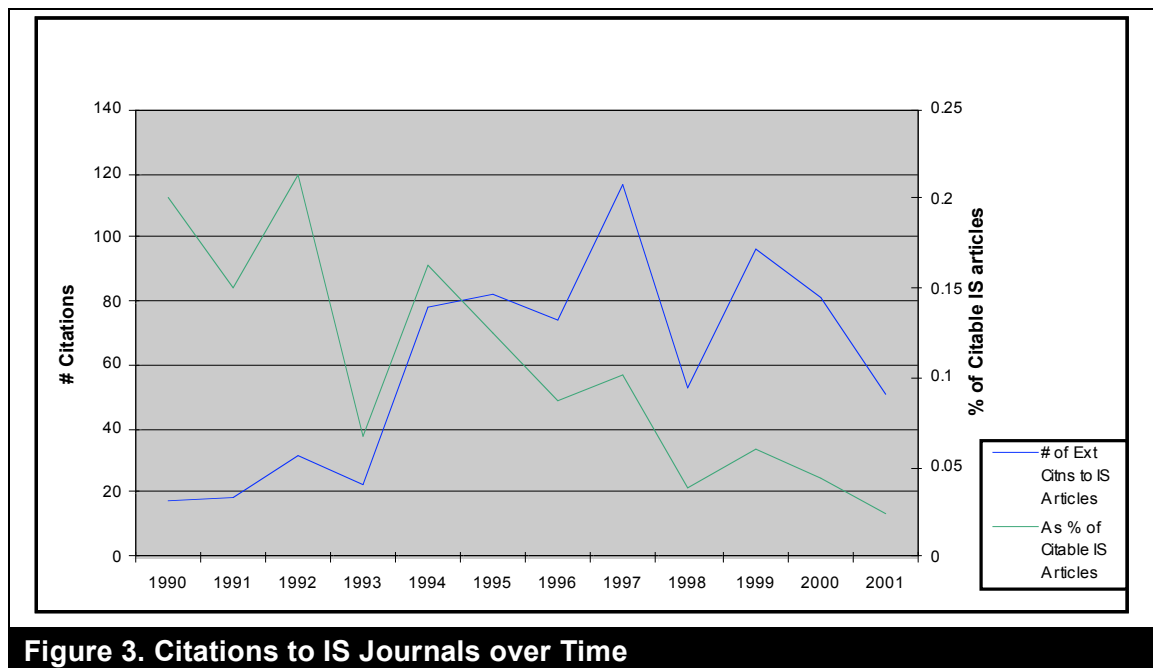
It is interesting to compare IS to other fields using the same longitudinal scales. One field that is approximately the same age as IS is International Business (IB). The IB field, like IS, has faced issues of external legitimacy. Also like IS, the IB field has now established itself as a strong and vibrant academic discipline within most business schools. Figure 4 shows that the number of external citations to IB has risen over time (like the IS field), but the number of citations per article has not fallen (unlike the IS field).

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[4] A citable article is defined as one that is published three or more years before an article that cites the paper is published.
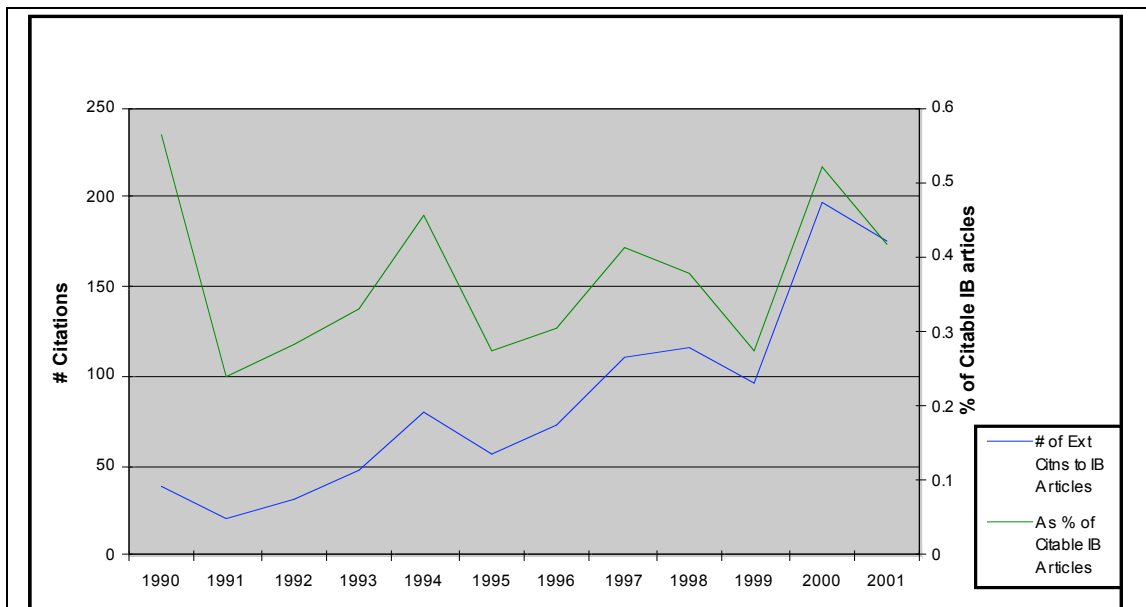
Figure 4. Citations to IB Journals over Time

It should also be noted that the measures of both citation categories are substantially higher for the IB field than for the IS field. IB has clearly been more successful than IS in gaining and maintaining external citations.

In summary, we have used citation analysis to explore the extent to which the IS field has influence on other fields of management research. While we caution that the results are not definitive, what they indicate is not encouraging. Scaled citation counts indicate that IS journals in the FT31+ set are among the least cited by other journals. When the four IS journals in the FT31+ set, *MISQ*, *ISR*, *JMIS*, and *CACM* are removed, citation profiles of the remaining journals are minimally affected. The diffusion of research from the IS field, as measured by two degrees of separation, is modest. IS does not appear to have many 'bridge' articles, or articles that are heavily cited by other fields. Further, the evidence points to a negligible growth in cross-functional influence over the 12-year period from 1990-2001. These findings cast doubt on Baskerville and Myers' conclusion that IS is ready to attain the status of a reference discipline. They also draw into question the extent to which the IS field has become a contributing discipline for other management fields, at least within the limited set of journals considered in this paper.

How Can Information Systems Become a Reference Discipline?

Information, and technologies to manage it, are ubiquitous in business. Firms use IT in practically every aspect of their operations from procurement to manufacturing to marketing to product and service delivery to customer service to human resources and so on. Many inter- and intra-firm relationships are mediated by IT. Why then has the academic field of IS not been similarly influential on other academic disciplines? The evidence presented in this paper indicates that IS is not yet a reference discipline, as defined by its influence on other fields.

As a field, should we care? Clearly we should, because in the words of DeSanctis, our

very survival may depend on it (DeSanctis, 2003, p369). Most members of the field would agree that it behooves us to increase our external influence (Robey, 2003). Yet, achieving this goal is not straightforward. Over the years, a number of ideas have been suggested to address the problem of low external influence (i.e. Lee, 1999, 2000, 2001; Benbasat and Zmud, 2003; Galliers, 2003; Hirschiem and Klein, 2003). We have drawn together those ideas that we feel carry the most potential to increase the external visibility of the field, and added a few of our own (see Table 6).

Table 6. Summary of Strategies to Increase the External Influence of the IS Field	
Idea/strategy	Benefit
Cross-pollination of ideas: - joint issue publications - cross functional conferences	Promotes cross-functional research on areas of common interest. Conducive to the sharing of ideas and to building contacts with researchers in other fields. Enhances visibility.
Accessibility of research: - out-of-field publishing - availability of full-text electronic versions of key journals - minimize technical jargon and esoteric language	Increases the accessibility of IS research to external audiences. Increases the reach and range of the field and introduces other fields to IS ideas and concepts.
Increase research quantity (without sacrificing quality)	More papers on more topics in top IS journals will increase the odds that researchers in others fields will find something of interest in the IS field.
Promote systems thinking	Increases the relevance of IS research to researchers in other fields.

Cross Pollination of Ideas

> *"To achieve this, one possibility could involve MISQ's pursuing a cross-journal special issue, with an editorial board composed of some MISQ editors and some of the editors of another journal (representing accounting, marketing, or another field), where MISQ would publish two of the articles and the other journal would publish another two; more than one such cross-journal special issue would be needed to represent different fields. A less ambitious but more easily implemented possibility would be to commission papers on specific themes (such as "MIS research and marketing research" and "MIS research and organizational research"), where the commissioned papers would still undergo the standard MISQ review process."*
> Allen Lee (1999), MISQ Editor Inaugural Comments

The idea of publishing an IS/non-IS joint issue is not a new one (see above quote). Yet, it has never occurred in a major IS journal. Other fields appear to be somewhat better in this regard. In 1998, the *Journal of Computer-Mediated Communication* published a joint issue with *Organization Science* on virtual organizations. There are few examples beyond this one, and none involving the FT40 set of journals, suggesting that IS is not the only area that avoids joint issue publications. However, many journals have

published issues on cross-disciplinary topics. For instance, the *Journal of Operations Management* has published an issue on organizational theory and supply chain management. The journal *Management Science* has frequently published issues on boundary-spanning topics.

We encourage IS journal editors to pursue opportunities for joint publications or special issues on cross-functional topics. Since IS is at the intersection of many fields, it is entirely appropriate to pursue this strategy. Suitable topic areas include supply chain management (IS and Operations Management), e-commerce (IS and Strategy, or IS and Marketing), self-efficacy (IS and Organizational Behaviour) systems analysis and design (IS and Computer Science), IS productivity (IS and Economics, or IS and Strategy), and customer relationship management (IS and Marketing), among others. As an promising example, *Organization Science* recently organized a special issue on information technology and organizational form and function.

A related suggestion is for IS researchers to attend other areas' conferences and to encourage researchers from other fields to attend IS conferences (Benbasat & Zmud, 2003; Nambisan, 2003). At present, the former tends to happen with more frequency than the latter. The annual summer Academy of Management conference is always well attended by IS researchers. The IS community also regularly attends conferences in the areas of management science, operations management, organizational behavior, and e-commerce, among others. More effort to include researchers from other areas in IS conferences might help to increase the cross-pollination of ideas between fields.

Make Information Systems Research More Accessible to External Researchers

Another option available to IS researchers is to publish their work in the top journals of other fields, as suggested by Benbasat and Zmud (2003) and Nambisan (2003). There is some evidence to suggest that this already occurs (Chua et al. 2002); yet, the profile of the field as a whole has not benefited from these efforts. It has not, as noted earlier, led to a high dispersion of second degree links emanating from IS papers. [5] There may be a reason for this. The data suggest that the IS field lacks 'champion' papers. A champion paper is one that is published in a top journal of another field that heavily references works in the original field. Champion papers are highly referenced outside the field. In other words, the second degree effect of a champion paper is substantial – it becomes a very efficient spreader of knowledge.

We can see the effect of champion articles in the field of Ethics. Ethics, like IS, was among the least externally influential academic management fields (see Tables 3,4). Articles in Ethics journals tended not to be widely referenced by journals in other fields. Second degree influence was similarly low (see Table 5). However, certain articles served as champions for the field. Three papers, for instance, accounted for a large proportion of the field's external influence. The paper "Toward a unified conception of business ethics: Integrative social contracts theory" (Donaldson and Dunfree, 1994) that appeared in the *Academy of Management Review*, heavily cited Ethics work and was, in turn, heavily cited by other FT31+ journals, achieving 26 unique citations. Another paper

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[5] If the first degree citation to an IS article is from a non-IS journal article that was written by an IS researcher, then this would, in fact, further reduce the diffusion of ideas from the field.

published in the *Academy of Management Journal* achieved 22 citations from the FT31+ set, and a further *AMR* paper achieved 21 citations. Thus 69 unique citations were received from just three papers.

By contrast, the most widely cited IS second degree paper was "Measuring system usage: Implications for IS theory testing" (Straub et al., 1995) from *Management Science*, which achieved 12 unique citations from the FT31+ set. The top three IS-related second degree papers together received 29 citations versus 69 for Ethics.

If editors of influential journals in other fields could be convinced to publish special issues on IS-related topics (like the *Organization Science* example cited earlier), then the field could take advantage of this and produce papers to become champions. A few examples of this approach exist. *The Journal of Production and Operations Management*, for example, published a special issue in 1999 on the IT/Operations interface. *The International Journal of Production Economics* published a special issue on Information Technology/Information Systems. *INTERFACES* published a special issue on the OR/Marketing interface in 2001, and *Management Science* released a double special issue on management science and e-commerce in 2003.

Enhancing the external accessibility of IS research may be as simple as making IS journals widely available to a non-IS audience. For example, it is important to ensure that the up-to-date, electronic, full-text versions of key journals are available on common research databases, such as ABI/Inform, and Proquest (Benbasat & Zmud, 2003). The field's major journals are not vigilant in this regard. Recent versions of ISR are only available through a subscription to INFORMS, which may or may not be available to researchers in other fields. Finally, it has been suggested that IS researchers should write papers in a manner that is easily accessible to a non-IS audience. By this, we mean writing with a minimum of jargon, embedded cultural assumptions, technical jargon, and the like (Benbasat & Zmud, 2003).

Quantity in Addition to Quality

We uncovered an intriguing strategy to increase the field's external influence during the data analysis for this paper. The strategy, quite simply, is to pursue article quantity as well as quality. Since *MISQ* and *ISR* publish relatively few articles compared to journals in other fields, there may simply not be enough articles to touch on issues relevant to researchers in other areas (DeSanctis, 2003). This argument should not exist in theory – only papers of sufficient quality should be published and no more – but in practice there may be a quantity effect. *Management Science*, for instance, publishes an issue every month, and often places 10 or more papers in each issue. By contrast, *MISQ* and *ISR* together publish an average of less than 40 new research articles a year. While the per article citation count for a *Management Science* article outside the Management Science field is extremely low (the lowest of all journals in the FT31+ set), the actual citation count among the FT31+ set for *Management Science* is equal to *MISQ* and *ISR* put together! More articles may lead to more external citations, which may eventually help the IS field's quest to become more influential externally.

Since the IS field has grown substantially in the last two decades, top IS journals could arguably publish more papers without in any way diluting the quality of the output. Simply put, the supply of top tier journal space has not kept pace with the supply of high quality articles. Evidence of this situation can be seen by the consistently increasing

number of paper submissions to, and falling acceptance rates of, top tier IS journals. The bottleneck for top tier journals may be page restrictions imposed by publishers, or it may be a lack of reviewing capacity, as recently suggested by the editor-in-chief of *MISQ* (Saunders, 2005).

The data in this paper suggest that the quantity factor may play a role in determining the extent of external influence. Of the four IS journals included in the dataset (*ISR*, *MISQ*, *JMIS*, and *CACM*), many IS researchers would agree that the highest quality journals are the first two. However, the journal that publishes the highest volume of articles is *CACM*. When we looked at the top 10 IS articles as measured by the number of external citations, four were from *CACM*, including the top three (see Table 7).

Table 7. Top Ten Externally Cited IS articles in the FT31+ Set			
Journal	First author	Title	External citations
CACM-34-1-59, 1991	Gurbaxani	The Impact Of Information-Systems On Organizations And Markets	12
CACM-34-7-40, 1991	Nunamaker	Electronic Meeting Systems To Support Group Work	9
CACM-36-12-67, 1993	Brynjolfsson	The Productivity Paradox Of Information Technology	8
ISR-2-3-173, 1991	Mathieson	Predicting User Intentions: Comparing The Technology Acceptance Model With The Theory Of Planned Behavior.	8
ISR-2-3-192, 1991	Moore	Development Of An Instrument To Measure The Perceptions Of Adopting An Information Technology Innovation.	7
ISR-3-4-334, 1992	Loh	Diffusion Of Information Technology Outsourcing: Influence Sources And The Kodak Effect.	7
MISQ-14-3-313, 1990	Jessup	The Effects Of Anonymity On GDSS Group-Process With An Idea-Generating Task	7
MISQ-15-3-295, 1991	Bakos	A Strategic Analysis Of Electronic Marketplaces	7
MISQ-19-2-189, 1995	Compeau	Computer Self-Efficacy - Development Of A Measure And Initial Test	7
CACM-33-10-75, 1990	Glynn	Likelihood Ratio Gradient Estimation For Stochastic-Systems	6

Of course, *CACM* has a much higher readership than the other three journals, and this may contribute to the high number of its external citations. However, number of journal articles and journal readership are only indirectly related to article content. Presumably, a journal article will be cited highly if it is ground-breaking, and poorly cited if it is not – something that can not be determined ex ante. Our argument is that the supply of high quality IS articles outstrips places to put them. If our top journal editors could publish a larger number, and greater variety, of papers without significantly reducing the quality of

each article (as we believe would be the case), then the odds of one of these papers becoming ground-breaking to someone outside the field would be increased.

Systems Thinking

It is beyond the scope of this paper to suggest specific research areas, topics, methodological approaches, and so on that may (or may not) enhance the external influence of the IS field. Nor do we wish to wade into the debate over disciplinary diversity, core theories, or central artifacts. It does, however, seem logical to us for researchers in the field to adopt Lee's (2000) notion of systems thinking. By treating technology as a component of a system, researchers are obligated to include other aspects of the system in their research. These aspects, such as people, processes, procedures, channel partners, environmental conditions, and the like, represent factors of interest to researchers in other fields. Thus, a systems thinking approach provides an intersection between IS and other fields (we are, after all, the field of information *systems* rather than information *technology*). A glance at Table 7 reveals a common thread of systems thinking, rather than a focus on a single technology.

Conclusion

Attaining the status of a reference discipline is clearly a worthy goal for the IS field. We have argued in this paper that while the field has accomplished much in terms of internal development, maturity, and sophistication, it has yet to be extensively recognized and appreciated by researchers in other areas of management research. Thus, our conclusion is that the IS field has not yet attained the status of a reference discipline. Yet, there is hope for the field. We have suggested a number of strategies that may help the field in its quest for external recognition. Clearly, no single action will achieve this goal. However, if a concerted effort is made and a few of the strategies are combined, then the IS field could, in time, achieve the status of a reference discipline.

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