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# Communications of the Association for Information Systems

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## Making Sense of the History of Information Systems Research 1975-1999: A View of Highly Cited Papers

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### Abstract:

In this paper, I analyze the history of IS research through the lens of 409 highly cited papers (i.e., papers with at least 100 Reuters Thompson Web of Science citations) published between 1975 and 1999. I focus on 1) what these highly cited papers are, 2) what they study, 3) who their authors are, and 4) where they were published.

**Keywords:** Information Systems, Discipline, History, Evolution, Core.

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## I. INTRODUCTION

During the spring of 2011, I taught a PhD course entitled “Information Systems as a Scientific Discipline”. In one class, I overviewed information systems (IS) research in terms of influential papers and researchers. In preparing for the class, I was unable to identify any ready-made material that I could, in good confidence, use for it. In line with Walstrom and Leonard’s (2000) observation, all the lists of reading materials I could find on the Internet were quite subjective selections of papers that their authoring teachers considered to be essential.

When I explored existing reviews of IS research, I discovered that many were quite old (Culnan, 1986; Culnan, 1987; Ein-Dor & Segev, 1993). Among more-recent reviews, Sidorova, Evangelopoulos, Valacich, and Ramakrishnan (2008) is narrow in the sense that it is limited to three North American journals (*Information Systems Research*, *Journal of MIS*, and *MIS Quarterly*). Taylor, Dillon, and Van Wingen (2010), which analyzes the co-citations of 100 highly influential IS researchers, is broader, but the authors selected almost half of the researchers (45 to be exact) based on their reputation, and the remaining 55 on their publications mainly in North American journals<sup>1</sup>.

Knowing that not all influential IS research has been published in the above journals, I compiled a broader selection of papers attempting to more objectively identify influential IS researchers. Thus, I found myself collecting IS papers with more than 100 citations in the Thompson Reuters Web of Science bibliographic database. This led to an initial corpus of the material used in this study. For simplicity, I call papers with at least 100 citations “highly cited”.

The call for papers to the *Communications of the Association for Information Systems* special section on IS history reminded me of this material. Could my corpus be meaningfully used to make sense of IS’s history? To answer this question, I updated the previously collected material, ultimately resulting in 762 papers. In this current paper, I analyze a subset of 409 papers published between 1975 and 1999. I selected this time frame based on two considerations: first, I determined 1975 because that’s when citation data became available; second, I considered 1999 to be far enough in the past so that one could consider citation data a meaningful indicator of a paper’s historical significance<sup>2</sup>.

More specifically, I answer the following research questions:

1. What are the highly cited papers in IS published between 1975-1999?
2. What is studied in these papers?
3. Who are influential authors in terms of highly cited papers?
4. Where were these papers published?

With this paper, I assume that a historical account of IS research between 1975 and 1999 is of interest. Applying Stake’s (1995) distinction between “intrinsic” and “instrumental” case studies<sup>3</sup>, this is an “intrinsic historical account” rather than an “instrumental historical account”. Thus, I do not generalize beyond the time frame of 1975 to 1999.

## II. EARLIER RESEARCH

This paper is connected to several research streams interested in IS researchers’ research productivity and the IS field’s intellectual history. However, it is also unique in many respects. According to my knowledge, there are few comprehensive analyses of most-cited papers in IS (with Walstrom and Leonard (2000) and Lowry, Karuga, and Richardson (2007) being the most notable exceptions). Building on Culnan (1986, 1987), Walstrom and Leonard (2000) develop a list of 76 classic publications, including both books and papers. They base their list on citation data

<sup>1</sup> Taylor et al. (2010), when selecting based on publication counts, picked up 46 foundational researchers based on their publications in the above North American journals and only nine based on publications in European Journals (*European Journal of Information Systems* and *Information Systems Journal*).

<sup>2</sup> Although such an “old” paper may continue to receive more citations, an annual increase is usually small when compared with the cumulative number of citations to it. In the case of fairly recent paper, an annual increase naturally is more dominant. As a consequence, one can expect that cumulative citations numbers provide a more stable view of the historical significance of older papers than newer ones.

<sup>3</sup> In an intrinsic case study, one wishes to learn something about a particular case. It is not undertaken because it represents other cases, nor because it illustrates a particular trait or problem; rather, it is undertaken because the case itself is of interest. In an instrumental case study, the aim is to learn something beyond the case (Stake, 1995).

collected from papers published in nine journals between 1986 and 1995<sup>4</sup>. More recently, Lowry et al. (2007) present a list of 100 most-cited IS papers published between 1990 and 2004. Their list is limited to papers published in *MIS Quarterly*, *Information Systems Research*, and *Management Science*.

My approach differs from these two precedents. Contrary to Lowry et al. (2007) and Walstrom and Leonard (2000), I cover highly cited IS papers as comprehensively as possible, without limiting the papers to any pre-determined set of journals such as in Walstrom and Leonard (2000). However, I use the 100 most-cited papers in Lowry et al. (2007) to cross-check the papers I identify as highly cited when developing a list of such papers.

In addition to identifying highly cited IS papers, I also analyze and categorize what they studied. This associates the present paper with previous studies of the IS field's structure (Culnan, 1986, 1987), with Sidorova et al. (2008) and Taylor et al. (2010) being the most recent representatives of this research stream. As I note above, both of these later studies suffer from a North American bias. However, I use Taylor et al.'s (2010) list of 100 foundational researchers to cross-check when developing my list of highly cited papers. More profoundly, I also use the core research areas that Sidorova et al. (2008) identify as a starting point for coding the highly cited papers' content. When required, I add new categories.

The third research question above is related to scholarly productivity of individual researchers. There has been some interest in this issue in IS (Chua, Cao, Cousins, & Straub, 2002), with Lowry et al. (2007) and Truex, Takeda, and Cuellar (2009) being the most recent examples. Although I identify authors of highly cited IS papers published between 1975 and 1999, I do not intend to contribute to the research stream on individual researchers' productivity. Instead, I simply report the authors with most highly cited papers without making any attempt to calculate the various indexes based on citations (see Truex et al., 2009). However, I do make use of Truex et al.'s (2009) list of 199 authors to ensure the comprehensiveness of the highly cited papers that I introduce.

As I note above, I analyze highly cited IS papers as broadly as possible, without specifically focusing on a pre-determined set of journals. To estimate the extent to which each paper succeeds in this endeavor, I report the distribution of papers by journal. Yet, I do not provide a new list of IS journal rankings (which has been quite a popular topic in prior research (Lowry, Romans, & Curtis, 2004)). My analysis shows that the Senior Scholars' basket of eight journals covers about 38 percent of the highly cited papers published during 1975 and 1999.

### III. RESEARCH METHOD

#### Selection of the Material

Even though citation numbers suffer from various biases (Reinstein, Hasselback, Riley, & Sinason, 2011), they nevertheless indicate scientific peers' interest in a cited piece of research—and, in that sense, its influence on the scientific community. Therefore, one could argue that citations provide a good view of the history of research, especially if one is obliged to focus on a sample of IS paper rather than the complete corpus of IS publications.

I used Thompson Reuters Web of Science, which provides citation information for scientific papers published from 1975 onwards. I performed the searches in February and March, 2014 with Web of Science's Science Citation Index Expanded, Social Sciences Citation Index, and Arts & Humanities Citation Index; however, I excluded the two conference citation indexes because I wanted to ensure that the citing papers were as scholarly and homogenous as possible.

Although Web of Science has a category called "computer science information systems", it does not do a particularly good job of capturing papers representing IS. After a few trials, I found a reasonable match using a search with the phrase "information systems' OR 'information technology' OR 'computer technology'". I limited this search to the categories "computer science information systems", "information science library science", "management", and "computer science interdisciplinary applications". I searched for journal papers, papers in proceedings, review papers, and editorial material, excluding book reviews. This search returned 20252 papers published between 1975 and 2013.

Table 1 describes the distribution of citations for the total material ( $n = 20252$ ) and for those papers published from 1975 to 1999 ( $n = 5320$ )<sup>5</sup>. It indicates that the distributions of papers with 100 or more citations are quite similar in

<sup>4</sup> The nine journals include some that are not primarily IS journals (*Management Science*, *Communications of the ACM*, *Organization Science*). It is not clear if the authors focused on all papers published in these journals or just IS papers. In any case, their list of classics include publications that are not IS publications.

<sup>5</sup> The analysis for years 1975-1999 was conducted on March 23, 2014.

the two data sets; however, quite interestingly, there are relatively more papers without any citations at all in the 1975 to 1999 material (39.8%) than in the total material (24.3%). Table 1 also shows that the 1975-2013 material includes 168 papers with at least 200 citations and 480 papers with at least 100 citations, while the 1975-1999 material includes 61 papers with at least 200 citations and 140 papers with at least 100 citations.

**Table 1: Distribution of Citations**

Citations	Number of papers				Cumulative			
	1975-2013		1975-1999		1975-2013		1975-1999	
	N	%	N	%	N	%	N	%
≥ 1000	7	0.03	2	0.04	7	0.03	2	0.04
500 - 999	25	0.12	7	0.13	32	0.16	9	0.17
400 - 499	18	0.09	6	0.11	50	0.25	15	0.28
300 - 399	29	0.14	14	0.26	79	0.39	29	0.55
200 - 299	89	0.44	32	0.60	168	0.83	61	1.1
100 - 199	312	1.5	79	1.5	480	2.4	140	2.6
50 - 99	727	3.6	179	3.4	1207	6.0	319	6.0
21 - 49	2025	10.0	402	7.6	3232	16.0	721	13.6
11 - 20	2437	12.0	415	7.8	5669	28.0	1136	21.4
6-10	2628	13.0	484	9.1	8297	41.0	1620	30.5
3-5	2969	14.7	659	12.4	11266	55.6	2279	42.8
1- 2	4056	20.0	924	17.4	15322	75.7	3203	60.2
0	4930	24.3	2117	39.8	20252	100.0	5320	100.0

Since information systems as an academic discipline was still at the formative stage especially during the 1970s and 1980s, there were good reasons to doubt that the list of 140 highly cited papers published from 1975 to 1999 was not exhaustive. Therefore I decided to focus first on the 480 highly cited papers published during 1975 to 2013 and check whether the authors from this larger pool may have published highly cited IS papers during 1975 to 1999 that weren't included in the 140 papers. If they had, I included their paper in the material.

To ensure that the 480 highly cited papers included essential IS papers, I also checked whether they covered the 199 authors ranked by Truex et al. (2009) using various h-indeces. If not, I checked in the case of each missing author whether he or she had highly cited IS or IS-related papers using the basic search in Web of Science. If the author had, I added these papers to my list. Additionally, I excluded some papers from my initial 480 that I did not regard as IS or IS-related paper. In order to limit the analysis, I also excluded papers published in special journals of medical informatics if none of the authors had published in any of the mainstream IS journals listed below. I applied a similar process to the case of geographic information systems.

Thus, for each of the 480+ papers, I checked whether the authors had other highly cited IS or IS-related papers that were not included in that number. If the author had, I included the paper, and repeated the process for each new paper<sup>6</sup>.

If a paper had appeared in the mainstream IS journals (*European Journal of Information Systems, Information & Management, Information Systems Journal, Information Systems Research, Journal of Information Technology, Journal of MIS, Journal of the AIS, Journal of Strategic Information Systems, or MIS Quarterly*), I accepted that it was an IS or IS-related paper. For papers published in other journals, they needed refer to IT or at least to technology that could be interpreted to comprise IS/IT. I excluded all papers on research methods in non-IS journals.

This iterative process resulted in 735 highly cited papers between 1975 and 2013, of which 382 appeared between 1975 and 1999.

Finally, I checked whether the 100 "foundational authors" identified by Taylor et al. (2010) were represented among the 382 papers. If an author was not, and if an author that Taylor et al. (2010) mentions had highly cited papers published between 1975 and 1999, I added those papers to my list. Similarly, I tested whether my list of papers included the 100 most-cited IS papers that Lowry et al. (2007) lists and that were published between 1990 and 1999. If not, and if a paper that Lowry et al. (2007) mentions had 100 citations or more, I included it<sup>7</sup>. As a final test, via

<sup>6</sup> In the case of some names, it was almost next to impossible to check if the authors had relevant papers, since Web of Science gave thousands hits. For example, H. Chen as an author returned roughly 48000 papers.

<sup>7</sup> Lowry et al. (2007) cover papers published between 1990-2005 and Taylor et al. (2010) between 1986-2005.

Web of Science, I checked whether the list covered highly cited papers published between 1975 and 1999 in the abovementioned mainstream IS journals<sup>8</sup>.

As a consequence, I added some papers even if they were not available through the basic search in Web of Science (Moore and Benbasat (1991) and DeLone and McLean (1992) are the most notable examples)<sup>9</sup>. If I knew that a particular author's name was widely misspelled, I corrected the citation numbers to take the mistake into account. Via this process, I identified an additional 27 papers, which resulted in a set of 409 highly cited papers published between 1975 and 1999 (see Appendix A)<sup>10</sup>. In this paper, I interpret the history of IS in terms of these 409 papers.

Table 2 reports the annual distribution of the 409 papers, and divides the 25-year history into stages<sup>11</sup>. As Table 2 shows, the number of highly cited papers has risen over the years. This rise may be explained by the increased maturity of the IS field, by the larger IS research community, and by the higher number of researchers in other fields interested in IS/IT-related phenomena.

**Table 2: Yearly Distribution of Highly Cited Papers (n = 409)**

Stage		Year	N	Stage sum		Stage		Year	N	Stage sum		
1. Formative years	Early	1975	1	9	54	2. First sprint of growth	First wave	1987	17	63	128	
		1976	0					1988	16			
		1977	1					1989	10			
		1978	1					1990	20			
		1979	4					65	3. Second sprint of growth			Second wave
		1980	2				1992			25		
	Late	Late	1981	9		45	Third wave	1993	18	109		227
			1982	5				1994	33			
			1983	9				1995	40			
			1984	9			118	Fourth wave	1996	36		
			1985	5					1997	34		
1986			8	1998	36							
						1999	48					

It is difficult to know in advance which are appropriate stages to understand IS history. Obviously, it would be too coarse to analyze all 25 years' papers as a single whole. On the other hand, a year-by-year analysis would be too detailed because of the relatively low number of highly cited papers per year, especially during the early years (see Table 2).

Quite interestingly, Table 2 shows that we can divide the 25 years into three major stages: the "formative years" (1975-1986), the "first sprint of growth" (1987-1993), and the "second sprint of growth" (1994-1999) based on papers published in those years. During the formative years, the number of highly cited papers was quite low (on average, 4.5 per year). There was a clear increase from 1987 onwards (on average, 18.3 per year during 1987-1993) and a second sharp increase from 1994 onwards (on average, 37.8 per year during 1994-1999).

As a consequence, I decompose my analysis of highly cited IS papers from the years 1975 to 1999 into three parts according to these three stages. However, I thought that the first stage was too long because it covered almost half of the 25-year history. Moreover, in the case of the third stage, the number of papers (N = 227) seemed excessive because they comprised 55.5% of all the highly cited papers (N = 409). Consequently, I divided each of the three stages into two sub-stages. Tables 3-8 present these stages together with their sub-stages<sup>12</sup>.

<sup>8</sup> These final tests took place as an afterthought in August 2014.

<sup>9</sup> In that case, I used "cited reference search" in ISI Web of Science and the cited author as the search term.

<sup>10</sup> So, the whole material covering years 1975-2013 included 762 highly cited papers (= 735 + 27).

<sup>11</sup> They are called stages rather than eras because of their tentative nature.

<sup>12</sup> I checked the final coding if a year-by-year analysis using a framework similar to Table 9 helped to figure out more insightful stages, but I was not able to identify clear juncture points, which indicate a beginning of a new era. One reason for this is that IS research as a whole includes several concurrent core research areas and research themes (Sidorova et al., 2008). So, if there are such juncture points such as TAM's publication (Davis, 1989; Davis et al., 1989), they tend to concern individual core research areas or research themes rather than the IS field as a whole (e.g., IT/individual interaction in the case of TAM).



## Coding and Analysis

I used Sidorova et al.'s (2008) five core research areas—IS development, IT and individuals, IT and groups, IT and organizations, IT and markets—to initially categorize each paper. When necessary, I expanded the categorization or made it more detailed<sup>13</sup>.

In addition to the research areas, I coded each paper according to specific technologies and/or specific research topics if the paper made such information clear. I picked most of the technology categories directly from their respective papers as illustrated by familiar acronyms (such as CMC, DSS, and OIS in Table 4). However, I identified some categories as a result of abstraction: the systems development methods and tools (SDMT) category being a prime example. I applied a similar inductive process when identifying specific topics. Technologies and special topics in Tables 3-8 roughly correspond to the research themes in Sidorova et al. (2008).

I undertook the coding alone, which I based on mainly each paper's title and abstract. When necessary, I also examined a paper's main body. Admittedly, my coding suffers from a certain level of subjectivity. Moreover, because I completed the coding alone, I could not calculate any inter-rater reliability. To partially compensate for this, Appendix B compares my coding to Sidorova et al.'s (2008) categorization for 26 papers that happened to be common between the two studies. The codes of 21 papers were largely compatible; however, in five cases, there were clear differences.

I made coding easier by allowing individual papers to belong to several categories. Still, I coded 14 papers (listed in Appendix A) in the "other" category in the final analysis. It would take too much space to explain these exceptions individually; however, together, they turned out to be "outliers". Appendix B explains one such case.

## IV. RESULTS OF THE ANALYSIS

Tables 3-8 describe the coding's results. All citations in Tables 3-8 refer to Appendix A. Those citations, which are pioneering in the sense that they are the first highly cited paper of the category in question, are in bold<sup>14</sup>.

Tables 3-8 also indicate the number of citations using the following categories: 100-199, 200-499, 500-999, and 1000 ≥. Of the 409 papers, there are six (i.e., Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Moore & Benbasat, 1991; DeLone & McLean, 1992; Taylor & Todd, 1995; Chidamber & Kemerer, 1994) that have 1000 citations or more, and, of these, Davis (1989) is the most cited with nearly 4300 citations. Additionally, there are 29 papers with 500-999 citations and 140 papers with 200-499 citations. The remaining 234 papers have 100-199 citations.

Note that the categories represented in the first columns of Figures 3-8 are the results of the complete coding that covers 1975-1999; that is, they do not describe the evolution of the codes that took place during the coding<sup>15</sup>.

### Formative Years (1975-1986)

#### Early Formative Years (1975-1980)

Table 3 describes the results of coding the highly cited papers published during the early formative years 1975-1980. Only nine highly cited papers were published during this period. Of these, Ives, Hamilton, & Davis (1980) exemplifies a paper that does not clearly fit into any of the five research areas that Sidorova et al. (2008) suggest. Therefore, I extended this initial categorization to comprise IS meta-research (i.e., research that may be programmatic as Ives et al. (1980) or that may review earlier research as Zmud (1979) does). As Section "The first sprint of growth (1987-1993)" shows, research on IS research methods forms a significant third theme of this IS meta-research category<sup>16</sup>.

Since Zmud (1979) reviews IT/individual interaction, I also coded in that category (see Table 3), which includes cross-referencing between the different codings (e.g., when Zmud (1979) is coded into category A3 (= reviews), there is a reference to category D1 (= IT/individual interaction); the same occurs when Zmud (1979) is coded into category D1).

<sup>13</sup> These core research areas seem to reflect the interaction between IT and different contexts as the units of analysis. I keep this interpretation in mind when considering possible extensions to the research areas.

<sup>14</sup> I did not have the energy to check if these "pioneering highly cited papers" are really the earliest papers in which the ideas were originally introduced.

<sup>15</sup> For brevity, Tables 3-8 include only relevant technologies and special research topics (i.e., which have associated papers in a table) (see Table 6 for the complete list).

<sup>16</sup> IS meta-research roughly corresponds to "IS discipline development" in the 13-factor solution in Sidorova et al. (2008).

Inspired by Nolan (1979) and Rockart (1979), but differing from Sidorova et al.'s (2008) five-category solution, Table 3 also distinguishes IT management from IS development<sup>17</sup>. I interpret IT management here as planning, organizing, controlling, and directing the introduction and use of IT in an organization (cf. Boynton & Zmud, 1987), while IS development refers to analyzing, designing, implementing, and evaluating information systems and corresponding IT applications.

As Table 3 shows, during the 1975-1980 period, pioneering papers on IT/individual interaction and IT/organization interaction were published. Quite interestingly, while Ein-Dor and Segev (1978) adopts a positivist view of the IT/organization interaction, Kling (1980) adopts a more anti-positivist, interactionist view. Inspired by this difference, Table 3 distinguishes these two paradigms of IS research with regard to IT/organization interaction when discernable.

<b>Table 3: Early Formative Years 1975-1980</b>		
A. IS meta-research • IS discipline (A1) • research methods (A2) • reviews (A3)	A1	<b>100-199: Ives et al. (1980)</b>
	A2	
	A3	<b>200-499: Zmud (1979) (D1)</b>
B. IT management (ITM)		<b>200-499: Nolan (1979)</b>
C. IS/IT development • analysis & design (C1) • implementation (C2) • adoption (C.2.1) • diffusion (C.2.2) • evaluation (C3) • project management (C4)	C1	<b>200-499: Rockart (1979)</b>
	C2	
	C2.1	
	C2.2	
	C3	
	C4	
D. IT/context interaction • individual (D1) • group (D2) • organization (D3) • positivistic view (D3.1) • anti-positivistic view (D3.2) • organizational alliance (D4) • markets (D5) • community (D6) • industry (D7) • society (D8)	D1	<b>200-499: Zmud (1979) (A3)</b> <b>100-199: Lucas (1975), Dickson et al. (1977) (UI), Robey (1979)</b>
	D2	
	D3.1	<b>100-199: EinDor &amp; Segev (1978)</b>
	D3.2	<b>200-499: Kling (1980)</b>
E. Technology/systems	UI	<b>100-199: Dickson et al. (1977) (D1)</b>
F. Special topics		
Note: UI = User interfaces		

#### Late Formative Years (1981-1986)

Table 4 lists the highly cited papers published during the late formative years 1981-1986. Compared with the early formative years, the gradual expansion of IS research was both quantitative and qualitative. During 1981 alone, nine highly cited papers were published (i.e., the same number as during the entirety of 1975 -1980). After 1982, the publication rate of highly cited papers stabilized, so that 45 such papers were published during 1981-1986 (i.e., 7.5 per year).

This period also suggests that there was a significant qualitative diversification of research interests and topics. Several highly cited papers on IS design, IS implementation, IS evaluation, and user participation appeared during this period. In fact, the papers from the 1981-1986 years exhibit the strongest emphasis on IS development issues of the whole 25-year history of IS that I analyzed.

<sup>17</sup> The 13-factor solution in Sidorova et al. (2008) identifies "IS management" as a separate research area.



**Table 4: Late Formative Years 1981-1986**

A. IS meta-research • IS discipline (A1) • research methods (A2) • reviews (A3)	A1	<b>100-199:</b> Bakos & Treacy (1986) (ITM), Culnan (1986)
	A2	
	A3	<b>100-199:</b> Sage (1981) (D1, D3.1), Davis (1982) (C1), Ives & Olson (1984) (C4)
B. IT management ITM		<b>200-499:</b> McFarlan (1981), Rockart & Flannery (1983) (EUC) <b>100-199:</b> McFarlan (1983), Dickson et al. (1984); Bakos & Treacy (1986) (ITM)
C. IS/IT development • analysis & design (C1) • implementation (C2) • adoption (C.2.1) • diffusion (C.2.2) • evaluation (C3) • project management (C4)	C1	<b>100-199:</b> Davis (1982) (SDMT), Huber (1983) (D1), Alavi (1984) (SDMT), Huber (1984) (C2.1, D2, GW)
	C2	
	C2.1	<b>500-999:</b> Markus (1983) (D3.2) <b>200-499:</b> Ginzberg (1981a), Keen (1981a) <b>100-199:</b> Ginzberg (1981b), Huber (1984) (C1, D2, GW)
	C2.2	<b>100-199:</b> Zmud (1982) (SDMT), Zmud (1984) (SDMT)
	C3	<b>100-199:</b> Hamilton & Chervany (1981), Keen (1981b) (DSS), Srinivasan (1985)
	C4	<b>200-499:</b> Ives & Olson (1984) (A3, UP) <b>100-199:</b> Robey & Farrow (1982) (UP), Franz & Robey (1986) (UP)
D. IT/context interaction • individual (D1) • group (D2) • organization (D3) • positivistic view (D3.1) • anti-positivistic view (D3.2) • organizational alliance (D4) • markets (D5) • community (D6) • industry (D7) • society (D8)	D1	<b>500-999:</b> Bailey & Pearson (1983), Ives et al. (1983) <b>100-199:</b> Sage (1981) (A3, D3.1), Huber (1983) (C1), Malone (1983) (OIS), Rice & Case (1983) (CMC), Hiltz & Turoff (1985) (D3, CMC), Sanders & Courtney (1985) (DSS), Dickson et al. (1986) (UI)
	D2	<b>500-999:</b> Kiesler et al. (1984) (CMC) <b>200-499:</b> Hiltz et al. (1986) (CMC), Siegel et al. (1986) (CMC)
	D3.1	<b>500-999:</b> Sproull & Kiesler (1986) (CMC) <b>200-499:</b> Ives & Learmonth (1984) (CA), McFarlan (1984) (CA), Cash & Konsynski (1985) (CA) <b>100-199:</b> Sage (A3, D1), EinDor & Segev (1982), Parsons (1983) (CA), Hiltz & Turoff (1985) (D1, CMC), Raymond (1985)
	D3.2	<b>500-999:</b> Markus (1983) (C2.1) <b>100-199:</b> Kling & Scacchi (1982), Gasser (1986)
	CG	<b>100-199:</b> Malone (1981) (CMEL)
	CMC	<b>500-999:</b> Kiesler et al. (1984) (D2), Sproull & Kiesler (1986) (D3.1) <b>200-499:</b> Hiltz et al. (1986) (D2), Siegel et al. (1986) (D2) <b>100-199:</b> Rice & Case (1983) (D1), Hiltz & Turoff (1985) (D1, D3)
E. Technology/ systems	CMEL	<b>100-199:</b> Malone (1981) (CG)
	DSS	<b>100-199:</b> Keen (1981b) (C3), Sanders & Courtney (1985) (D1); Dickson et al. (1986) (D3.1)
	EUC	<b>200-499:</b> Rockart & Flannery (1983) (ITM)
	GW	<b>100-199:</b> Huber (1984) (C1, C2.1, D2)
	OIS	<b>100-199:</b> Malone (1983) (D1)
	SDMT	<b>100-199:</b> Davis (1982) (C1), Zmud (1982) (C2.2), Alavi (1984) (C1), Zmud (1984) (C2.2)
	UI	<b>100-199:</b> DeSanctis (1984), Dickson et al. (1986) (D1)
F. Special topics	CA	<b>200-499:</b> Ives & Learmonth (1984) (D3), McFarlan (1984) (D3), Cash & Konsynski (1985) (D3) <b>100-199:</b> Parsons (1983) (D3)
	FF	<b>200-499:</b> Pawlak (1981)
	UP	<b>200-499:</b> Ives & Olson (1984) (A3, C4) <b>100-199:</b> Robey & Farrow (1982) (C4), Franz & Robey (1986) (C4)
<p>Note: CG = Computer games, CMC = Computer mediated communication, CMEL = Computer mediated education and learning, DSS = Decision support systems, EUC = End user computing, GW = Groupware systems, IOS = Inter-organizational information systems, OIS = Office information systems, SDMT = Systems development methods and tools, UI = User interfaces CA = Competitive advantage, FF = Formal foundations, UP = User participation</p>		

Papers on IS implementation are interested in how information systems or related software are implemented in organizations or other adopting units<sup>18</sup>. It may sometimes be tricky to distinguish these papers from those addressing IT/organization interaction. The crucial difference between these two categories is whether the paper is primarily interested in how an information system or related software is implemented or adopted or whether it focuses on the impact of the implemented system on the organizational context. As Markus (1983) illustrates, a paper may be coded into both categories.

Furthermore, inspired by Ginzberg (1981a, 1981b), Keen (1981) and Zmud (1982), Table 4 distinguishes implementation papers, which are interested in how organizations adopt an information system or software (such as an ERP package), and papers focusing on how an innovation (such as ERP software) is diffused through the population of potential adopters. Zmud (1982), focusing on the diffusion of software development practices (considered as SDMTs in Table 4), illustrates the latter stream of implementation research.

During 1981-1986, the method of addressing IT became also more nuanced. Papers identify various types of IT applications, such as computer games (CG), decision support systems (DSS), computer-mediated education and learning (CMEL), and computer-mediated communication (CMC) in 1981; end user computing (EUC) and office information systems (OIS) in 1983; and groupware (GW) in 1984. Among these technologies in particular, research on CMC technologies led to a continuous stream of highly cited paper (see Section "Summary").

Quite interestingly, the earliest highly cited papers on CMC (i.e., Rice & Case, 1983; Kiesler, Siegel, & McGuire, 1984, and so on) did not appear in the mainstream IS journals. These early papers also seem to address CMC from a quite multifaceted perspective in that they approach it from the levels of individuals, groups, and organizations.

Research on SDMTs represent another category of technology with a continuous stream of highly cited papers, with Davis (1982) and Zmud (1982) as pioneering examples.

Curiously, the first highly cited paper on CG (Malone, 1981) was published during this period. In fact, this is the only one among the 409 papers included in my study that focuses on CG. Moreover, Huber (1983) published a paper that effectively killed a burgeoning research topic of cognitive styles or human information processing styles in the context of information systems.

Finally, in addition to user participation (with Robey and Farrow (1982) as the earliest highly cited paper), the issue of information systems as tools for competitive advantage (with Parsons (1983) as the earliest paper) became a topic of continued research during 1981 to 1986.

## The First Sprint of Growth (1987-1993)

### The First Wave (1987-1990)

Table 5 describes the results of coding the highly cited papers published from 1987-1990. Quantitatively, the number of highly cited papers rose to a new level during 1987-1990: this period saw 63 highly cited papers (i.e., 15.8 per year) published. Qualitatively, it is noteworthy that several highly cited papers on research methods appeared, indicating a burgeoning desire to improve IS research's methodological rigor. Three of these papers addressed qualitative research, with Benbasat, Goldstein, and Mead (1987) as the pioneering paper (see Table 5). Moreover, Nunamaker, Chen, and Purdin's (1990-1991) seminal paper on design science research in IS is noteworthy.

During this period, the research focus in IS expanded from IT/individual, IT/group, and IT/organization interactions to include IT/market, IT/community, and IT/industry interactions, with Malone, Yates, and Benjamin (1987b), Rice and Love (1987), and Copeland and McKenney (1988) as pioneering examples. This expansion led to further extensions of the five core research areas that Sidorova et al. (2008) identify.

GW technology (i.e., group decision support systems, group support system, and meeting support systems) also became a topic of intensive research. As a consequence, several highly cited papers appeared focusing on IT/group interaction. Moreover, the first highly cited paper on inter-organizational information systems (IOS) (Johnston & Vitale, 1988) was published during this period.

<sup>18</sup> When coding, I did not consider individuals as adopting units since it is difficult in TAM research to separate when the question is about acceptance ( $\approx$  initial adoption) and when it's about IT/individual interaction. The idea here was to avoid extensive double coding in both categories. This decision was also motivated by Schwarz and Chin (2007), who argue that TAM is quite limited as a model of IT acceptance.

Although Malone, Grant, Turbak, Brobst, and Cohen (1987a) do not explicitly discuss knowledge management (KM), they address it implicitly. The pioneering paper on business process reengineering (BPR) (Davenport & Short, 1990) is also noteworthy. However, the most influential incident during this period was the publication of the technology acceptance model (TAM) (Davis, 1989; Davis et al., 1989), which heavily guided future IS research and was also significant in terms of highly cited publications.

**Table 5: The First Sprint of Growth—The First Wave 1987-1990**

A. IS meta-research • IS discipline (A1) • research methods (A2) • reviews (A3)	A1	<b>200-499:</b> Markus & Robey (1988) (D3) <b>500-999: Benbasat et al. (1987)</b>
	A2	<b>200-499:</b> Lee (1989), Straub (1989) <b>100-199:</b> Kaplan & Duchon (1988), Nunamaker et al. (1990-1991)
	A3	<b>200-499:</b> Lyytinen & Hirschheim (1987) (C), Hirschheim & Klein (1989) (C1), Melone (1990) (D1) <b>100-199:</b> Kraemer & King (1988) (D2, GW)
B. IT management ITM	ITM	<b>200-499:</b> Brancheau & Wetherbe (1987), Zachman (1987) <b>100-199:</b> Boynton & Zmud (1987), Lederer & Sethi (1988), Henderson (1990)
C. IS/IT development • analysis & design (C1) • implementation (C2) • adoption (C.2.1) • diffusion (C.2.2) • evaluation (C3) • project management (C4)	C	<b>100-199:</b> Lyytinen & Hirschheim (1987) (A3)
	C1	<b>200-499:</b> Mylopolos et al. (1990) (SDMT) <b>100-199:</b> Hirschheim & Klein (1989) (A3), Batra et al. (1990) (SDMT), Davenport & Short (1990) (D3.1, BPR), Silver (1990) (D1, DSS)
	C2	<b>100-199:</b> Reich & Benbasat (1990) (D3.1, IOS)
	C2.1	<b>100-199:</b> Rice et al. (1990)
	C2.2	<b>500-999:</b> Cooper & Zmud (1990) <b>200-499:</b> Markus (1987) (CMC) <b>100-199:</b> Brancheau & Wetherbe (1990) (EUC)
	C3	
	C4	<b>200-499:</b> Baroudi et al. (1987) (UP) <b>100-199:</b> Tait & Vessey (1988) (UP), Barki & Hartwick (1989) (UP), Doll & Torkzadeh (1989) (UP)
	D. IT/context interaction • individual (D1) • group (D2) • organization (D3) • positivistic view (D3.1) • anti-positivistic view (D3.2) • organizational alliance (D4) • markets (D5) • community (D6) • industry (D7) • society (D8)	D1
D2		<b>500-999:</b> DeSanctis & Gallupe (1987) (GW), <b>200-499:</b> Dennis et al. (1988) (GW), Connolly et al. (1990b) (GW), Huber (1990) (D3) <b>100-199:</b> McGuire et al. (1987) (CMC), Gallupe et al. (1988) (GW), Kraemer & King (1988) (A3, GW), Sharda et al. (1988) (DSS), Watson et al. (1988) (GW), Connolly et al. (1990a) (GW), Finholt & Sproull (1990) (CMC), George et al. (1990) (GW), Jessup et al. (1990) (GW)
D3		<b>500-999:</b> Malone et al. (1987b) (D5, OTH) <b>200-499:</b> Trevino et al. (1987), Huber (1990) (D2) <b>100-199:</b> Malone et al. (1987a) (CMC, KM), Copeland & McKenney (1988) (D7, CA), Markus & Robey (1988) (A1)
D3.1		<b>500-999:</b> Davenport & Short (1990) (BPR) <b>200-499:</b> Johnston & Vitale (1988) (IOS, CA) <b>100-199:</b> DeLone (1988), Johnston & Carrico (1988) (CA), Reich & Benbasat (1990) (C2, IOS), Rice et al. (1990) (CMC)
D3.2		
D4		
D5		<b>500-999: Malone et al. (1987b) (D3, OTH)</b>
D6		<b>200-499: Rice &amp; Love (1987) (D1, CMC)</b>
D7		<b>100-199: Copeland &amp; McKenney (1988) (D3, CA)</b>
D8		



E. Technology/ system	CMC	<b>200-499:</b> Markus (1987) (C2.2), Rice & Love (1987) (D1, D6), <b>100-199:</b> McGuire et al. (1987) (D2), Malone et al. (1987a) (D3, KM), Rice (1987), Finholt & Sproull (1990) (D2), Rice et al. (1990) (D3.1)
	DSS	<b>100-199:</b> Sharda et al. (1988) (D2), Silver (1990) (C1, D1)
	EUC	<b>100-199:</b> Rivard & Huff (1988) (D1), Brancheau & Wetherbe (1990) (EUC)
	GW	<b>500-999:</b> DeSanctis & Gallupe (1987) (D2) <b>200-499:</b> Dennis et al. (1988) (D2), Connolly et al. (1990b) (D2) <b>100-199:</b> Gallupe et al. (1988) (D2), Kraemer & King (1988) (A3, D2), Watson et al. (1988) (D2), Zigurs et al. (1988) (D2), Connolly et al. (1990a) (D2), George et al. (1990) (D2), Jessup et al. (1990) (D2)
	IOS	<b>200-499: Johnston &amp; Vitale (1988)</b> (D3.1, CA), Reich & Benbasat (1990) (C2, D3.1)
	SDMT	<b>200-499:</b> Kemerer (1987), Mylopolos et al. (1990) (C1) <b>100-199:</b> Batra et al. (1990) (C1)
	UI	<b>200-499:</b> Jarvenpaa (1989) (D1)
F. Special topics	BPR	<b>500-999: Davenport &amp; Short (1990)</b> (C1, D3.1)
	CA	<b>200-499:</b> Johnston & Vitale (1988) (D3.1, IOS) <b>100-199:</b> Copeland (1988) (D3, D7), Johnston & Carrico (1988) (D3.1)
	FF	<b>100-199:</b> Wand & Weber (1990)
	KM	<b>100-199: Malone et al. (1987a)</b> (D3, CMC)
	UP	<b>200-499:</b> Baroudi et al. (1987) (C4) <b>100-199:</b> Tait & Vessey (1988) (C4), Barki & Hartwick (1989) (C4), Doll & Torkzadeh (1989) (C4)
	Other	<b>500-999: Malone et al. (1987b)</b> (D3, D5) <b>200-499: Malone (1987)</b>
<p>Note: CMC = Computer mediated communication, DSS = Decision support systems, EUC = End user computing, GW = Groupware systems, IOS = Inter-organizational information systems, SDMT = Systems/software development methods and tools, UI = User Interfaces BPR = Business process reengineering, CA = Competitive advantage, CT = Coordination theory, FF = formal foundations, KM = Knowledge management, UP = User participation</p>		

### The Second Wave (1991-1993)

Table 6 describes the highly cited papers published from 1991-1993. During this period, the number of highly cited papers stabilized at 21.7 papers per year. Among IS meta-research, DeLone and McLean's (1992) paper, with more than 1000 citations, represents a remarkable achievement.

The first signs of TAM research's influence are also visible in the research on IT/individual interaction, with 18 highly cited paper (with the top-cited paper of Moore and Benbasat (1991) being one of them). Not all of the 18 papers are directly inspired by TAM; however, a significant number are. In any case, there is the highest proportion of paper on IT/individual interaction over the whole 25-year IS history during 1991-1993.

As for the core IS research areas (Sidorova et al., 2008), Brynjolfsson (1993) extended them to include the interaction between IT and whole societies (economies).

**Table 6: The First Sprint of Growth—The Second Wave 1991-1993**

A. IS meta-research • IS discipline (A1) • research methods (A2) • reviews (A3)	A1	<b>≥ 1000:</b> DeLone & McLean (1992)
	A2	<b>200-499:</b> Orlikowski & Baroudi (1991), Walls et al. (1992) (DSS) <b>100-199:</b> Lee (1991)
	A3	<b>200-499:</b> Brynjolfsson (1993) (D7, D8, PP) <b>100-199:</b> Alavi & Joachimsthal (1992) (DSS), Benbasat & Lim (1993) (D2, GW)
B. IT management ITM	ITM	<b>200-499:</b> Sowa & Zachman (1992), Henderson & Venkatraman (1993) (D3.1) <b>100-199:</b> Beath (1991), Jarvenpaa & Ives (1991), Niederman et al. (1991), Loh & Venkatraman (1992a) (C2.2, OUT), Loh & Venkatraman (1992b) (OUT), Earl (1993), Lacity & Hirschheim (1993) (OUT)
C. IS/IT development • analysis & design (C1)	C1	<b>100-199:</b> Byrd et al. (1992) (SDMT), Mylopoulos et al. (1992) (SDMT), Ramesh & Dhar (1992) (SDMT)
	C2	

<ul style="list-style-type: none"> <li>• implementation (C2)               <ul style="list-style-type: none"> <li>• adoption (C.2.1)</li> <li>• diffusion (C.2.2)</li> </ul> </li> <li>• evaluation (C3)</li> <li>• project management (C4)</li> </ul>	C2.1		
	C2.2	<b>200-499:</b> Grover (1993) (IOS)	
	C3	<b>100-199:</b> Loh & Venkatraman (1992a) (ITM, OUT), Pennings & Harianto (1992) (EC), Cragg & King (1993)	
	C4	<b>100-199:</b> Clemons (1991) (D3.1)	
<p>D. IT/context interaction</p> <ul style="list-style-type: none"> <li>• individual (D1)</li> <li>• group (D2)</li> <li>• organization (D3)               <ul style="list-style-type: none"> <li>• positivistic view (D3.1)</li> <li>• anti-positivistic view (D3.2)</li> </ul> </li> <li>• organizational alliance (D4)</li> <li>• markets (D5)</li> <li>• community (D6)</li> <li>• industry (D7)</li> <li>• society (D8)</li> </ul>	D1	<p>≥ <b>1000:</b> Moore &amp; Benbasat (1991)</p> <p><b>500-999:</b> Mathieson (1991), Adams et al. (1992), Davis et al. (1992), Davis (1993)</p> <p><b>200-499:</b> Thompson et al. (1991), Vessey (1991) (UI), Trevino &amp; Webster (1992) (CMC), Webster &amp; Martocchio (1992), Segars &amp; Grover (1993)</p> <p><b>100-199:</b> Schmitz &amp; Fulk (1991) (CMC), Todd &amp; Benbasat (1991) (DSS), Martocchio &amp; Webster (1992), Rice (1992), Todd &amp; Benbasat (1992) (DSS), Culnan (1993) (EC, RISK), Hendrickson et al. (1993), Igbaria (1993)</p>	
	D2	<p><b>200-499:</b> Ellis et al. (1991) (GW), Nunamaker et al. (1991) (GW), Gallupe et al. (1992) (GW), Kiesler &amp; Sproull (1992) (CMC)</p> <p><b>100-199:</b> Gallupe et al. (1991) (GW), Benbasat &amp; Lim (1993) (A3, GW), Dennis &amp; Valacich (1993) (GW), Chidambaram &amp; Jones (1993) (GW)</p>	
	D3		
	D3.1	<p><b>200-499:</b> Clemons &amp; Row (1991) (CA), Weill (1992), Henderson &amp; Venkatraman (1993) (ITM)</p> <p><b>100-199:</b> Gurbaxani &amp; Whang (1991), Clemons (1991), Don Santos et al. (1993), Rice (1993)</p>	
	D3.2	<p><b>500-999:</b> Orlikowski (1992)</p> <p><b>200-499:</b> Orlikowski &amp; Robey (1991), Fulk (1993) (CMC), Orlikowski (1993) (SDMT)</p>	
	D4		
	D5	<b>200-499:</b> Bakos (1991), Gurbaxani & Whang (1991)	
	D6		
	D7	<b>200-499:</b> Brynjolfsson (1993) (A3, D8, PP)	
	D8	<b>200-499:</b> Brynjolfsson (1993) (A3, D7, PP)	
	<p>E. Technology/system</p>	B2C EC	<b>100-199:</b> Pennings & Harianto (1992) (C2.2), Culnan (1993) (D1, RISK)
		CMC	<p><b>200-499:</b> Kiesler &amp; Sproull (1992) (D2), Trevino &amp; Webster (1992) (D1), Fulk (1993) (D3.2)</p> <p><b>100-199:</b> Schmitz &amp; Fulk (1991) (D1)</p>
DSS		<p><b>200-499:</b> Walls et al. (1992) (A2)</p> <p><b>100-199:</b> Todd &amp; Benbasat (1991) (D1), Todd &amp; Benbasat (1992) (D1), Alavi &amp; Joachimsthal (1992) (A3)</p>	
GW		<p><b>200-499:</b> Ellis et al. (1991) (D2), Nunamaker et al. (1991) (D2), Gallupe et al. (1992) (D2)</p> <p><b>100-199:</b> Gallupe et al (1991) (D2), Benbasat &amp; Lim (1993) (A3, D2), Chidambaram &amp; Jones (1993) (D2)</p>	
IOS		<b>100-199:</b> Grover (1993) (C2.2)	
NN		<b>200-499:</b> Tam & Kiang (1992)	
SDMT		<p><b>200-499:</b> Orlikowski (1993) (D3.2)</p> <p><b>100-199:</b> Byrd et al. (1992) (C1), Mylopoulos et al. (1992) (C1), Ramesh &amp; Dhar (1992) (C1)</p>	
UI		<b>200-499:</b> Vessey (1991) (D1)	
<p>F. Special topics</p>	CA	<b>200-499:</b> Clemons & Row (1991) (D3.1)	
	OUT	<b>100-199:</b> Loh & Venkatraman (1992a) (ITM, C2.2), Loh & Venkatraman (1992b) (ITM), Lacity & Hirschheim (1993) (ITM)	
	PP	<b>200-499:</b> Brynjolfsson (1993) (A3, D7, D8)	
	RISK	<b>100-199:</b> Culnan (1993) (D1, EC)	
	UP	<b>100-199:</b> Newman & Robey (1992) (C4)	
	Other	<p><b>200-499:</b> Yates &amp; Orlikowski (1992)</p> <p><b>100-199:</b> Conner &amp; Rumelt (1991), Gasser (1991), Koh &amp; Venkatraman (1991)</p>	

Note: B2C EC = Business-to-consumer electronic commerce, CMC = Computer mediated communication, DSS = Decision support systems, GW = Groupware systems, IOS = Inter-organizational information systems, NN = Neural network applications, SDMT = Systems/software development methods and tools, UI = User Interfaces  
 CA = competitive advantage, OUT = Outsourcing, PP = Productivity paradox, RISK = IS risks, UP = User participation

Among specific technologies, the first highly cited papers on business-to-consumer (B2C) electronic commerce (EC) or its predecessors, such as video banking (Pennings & Harianto, 1992) and information systems for direct marketing (Culnan, 1993), were published. At the end of this period, the pioneering highly cited papers on outsourcing (Loh & Venkatraman, 1992a, 1992b), the productivity paradox (Brynjolfsson, 1993), and IS risks (Culnan, 1993) also appeared, leading to a corresponding increase in papers on IT management.

## The Second Sprint of Growth (1994-1999)

### The Third Wave (1994-1996)

Table 7 depicts the highly cited papers published from 1994-1996. During this period the number of highly cited papers grew to 36.3 per year, which is almost twice as many as during 1991-1993. Perhaps surprisingly, this growth is not explained so much by the increase in the number of papers on IT/individual interaction (18 in 1991-1993; 26 in 1994-1996), but by the number of papers on IT/organization interaction (11 in 1991-1993; 31 in 1994-1996). However, Taylor and Todd's (1996) paper on IT/individual interaction was the top-cited paper during this period.

Among technologies, Chidamber and Kemerer (1994) published their top-cited paper on object-oriented metrics. The first highly cited paper on B2C electronic commerce in the World Wide Web environment (Berthon, Pitt, & Watson, 1996) appeared as early as 1996. Moreover, a highly cited paper on workflow technologies (Georgakopoulos, Hornick, & Sheth, 1995) was also published.

Table 7 also evidences the emerging boom of knowledge management (KM) with six highly cited paper. These, together with the revived interest in inter-organizational information systems (IOS) due to the EDI technology (with seven highly cited paper), partially explain the sharp increase in the number of papers on IT/organization interaction noted earlier. Four highly cited paper on outsourcing also increased the number of paper on IT management.

Finally, even though not explicitly referring to virtuality, Orlikowski and Yates (1994) address virtual communities and/or groups in their empirical analysis of distributed work. Finally, the issue of data quality emerged through Wang, Storey, and Firth (1995), who wrote the first highly cited paper on the subject.

**Table 7: The Second Sprint of Growth—The Third Wave 1994-1996**

A. IS meta-research • IS discipline (A1) • research methods (A2) • reviews (A3)	A1	
	A2	<b>200-499:</b> March & Smith (1995), Walsham (1995) <b>100-199:</b> Walsham (1995b), Baskerville & Wood-Harper (1996)
	A3	<b>200-499:</b> Thomas & Griffin (1996) (SCM) <b>100-199:</b> Stein (1995) (KM), Wang et al. (1995) (DQ), Williams & Edge (1996) (D8)
B. IT management ITM	ITM	<b>200-499:</b> Brancheau et al. (1994), Pitt et al. (1995) (D1) <b>100-199:</b> Brown & Magill (1994), Kettinger & Lee (1994), Lacity et al. (1995) (OUT), McFarlan & Nolan (1995) (OUT), Lee et al. (1995), Earl (1996) (OUT), Lacity et al. (1996) (OUT), Nelson & Coopriider (1996), Reich & Benbasat (1996), Rockart et al. (1996)
C. IS/IT development • analysis & design (C1) • implementation (C2) • adoption (C.2.1) • diffusion (C.2.2) • evaluation (C3) • project management (C4)	C1	<b>200-499:</b> Guarino (1995) (FF)
	C2	
	C2.1	<b>200-499:</b> Iacovou et al. (1995) (IOS)
	C2.2	<b>200-499:</b> Alavi (1994) (CMEL, GW), Swanson (1994), Tyre & Orlikowski (1994) (D3.2) <b>100-199:</b> Thong & Yap (1995), Thong et al. (1996)
	C3	
	C4	<b>200-499:</b> Barki & Hartwick (1994) (UP), Hartwick & Barki (1994) (UP), Kraut & Streeter (1995) <b>100-199:</b> McKeen et al. (1994) (UP), Keil (1995), Nidomolu (1995), Kirsch (1996)



D. IT/context interaction	<ul style="list-style-type: none"> <li>• individual (D1)</li> <li>• group (D2)</li> <li>• organization (D3)                             <ul style="list-style-type: none"> <li>• positivistic view (D3.1)</li> <li>• anti-positivistic view (D3.2)</li> </ul> </li> <li>• organizational alliance (D4)</li> <li>• markets (D5)</li> <li>• community (D6)</li> <li>• industry (D7)</li> <li>• society (D8)</li> </ul>	D1	<p>≥ 1000: Taylor &amp; Todd (1995a)</p> <p>500-999: Compeau &amp; Higgins (1995b), Goodhue &amp; Thompson (1995), Venkatesh &amp; Davis (1996)</p> <p>200-499: Constant et al. (1994) (D3.1, KM), Lee (1994) (D3.2, CMC), Markus (1994) (CMC), Webster et al. (1994), Chin &amp; Gopal (1995) (GW), Chin &amp; Todd (1995), Goodhue (1995), Igbaria &amp; Iivari (1995), Pitt et al. (1995) (ITM), Straub et al. (1995), Taylor &amp; Todd (1995b), Constant et al. (1996) (D3.1, CMC), Szajna (1996)</p> <p>100-199: Doll et al. (1994), Straub (1994) (CMC), Igbaria et al. (1995), Keil et al. (1995), Webster &amp; Trevino (1995) (CMC), Alavi et al. (1995) (CMEL), Davis &amp; Venkatesh (1996), EtezadiAmoli &amp; Farhoomand (1996), Iivari (1996) (D3.1, SDMT), Sproull et al. (1996) (UI)</p>
		D2	<p>500-999: DeSanctis &amp; Poole (1994) (D3, GW), Malone &amp; Crowston (1994) (D3, D5, OTH)</p> <p>200-499: Orlikowski &amp; Yates (1994) (D6, CMC, VIRT)</p> <p>100-199: Valacich et al. (1994) (GW), Weisband et al. (1995) (CMC), Chidambaram (1996) (GW), Dennis (1996) (GW)</p>
		D3	<p>500-999: DeSanctis &amp; Poole (1994) (D2, GW), Malone &amp; Crowston (1994) (D2, D5, OTH)</p> <p>100-199: Fulk &amp; DeSanctis (1995), Davenport et al. (1996) (KM)</p>
		D3.1	<p>500-999: Mata et al. (1995) (CA)</p> <p>200-499: Boynton et al. (1994), Constant et al. (1994) (D1, KM), Venkatraman (1994) (BPR), Barua et al. (1995), Mukhopadhyay et al. (1995) (IOS), Premkumar &amp; Ramamurthy (1995) (IOS), Stein &amp; Zwass (1995) (KM), Brynjolfsson &amp; Hitt (1996) (PP), Constant et al. (1996) (D1, CMC), Hitt &amp; Brynjolfsson (1996) (PP), Kumar &amp; van Dissel (1996) (IOS), Ross et al. (1996) (CA)</p> <p>100-199: Brynjolfsson et al. (1994), Davenport &amp; Stoddard (1994) (BPR), Kettinger et al. (1994) (CA), Sethi &amp; King (1994) (CA), Srinivasan et al. (1994) (IOS), Zaheer &amp; Venkatraman (1994) (IOS), Iivari (1996) (D1, SDMT), Massetti &amp; Zmud (1996) (IOS)</p>
		D3.2	<p>200-499: Lee (1994) (D1, CMC), Orlikowski &amp; Gash (1994), Tyre &amp; Orlikowski (1994) (C2.2), Boland &amp; Tenkasi (1995) (KM), Orlikowski (1996)</p> <p>100-199: Boland et al. (1994) (KM)</p>
		D4	
		D5	<p>500-599: Malone &amp; Crowston (1994) (D2, D3, OTH)</p> <p>200-499: Benjamin &amp; Wigand (1995)</p>
		D6	<p>200-499: Orlikowski &amp; Yates (1994) (D2, CMC, VIRT), Star &amp; Ruhleder (1996)</p>
		D7	
		D8	<p>100-199: King et al. (1994), Williams &amp; Edge (1996) (A3)</p>
E. Technology/system	B2C EC	<p>100-199: Berthon et al. (1996) (WWW)</p>	
	CMC	<p>200-499: Lee (1994) (D1, D3.2), Markus (1994) (D1), Orlikowski &amp; Yates (1994) (D2, D6, VIRT), Constant et al. (1996) (D1, D3.1)</p> <p>100-199: Straub (1994) (D1), Webster &amp; Trevino (1995) (D1), Weisband et al. (1995) (D2)</p>	
	CMEL	<p>200-499: Alavi (1994) (C2.2, GW)</p> <p>100-199: Alavi et al. (1995) (D1), Leidner &amp; Jarvenpaa (1995)</p>	
	GW	<p>500-999: DeSanctis &amp; Poole (1994) (D2, D3)</p> <p>200-499: Alavi (1994) (C2.2, CMEL), Chin &amp; Gopal (1995) (D2)</p> <p>100-199: Valacich et al. (1994) (D2), Chidambaram (1996) (D2), Dennis (1996) (D2)</p>	
	IOS/ EDI	<p>200-499: Iacovou et al. (1995) (C2.1), Mukhopadhyay et al. (1995) (D3.1), Premkumar &amp; Ramamurthy (1995) (D3.1), Kumar &amp; van Dissel (1996) (D3.1)</p> <p>100-199: Srinivasan et al. (1994) (D3.1), Zaheer &amp; Venkatraman (1994) (D3.1), Massetti &amp; Zmud (1996) (D3.1)</p>	
	NN	<p>100-199: Wilson &amp; Sharda (1994)</p>	

	SDMT	≥ 1000: Chidamber & Kemerer (1994) 200-499: Guarino (1995) (C1, FF) 100-199: Egenhofer (1994), Artale et al. (1996), Brinkkemper (1996), livari (1996) (D1, D3.1)
	WF	200-499: <b>Georgakopoulos et al. (1995)</b>
	WWW	100-199: <b>Berthon et al. (1996)</b> (EC)
	UI	100-199: Sproull et al. (1996) (D1)
F. Special topics	BPR	200-499: Venkatraman (1994) (D3.1) 100-199: Davenport & Stoddard (1994) (D3.1)
	CA	500-999: Mata et al. (1995) (D3.1) 200-499: Ross et al. (1996) (D3.1) 100-199: Kettinger et al. (1994) (D3.1), Sethi & King (1994) (D3.1)
	DQ	100-199: <b>Wang et al. (1995)</b> (A3), Wand & Wang (1996)
	FF	200-499: Guarino (1995) (C1, SDMT) 100-199: Wand & Weber (1995)
	KM	200-499: Constant et al. (1994) (D1, D3.1), Boland & Tenkasi (1995) (D3.2), Stein & Zwass (1995) (D3.1) 100-199: Boland et al. (1994) (D3.2), Stein (1995) (A3), Davenport et al. (1996) (D3)
	OUT	100-199: Lacity et al. (1995) (D3), McFarlan & Nolan (1995) (D3), Earl (1996) (D3), Lacity et al. (1996) (D3)
	PP	200-299: Brynjolfsson & Hitt (1996) (D3.1), Hitt & Brynjolfsson (1996) (D3.1)
	RISK	200-499: Smith et al. (1996)
	SCM	200-499: <b>Thomas &amp; Griffin (1996)</b> (A3)
	VIRT	200-499: <b>Orlikowski &amp; Yates (1994)</b> (D2, D6, CMC)
	UP	200-499: Barki & Hartwick (1994) (C4), Hartwick & Barki (1994) (C4) 100-199: McKeen et al. (1994) (C4)
	Other (OTH)	500-599: Malone & Crowston (1994) (D2, D3, D5) 200-499: Compeau & Higgins (1995a) 100-199: Brynjolfsson & Kemerer (1996), Carlsson & Fuller (1996), Newhagen & Rafaeli (1996)

Note: B2C EC = Business-to-consumer electronic commerce, CMC = Computer mediated communication, CMEL = Computer mediated education and learning, GW = Groupware systems, IOS/EDI = Inter-organizational information systems/ Electronic data interchange, NN = Neural network applications, SDMT = Systems/software development methods and tools, WF = Work Flow technologies, WWW = World Wide Web (Internet), UI = User Interfaces  
BPR = Business process reengineering, CA = Competitive advantage, DQ = Data quality, FF = Formal foundations, KM = Knowledge management, OUT = Outsourcing, PP = Productivity paradox, RISK = IS risks, SCM = Supply chain management, VIRT = Virtual teams, organizations, communities, UP = User participation

### The Fourth Wave (1997-1999)

Finally, Table 8 lists the highly cited papers published from 1997-1999. During this period, the number of highly cited papers stabilized at 39.3 per year. Otherwise, it seems that research continued along the existing paths. During this time, the first highly cited papers on ERP (Davenport, 1998) and on open systems technologies (Chau & Tam, 1997) appeared, and two papers on the role of IT in mass customization and agile manufacturing (Gilmore & Pine, 1997; Gunasekaran, 1998) were published<sup>19</sup>.

Continued research on outsourcing (with five highly cited papers) and research on various IS risks (with three papers) increased the number of papers on IT management during 1997-1999.

There was also increased interest in IS development, which is partly explained by research on BPR, with four highly cited papers<sup>20</sup>. One should note, however, that certain papers—and especially papers on IS analysis and design published from 1997-1999—lie at the outskirts of IS and were not published in the mainstream IS journals.

<sup>19</sup> I admit that the latter two papers are borderline cases, which are included in this study.

<sup>20</sup> This paper interprets that IS analysis & design includes business process (re)design, especially when the new business processes are enable by IT.



**Table 8: The Second Sprint Of Growth —The Fourth Wave 1997-1999**

A. IS meta-research • IS discipline (A1) • research methods (A2) • reviews (A3)	A1	<b>200-499:</b> Seddon (1997), Benbasat & Zmud (1999)
	A2	<b>500-999:</b> Klein & Myers (1998) <b>200-499:</b> Chin (1998), Avison et al. (1999) <b>100-199:</b> Myers (1997), Segars (1997), Baskerville & Wood-Harper (1998), Darke et al. (1998)
	A3	
B. IT management ITM	ITM	<b>200-499:</b> Lacity & Willcocks (1998) (OUT), Segars & Grover (1998) <b>100-199:</b> Ang & Cummings (1997) (OUT), Broadbent & Weill (1997), Chan et al. (1997), Chau (1997), Van Dyke et al. (1997), Ang & Straub (1998) (OUT), DiRomualdo & Gurbaxani (1998) (OUT), Lytinen et al. (1998) (C4, RISK), Straub & Welke (1998) (RISK), Benaroch & Kauffman (1999), Henderson & Venkatraman (1999), Martinsons et al. (1999), Sabherwal (1999) (C4, OUT), Sambamurthy & Zmud (1999)
C. IS/IT development • analysis & design (C1) • implementation (C2) • adoption (C.2.1) • diffusion (C.2.2) • evaluation (C3) • project management (C4)	C1	<b>100-199:</b> Guarino (1997) (FF, SDMT), Kettinger et al. (1997) (C2, C3, BPR, SDMT), Weidenhaupt et al. (1998) (SDMT), Keeney (1999) (B2C EC), Malone et al. (1999) (BPR, SDMT), Mylopoulos et al. (1999) (SDMT), Truex et al. (1999)
	C2	
	C2.1	<b>200-499:</b> Armstrong & Sambamurthy (1999), Bingi et al. (1999) (ERP) <b>100-199:</b> Kettinger et al. (1997) (C1, C3, BPR)
	C2.2	<b>200-499:</b> Fichman & Kemerer (1997) <b>100-199:</b> Harrison et al. (1997), Premkumar et al. (1997), Swanson & Ramiller (1998), Fichman & Kemerer (1999), Poon & Swatman (1999) (EC), Premkumar & Roberts (1999)
	C3	<b>100-199:</b> Kettinger et al. (1997) (C1, C2, BPR)
	C4	<b>500-999:</b> Davenport et al. (1998) (KM) <b>100-199:</b> Kirsch (1997), Chidamber et al. (1998), Keil et al. (1998), Lytinen et al. (1998) (ITM, RISK), Sabherwal (1999) (ITM, OUT)
	D1	<b>500-999:</b> Kraut et al. (1998) (D8, WWW), Karahanna et al. (1999) <b>200-499:</b> Agarwal & Prasad (1997) (WWW), Gefen & Straub (1997) (CMC), Igbaria et al. (1997), Agarwal & Prasad (1998), Agarwal & Prasad (1999), Carlson & Zmud (1999) (CMC), Compeau & Higgins (1999), Dishaw & Strong (1999), Hu et al. (1999), Teo et al. (1999) (WWW), Venkatesh (1999) <b>100-199:</b> Jackson et al. (1997), Straub et al. (1997) (CMC), Webster & Hackley (1997) (CMEL), Gelderman (1998), Marakas et al. (1988), Parthasarathy & Bhattacharjee (1998) (EC), Chen et al. (1999) (WWW), Karahanna & Straub (1999), Lucas & Spitler (1999), Torkzadeh & Doll (1999)
D. IT/context interaction • individual (D1) • group (D2) • organization (D3) • positivistic view (D3.1) • anti-positivistic view (D3.2) • organizational alliance (D4) • markets (D5) • community (D6) • industry (D7) • society (D8)	D2	<b>500-999:</b> Jarvenpaa & Leidner (1999) (VIRT) <b>200-499:</b> Zigurs & Buckland (1998) (GW) <b>100-199:</b> Chin et al. (1997) (GW), Dewan & Min (1997), Warkentin et al. (1997) (CMC, VIRT), Anand et al. (1998) (KM), Dennis & Kinney (1998) (CMC), Doll et al. (1998), Sewell (1998)
	D3	<b>500-999:</b> Davenport (1998) (ERP) <b>200-499:</b> Gilmore & Pine (1997) (MC), McDermott (1999) (KM), Zack (1999a) (KM), Zack (1999b) (KM) <b>100-199:</b> Crowston (1997) (BPR, CT), Fahey & Prusak (1988) (KM), Goodman & Darr (1998) (CMC, KM), Gunasekaran (1998) (AM), Venkatraman & Henderson (1998) (VIRT), Robey & Boudreau (1999)
	D3.1	<b>200-499:</b> Hart & Saunders (1997) (D4, IOS), Powell & Dent-Micallef (1997) (CA), Brynjolfsson & Hitt (1998) (PP), Bharadwaj et al. (1999) <b>100-199:</b> Chau & Tam (1997) (OS), Ahuja & Carle (1999) (VIRT), Broadbent et al. (1999) (BPR), Feeny & Willcocks (1999) (CA)
	D3.2	<b>100-199:</b> Ngwenyama & Lee (1997) (CMC), Walsham & Sahay (1999)
	D4	<b>200-499:</b> Hart & Saunders (1997) (D3.1, IOS) <b>100-199:</b> Bensaou (1997) (IOS), Young-Ybarra & Wiersema (1999)
	D5	<b>200-499:</b> Bakos (1997), Bakos (1998) <b>100-199:</b> Choudhury et al. (1998)
	D6	<b>100-199:</b> Hiltz & Wellman (1997) (CMC, CMEL, VIRT)



	D7	<b>100-199:</b> Buhalis (1998)	
	D8	<b>500-999:</b> Kraut et al. (1998) (D1, WWW)	
E. Technology/system	B2C EC	<b>100-199:</b> Parthasarathy & Bhattacharjee (1998) (D1), Keeney (1999) (C1), Poon & Swatman (1999) (C2.2)	
	CMC	<b>200-499:</b> Gefen & Straub (1997) (D1), Carlson & Zmud (1999) (D1) <b>100-199:</b> Hiltz & Wellman (1997) (D6, CMEL, VIRT), Ngwenyama & Lee (1997) (D3.2), Straub et al. (1997) (D1), Warkentin et al. (1997) (D1, VIRT), Dennis & Kinney (1998) (D2), Goodman & Darr (1998) (D3, KM)	
	CMEL	<b>100-199:</b> Hiltz & Wellman (1997) (D6, CMC, VIRT), Webster & Hackley (1997) (D1)	
	ERP	<b>500-999:</b> Davenport (1998) (D3) <b>200-499:</b> Bingi et al. (1999) (C2.1)	
	GW	<b>200-499:</b> Zigurs & Buckland (1998) (D2) <b>100-199:</b> Chin et al. (1997) (D2)	
	IOS/ EDI	<b>200-499:</b> Hart & Saunders (1997) (D3.1, D4) <b>100-199:</b> Bensaou (1997) (D4)	
	OS	<b>100-199:</b> Chau & Tam (1997) (D3.1)	
	SDMT	<b>200-499:</b> Guarino et al. (1999) (WWW) <b>100-199:</b> Guarino (1997) (C1), Kettinger et al. (1997) (C1, C2, C3, BPR), Weidenhaupt et al. (1998) (C1), Malone et al. (1999) (C1, BPR), Mylopoulos et al. (1999) (C1)	
	WF	<b>500-999:</b> van der Aalst (1998) <b>200-499:</b> van der Aalst (1997) <b>100-199:</b> van der Aalst (1999)	
	WWW	<b>500-999:</b> Kraut et al. (1998) (D1, D8) <b>200-499:</b> Agarwal & Prasad (1997) (D1), Guarino et al. (1999) (SDMT), Teo et al. (1999) (D1) <b>100-199:</b> Chen et al. (1999) (D1)	
	F. Special topics	AM	<b>100-199:</b> Gunasekaran (1998) (D3)
		BPR	<b>100-199:</b> Crowston (1997) (D3, OTH), Kettinger et al. (1997) (C1, C2, C3), Broadbent et al. (1999) (D3.1), Malone et al. (1999) (C1)
CA		<b>200-499:</b> Powell & Dent-Micallef (1997) (D3.1) <b>100-199:</b> Feeny & Willcocks (1999) (D3.1)	
DQ		<b>100-199:</b> Strong et al. (1997), Wang (1998)	
FF		<b>200-499:</b> Kryszkiewicz (1998), Kryszkiewicz (1999) <b>100-199:</b> Wand et al. (1999)	
KM		<b>500-999:</b> Davenport et al. (1998) (C5) <b>200-499:</b> McDermott (1999) (D3), Zack (1999a) (D3), Zack (1999b) (D3) <b>100-199:</b> Anand et al (1998) (D2), Fahey & Prusak (1988) (D3), Goodman & Darr (1998) (D3, CMC)	
MC		<b>200-499:</b> Gilmore & Pine (1997) (D3)	
OUT		<b>200-499:</b> Lacity & Willcocks (1998) (ITM) <b>100-199:</b> Ang & Cummings (1997) (ITM), Ang & Straub (1998) (ITM), DiRomualdo & Gurbaxani (1998) (ITM), Sabherwal (1999) (ITM, C4)	
PP		<b>200-299:</b> Brynjolfsson & Hitt (1998) (D3.1)	
RISK		<b>100-199:</b> Lyytinen et al. (1998) (ITM, C5), Straub & Welke (1998) (ITM), Culnan & Armstrong (1999)	
VIRT		<b>500-999:</b> Jarvenpaa & Leidner (1999) (D2) <b>100-199:</b> Hiltz & Wellman (1997) (D6, CMC, CMEL), Warkentin et al. (1997) (D1, CMC), Venkatraman & Henderson (1998) (D3), Ahuja & Carle (1999) (D3.1), DeSanctis & Monge (1999)	
Other		<b>200-499:</b> Bakos & Brynjolfsson (1999) <b>100-199:</b> Crowston (1997) (D3, BPR), Debar et al. (1999)	
<p>Note: B2C EC = Business-to-consumer electronic commerce, CMC = Computer mediated communication, CMEL = Computer mediated education and learning, ERP = Enterprise resource planning packages, GW = Groupware systems, IOS/EDI = Inter-organizational information systems/ Electronic data interchange, NN = Neural network applications, OS = Open systems, SDMT = Systems/software development methods and tools, WF = Work flow technologies, WWW = World Wide Web AM = Agile manufacturing, BPR = Business Process Reengineering, CA = Competitive advantage, DQ = Data quality, FF = Formal foundations, KM = Knowledge management, MC = Mass customization, OUT = Outsourcing, PP = Productivity paradox, RISK = IS risks, VIRT = Virtual teams, organizations, communities</p>			

## Summary

Table 9 summarizes the results of the above analyses. Because there are only nine highly cited papers from 1975 to 1980, the percentages during this period are not necessarily representative; thus, I do not pay them much attention in the following analysis. Nevertheless, based on Table 9, one can identify several trends:

1. Meta-research into IS research represents 10 percent of the highly cited papers. Despite some variation, this has been a consistent trend since 1981. High citation numbers for IS meta-research studies is understandable since, typically, such papers are of interest to the entire IS research community—or, at least, a sub-community (if a review papers addresses a special topic).
2. The proportion of highly cited papers on IT management has remained stable at around 10 percent. The reason for this is that IT management has continuously encountered new challenges, such as outsourcing and various IT risks, during the last decade of the 20th century.
3. Although the proportion of research on IS development has been reasonably high (18 percent), the trend has been declining (with the 1997-1999 period as an exception). Most of the papers in this category address IS implementation, whose proportion has remained quite stable following the 1981-1986 period. In the case of the 21 papers on IS analysis and design, 12 view IS analysis and design through the lens of systems/software development methods and tools. Many of these papers are somewhat peripherally related to IS and are published in journals outside of mainstream IS research. Overall, Table 9 confirms that IS analysis and design has been underrepresented in mainstream IS research (Vessey, Ramesh, & Glass, 2002).

It is notable that, of the 22 highly cited papers on project management, 11 address only user participation.

An alarming finding with regard to the IS development category is the omission of IS evaluation. In this respect, business-oriented mainstream IS research differs radically from IS research in medical/health informatics, such that a considerable number of papers attempt to evaluate various medical/health information systems (e.g., Ammenwerth & de Keizer, 2005).

4. The proportion of highly cited papers focusing on the interaction between IT and its contexts constitutes about 55 percent of all papers. Most of the papers in this category address IT/individual and IT/organization interactions, with IT/group interaction following as a third topic of study. However, there has been a slight decrease in the proportion of papers concerning IT/context interactions since 1991-1993. This decline is mostly due to the decline in the proportion of papers concerning IT/individual interaction, but it is also due to the decline in papers on IT/organization interaction since 1994-1997 and on IT/group interaction since 1987-1990.

Highly cited papers (though there are only a few) on the interactions between IT and markets, IT and organizational alliances, IT and communities, IT and industries, and IT and societies hint that these contexts are also relevant subjects of IS studies that may eventually may later lead to more highly cited papers.

5. As one might expect, the variety of specific technologies has increased during the years. However, only papers on computer-mediated communication (CMC) systems, groupware (GW), and systems development methods and tools (SDMT) have continued to be highly cited. This has remained true even as the trend in GW has declined (as in the case of IT/group interaction). While some early technologies, such as OIS and EUC, are likely dead ends, the neglect of computer games, despite their early start in the research (Malone 1981), indicates the bias of IS research toward work-oriented uses. The significance of most recent technologies, such as the World Wide Web, related B2C e-commerce, ERP, and WF technologies is more likely to be visible during the later years.
6. Of the special topics, only competitive advantage, knowledge management, outsourcing, and user participation have led to more than 10 highly cited papers.

**Table 9: IS Research Trends**

	1975-1980		1981-1986		1987-1990		1991-1993		1994-1996		1997-1999		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
A. IS meta-research	2	22.2	5	11.1	10	15.9	7	10.8	8	7.3	9	7.6	41	10.0
B. IS management	1	11.1	5	11.1	5	7.9	9	13.8	12	11.0	16	13.6	48	11.7
C. IS development	1	11.1	15	33.3	15	23.8	9	13.8	13	11.9	22	18.6	75	18.3
• IS analysis/design	1	11.1	4	8.9	5	7.9	3	4.6	1	0.9	7	5.9	21	5.1
• IS implementation/diffusion			7	15.6	5	7.9	4	6.2	6	5.5	10	8.5	32	7.8
• IS evaluation			3	6.7			1	1.5			1	0.8	5	1.2
• project management			3	6.7	4	6.3	2	3.1	7	6.4	6	5.1	22	5.4
D. IS/context interaction	6	66.6	22	48.9	36	57.1	40	61.5	62	56.9	60	50.8	226	55.3
• Individual level	4	44.4	9	20.0	13	20.6	18	27.7	26	23.9	23	19.5	93	22.7
• Group level			3	6.7	13	20.6	8	12.3	7	6.4	9	7.6	40	9.8
• Organizational level	2	22.2	12	26.7	12	19.0	11	16.9	31	28.4	21	17.8	89	21.8
• Organizational alliances											3	2.5	3	0.7
• Markets					1	1.6	2	3.1	2	1.8	3	2.5	8	2.0
• Communities					1	1.6			2	1.8	1	0.8	4	1.0
• Industry					1	1.6	1	1.5			1	0.8	3	0.7
• Society							1	1.5	2	1.8	1	0.8	4	1.0
E. Technologies	1		2		1		1		1				6	
• UI			1										1	
• CG			1										1	
• CMEL			1						3		2		6	
• DSS			3		2		4						9	
• SDMT			4		3		4		6		6		23	
• CMC			6		7		4		7		7		31	
• OIS			1										1	
• EUC			1		2								3	
• GW			1		10		6		6		2		25	
• IOS/EDI					2		1		7		2		12	
• NN							1		1				2	
• B2C EC							2		1		3		6	
• WWW									1		5		6	
• WF									1		3		4	
• Open systems											1		1	
• ERP											2		2	
F. Special topics			1		1				2		3		7	
• Formal foundations			3		4		1		3				11	
• User participation			4		3		1		4		2		14	
• Competitive advantage					1				6		7		14	
• Knowledge management					1				2		4		7	
• Business Process Reeng.									3		5		12	
• Outsourcing							3		4		5		12	
• Productivity paradox							1		2		1		4	
• IS risks							1		1		3		5	
• Data quality									2		2		4	
• Supply Chain Management									1				1	
• Virtuality									1		6		7	
• Mass customization											1		1	
• Agile manufacturing											1		1	
• Other					2		4		5		3		14	
Total	9		45		63		65		109		118		409	
N per year	1.5		7.5		15.8		21.7		36.3		39.3		16.4	

Note: B2C EC = Business-to-consumer electronic commerce, CG = Computer games, CMC = Computer-mediated communication, CMEL = Computer-mediated education and learning, DSS = Decision support systems, ERP = Enterprise resource planning packages, EUC = End user computing, GW = Groupware systems, IOS/EDI = Inter-organizational information systems/Electronic data interchange, NN = Neural network applications, OIS = Office information systems, SDMT = Systems development methods and tools, WF = Work flow technologies, WWW = World Wide Web (Internet), UI = User interfaces.

## V. DISCUSSION

I partly wrote this paper based on the observation that the most recent systematic studies of previous IS literature (e.g., Lowry et al., 2007; Sidorova et al., 2008; Truex et al., 2009) tend to limit their analyses to a preselected set of

IS journals. This is problematic, especially when one attempts to make sense of the early history of the IS field, since many elite IS journals were founded in the early 1990s (e.g., *Information Systems Research* in 1990, *European Journal of Information Systems* in 1991, *Information Systems Journal* in 1991, and *Journal of Strategic Information Systems* in 1991). Therefore, it is understandable that much of the early highly cited IS research was published in non-IS journals. Table 10 lists the top ten journals, with *MIS Quarterly* clearly leading, *Management Science* and *Information Systems Research* as second and third, respectively, and *Communications of the ACM* as fourth (a hyphen (-) indicates that a particular journal was founded later). Quite interestingly, *MIS Quarterly's* dominance has steadily declined since the period of 1987 to 1990, likely due to the appearance of competing IS journals<sup>21</sup>.

Table 10 shows that the Senior Scholars' Basket Eight Journals cover less than half of the highly cited IS papers published from 1975 to 1999 (37.9 percent to be exact). Therefore, focusing on only a preselected set of IS journals does not provide a comprehensive view of these early years.

**Table 10: Top Journals**

	1975-1980		1981-1986		1987-1990		1991-1993		1994-1996		1997-1999		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1. <i>MISQ</i>			10	22.2	23	36.5	19	29.2	30	27.5	23	19.5	105	25.7
2. <i>MS</i>	5	55.6	9	20.0	10	15.9	4	6.2	11	10.1	6	5.1	45	11.0
3. <i>ISR</i>	-	-	-	-	4	6.3	10	15.4	12	11.0	15	12.7	41	10.0
4. <i>CACM</i>			8	17.8	7	11.1	5	7.7	3	2.8	10	8.5	33	8.1
5. <i>OS</i>	-	-	-	-	1	1.6	3	4.6	8	7.3	9	7.6	21	5.1
6. <i>SMR</i>			1	2.2	2	3.2	1	1.5	8	7.3	6	5.1	18	4.4
7. <i>DS</i>			2	4.4	1	1.6	2	3.1	3	2.8	7	5.9	15	3.7
8. <i>HBR</i>	2	22.2	4	8.9					1	0.9	2	1.7	9	2.2
9. <i>AMJ</i>	1	11.1					3	4.6	2	1.8	2	1.7	8	2.0
10. <i>I&amp;M</i>									2	1.8	5	4.2	7	1.7
10. <i>Omega</i>							1	1.5	2	1.8	4	3.4	7	1.7

Note: *MISQ* = *MIS Quarterly*, *MS* = *Management Science*, *CACM* = *Communications of the ACM*, *ISR* = *Information Systems Research*, *OS* = *Organization Science*, *SMR* = *Sloan Management Review*, *DS* = *Decision Sciences*, *HBR* = *Harvard Business Review*, *AMJ* = *Academy of Management Journal*, *I&M* = *Information & Management*.

Focusing on IS journals only may also result in a biased view of the most influential scholars. Table 11 lists the researchers with most highly cited papers from 1975 to 1999. The list includes 94 authors, each with at least three such papers. Table 11 is comprised mostly of well-known IS researchers. However, it also includes a number of names that are missing in Truex et al. (2009) and/or in Taylor et al. (2010), such as Gerardine DeSanctis (missing in Truex et al. (2009)), Sara Kiesler (missing in both), Thomas W. Malone (missing in both), Eric Brynjolfsson (missing in Taylor et al. (2010)), Fred Davis (missing in Taylor et al. (2010)), Chris F. Kemerer (missing in Taylor et al. (2010)), Ronald E. Rice (missing in both), Lee S. Sproull (missing in both), Jane Webster (missing in Taylor et al. (2010)), Yannis Bakos (missing in Taylor et al. (2010)), Thomas H. Davenport (missing in both), William J. Doll (missing in both), John C. Henderson (missing in both), F. Warren McFarlan (missing in Truex et al. (2009)), Linda K. Trevino (missing in both), and so on. Some of these authors are not predominantly IS researchers; however, equally many are. In any case, they have all made remarkable contributions to the IS field or, at least, to IS-related research topics.

The likely reason for the above omissions is the sampling. Truex et al. (2009) focuses on *MIS Quarterly*, *Management Science*, *Information Systems Research*, *European Journal of Information Systems*, and *Information Systems Journal*, which cover less than 50 percent of the highly cited papers published between 1975 and 1999 (see Table 10). Taylor et al.'s (2010) selection of researchers excludes those (excepting those included by reputation) who have not actively published in *MIS Quarterly*, *Information Systems Research*, *Journal of Management Information Systems*, *European Journal of Information Systems*, or *Information Systems Journal*.

At the same time, the above omissions indicate the difficulty of sampling when one attempts to gain a fair view of the intellectual history of IS research, especially during its early years, when its borders with its sister fields (such as computer science and software engineering) and its reference fields (such as organization science and management) were quite fluid.

<sup>21</sup> Journal of MIS appears only three times among the 409 papers, even though its first issue was published in 1984. The likely explanation is that Web of Science covers it from 1999 onwards.



**Table 11: Authors with Most Highly Cited Papers During 1975-1999**

Rank	Author	N	Rank	Author	N
1	R. W. Zmud	11		Y. Wand	4
2	I. Benbasat	9		R. Y. Wang	4
	G. DeSanctis	9		L. P. Willcocks	4
	S. Kiesler	9	51	R. Agarwal	3
	W. J. Orlikowski	9		H. Barki	3
	D. W. Straub	9		J. J. Baroudi	3
7	T. W. Malone	8		R. Baskerville	3
	N. Venkatraman	8		M. Broadbent	3
9	E. Brynjolfson	7		P. Y. K. Chau	3
	A. R. Dennis	7		N. L. Chervany	3
	D. Robey	7		D. R. Compeau	3
12	F. D. Davis	6		K. Crowston	3
	M. Igbaria	6		M. J. Culnan	3
	B. Ives	6		M. J. Earl	3
	C. F. Kemerer	6		D. F. Feeny	3
	R. E. Rice	6		J. Fulk	3
	L. (S.) Sproull	6		J. F. George	3
	P. A. Todd	6		D. L. Goodhue	3
	J. S. Valacich	6		J. Hartwick	3
	J. Webster	6		S. R. Hiltz	3
	J. C. Wetherbe	6		R. Hirschheim	3
22	Y. Bakos	5		L. M. Hitt	3
	T. Connolly	5		G. P. Huber	3
	T. H. Davenport	5		J. Iivari	3
	W. J. Doll	5		E. Karahanna	3
	S. L. Jarvenpaa	5		W. J. Kettinger	3
	J. C. Henderson	5		H. K. Klein	3
	F. W. McFarlan	5		K. Lyytinen	3
	J. F. Nunamaker	5		T. W. McGuire	3
	L. K. Trevino	5		T. Mukhopadhyay	3
31	M. Alavi	4		M. D. Myers	3
	J. C. Brancheau	4		J. Mylopoulos	3
	W. W. Chin	4		M. H. Olson	3
	G. W. Dickson	4		M. S. Poole	3
	R. B. Gallupe	4		J. Prasad	3
	V. Grover	4		G. Premkumar	3
	N. Guarino	4		J. F. Rockart	3
	V. Gurbaxani	4		J. Siegel	3
	C. A. Higgins	4		K. Y. Tam	3
	L. M. Jessup	4		W. M. P. van der Aalst	3
	M. Keil	4		V. Venkatesh	3
	B. R. Konsynski	4		G. Walsham	3
	M. C. Lacity	4		R. T. Watson	3
	A. S. Lee	4		R. Weber	3
	M. L. Markus	4		P. Weill	3
	A. H. Segars	4		C. S. Yap	3
	G. Torkzadeh	4		J. Yates	3

Despite differences in sampling, the present papers largely confirm Sidorova et al.'s (2008) major finding that IS research has been governed by fairly stable core research areas, although more specific research themes (i.e., technologies and specific research topics in this paper) have varied. The summary of analyses in Table 9 suggests six such core areas: 1) IS meta-research, 2) IT management, 3) IS development, 4) IT/individual interaction, 5) IT/group interaction, and 6) IT/organization interaction. The last four areas correspond to the five-factor model of Sidorova et al. (2008), who also proposes "IT and markets" as a factor. As I note above, the 13-factor model of Sidorova et al. (2008) identified factors similar to IS meta-research and IT management. My findings also suggest 7) IT and markets, 8) IT and organizational alliances, 9) IT and communities, 10) IT and industries, and 11) IT and so-

ciety as potential core research areas with quite a few highly cited papers, but that there are weak signs that they will gain more attention in the future<sup>22</sup>.

Tables 3-4 show that the foundations for these six core areas were laid much earlier than implied by the material that Sidorova et al. (2008) analyzed. To provide a more concrete idea of the top-cited papers in the six core areas, Appendix C reports the ten most cited papers in each area with a coding following that in Tables 3-8. Note, again, that a single paper may belong to several core areas.

## VI. FINAL COMMENTS

As with any piece of research, this paper suffers from weaknesses. Firstly, the analysis is limited to papers published after 1975 since comparable citation information available for earlier papers does not exist. Second, due to Web of Science's limitations, highly cited papers—especially in *Journal of MIS*—may be missing. It would have required too much effort to individually check each paper published in this journal between 1984-1998 to find out if it was highly cited.

Third, my analysis does not include any books, and the selection of conference papers is quite limited. Walstrom and Leonard (2000) complements my paper as far as books are concerned. As to conference papers, it is probable that only a few are highly cited. The 409 papers I explore in the present study includes only one conference paper. Finally, as I note in the introduction, citation numbers involve inherent problems.

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<sup>22</sup> In any case, these are quite logical contexts to be analyzed in IS.

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**APPENDIX A: HIGHLY CITED IS PAPERS 1975-1999**

Author(s) and year	Paper title	Journal name, volume number, and issue number	Times cited
D.A. Adams, R. R. Nelson, & P. A. Todd (1992)	Perceived usefulness, ease of use, and usage of information technology—a replication	<i>MIS Quarterly</i> , 16(2)	616



R. Agarwal, R. & J. Prasad (1997)	The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies	<i>Decision Sciences</i> , 28(3)	302
R. Agarwal, R. & J. Prasad (1998)	A conceptual and operational definition of personal innovativeness in the domain of information technology	<i>Information Systems Research</i> , 9(2)	379
R. Agarwal, R. & J. Prasad (1999)	Are individual differences germane to the acceptance of new information technologies?	<i>Decision Sciences</i> , 30(2)	393
M. K. Ahuja & K. M. Carley (1999)	Network structure in virtual organizations	<i>Organization Science</i> , 10(6)	120
M. Alavi (1984)	Assessment of the prototyping approach to information systems development	<i>Communications of the ACM</i> , 27(6)	119
M. Alavi (1994)	Computer-mediated collaborative learning—an empirical evaluation	<i>MIS Quarterly</i> , 18(2)	221
M. Alavi, J. A. Joachimsthaler (1992)	Revisiting DSS implementation research—a meta-analysis of the literature and suggestions for researchers	<i>MIS Quarterly</i> , 16(1)	114
M. Alavi, B. C. Wheeler, & J. S. Valacich (1995)	Using IT to reengineer business education—an exploratory investigation of collaborative telelearning	<i>MIS Quarterly</i> , 19(3)	114
V. Anand, C. C. Manz, & W. H. Glick (1998)	An organizational memory approach: To information management	<i>Academy of Management Review</i> , 23(4)	124
S. Ang & L. L. Cummings (1997)	Strategic response to institutional influences on information systems outsourcing	<i>Organization Science</i> , 8(3)	123
S. Ang & W. W. Straub (1998)	Production and transaction economies and IS outsourcing: A study of the US banking industry	<i>MIS Quarterly</i> , 22(4)	172
C. P. Armstrong & V. Sambamurthy (1999)	Information technology assimilation in firms: The influence of senior leadership and IT infrastructures	<i>Information Systems Research</i> , 10(4)	214
A. Artale, E. Franconi, N. Guarino, & L. Pazzi (1996)	Part-whole relations in object-centered systems: An overview	<i>Data &amp; Knowledge Engineering</i> , 20(3)	103
D. Avison, F. Lau, M. Myers, & P. A. Nielsen (1999)	Action research	<i>Communications of the ACM</i> , 42(1)	246
J. E. Bailey & S. W. Pearson (1983)	Development of a tool for measuring and analyzing computer user satisfaction	<i>Management Science</i> , 29(5)	623
J. Y. Bakos (1991)	A strategic analysis of electronic marketplaces	<i>MIS Quarterly</i> , 15(3)	275
J. Y. Bakos (1997)	Reducing buyer search costs: Implications for electronic marketplaces	<i>Management Science</i> , 43(12)	443
J. Y. Bakos (1998)	The emerging role of electronic marketplaces on the Internet	<i>Communications of the ACM</i> , 41(8)	326
J. Y. Bakos & E. Brynjolfsson (1999)	Bundling information goods: Pricing, profits, and efficiency	<i>Management Science</i> , 45(12)	224
J. Y. Bakos & M. E. Treacy (1986)	Information technology and corporate strategy—a research perspective	<i>MIS Quarterly</i> , 10(2)	147
H. Barki & J. Hartwick (1989)	Rethinking the concept of user involvement	<i>MIS Quarterly</i> , 13(1)	152
H. Barki & J. Hartwick (1994)	Measuring user participation, user involvement, and user attitude	<i>MIS Quarterly</i> , 18(1)	218
J. J. Baroudi, M. H. Olson, & B. Ives (1987)	An empirical study of the impact of user involvement on system usage and information satisfaction	<i>Communications of the ACM</i> , 29(3)	259
A. Barua, C. H. Kriebel, & T. Mukhopadhyay (1995)	Information technologies and business value—an analytic and empirical investigation	<i>Information Systems Research</i> , 6(1)	308
R. L. Baskerville & A. T. Wood-Harper (1996)	A critical perspective on action research as a method for information systems research	<i>Journal of Information Technology</i> , 11(3)	198

R. L. Baskerville & A. T. Wood-Harper (1998)	Diversity in information systems action research methods	<i>European Journal of Information Systems</i> , 7(2)	144
D. Batra, J. A. Hoffer, & R. P. Bostrom (1999)	Comparing representations with relational and EER models	<i>Communications of the ACM</i> , 33(2)	113
C. M. Beath (1991)	Supporting the information technology champion	<i>MIS Quarterly</i> , 15(3)	114
M. Benaroch & R. J. Kauffman (1999)	A case for using real options pricing analysis to evaluate information technology project investments	<i>Information Systems Research</i> , 10(1)	143
I Benbasat, D. K. Goldstein, & M. Mead (1987)	The case research strategy in studies of information systems	<i>MIS Quarterly</i> , 11(3)	638
I. Benbasat & L. H. Lim (1993)	The effects of group, task, context, and technology variables on the usefulness of group support systems—a meta-analysis of experimental studies	<i>Small Group Research</i> , 24(4)	128
I. Benbasat & R. W. Zmud (1999)	Empirical research in information systems: The practice of relevance	<i>MIS Quarterly</i> , 23(1)	227
R. I. Benjamin & R. Wigand (1995)	Electronic markets and virtual value chains on the information superhighway	<i>Sloan Management Review</i> ,	205
M. Bensaou (1997)	Interorganizational cooperation: The role of information technology—an empirical comparison of US and Japanese supplier relations	<i>Information Systems Research</i> , 8(2)	100
O. Berthon, L. F. Pitt, & R. T. Watson (1996)	The World Wide Web as an advertising medium: Toward an understanding of conversion efficiency	<i>Journal of Advertising Research</i> , 36(1)	116
A. S. Bharadwaj, S. G. Bharadwaj, & B. R. Konsynski (1999)	Information technology effects on firm performance as measured by Tobin's q	<i>Management Science</i> , 45(7)	212
P. Bingi, M. K. Sharma, & J. K. Godla (1999)	Critical issues affecting an ERP implementation	<i>Information Systems Management</i> , 16(3)	240
R. J. Boland & R. V. Tenkasi (1995)	Perspective making and perspective-taking in communities of knowing	<i>Organization Science</i> , 6(4)	433
R. J. Boland, R. V. Tenkasi, & D. Te'eni (1994)	Designing information technology to support distributed cognition	<i>Organization Science</i> , 5(3)	128
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W. M. P. Van der Aalst (1999)	Formalization and verification of event-driven process chains	<i>Information and Software Technology</i> , 41(10)	142
W. M. P. Van der Aalst (1997)	Verification of Workflow nets	<i>Book Series: Lecture Notes in Computer Science</i> , 1248	213
T. P. VanDyke, L. A. Kappelman, V. R. Prybutok (1997)	Measuring information systems service quality: Concerns on the use of the SERVQUAL questionnaire	<i>MIS Quarterly</i> , 21(2)	108
V. Venkatesh (1999)	Creation of favorable user perceptions: Exploring the role of intrinsic motivation	<i>MIS Quarterly</i> , 23(2)	312
V. Venkatesh & F. D. Davis (1996)	A model of the antecedents of perceived ease of use: Development and test	<i>Decision Sciences</i> , 27(3)	536
N. Venkatraman (1994)	IT-enabled business transformation—from automation to business scope redefinition	<i>Sloan Management Review</i> , 32(2)	221
N. Venkatraman & J. C. Henderson (1998)	Real strategies for virtual organizing	<i>Sloan Management Review</i> , 40(1)	102
I. Vessey (1991)	Cognitive fit—a theory-based analysis of the graphs versus tables literature	<i>Decision Sciences</i> , 22(2)	266
J. Walls, G. R. Widmeyer, & O. A. El Sawy (1992)	Building an information system design theory for vigilant EIS	<i>Information Systems Research</i> , 3(1)	238
G. Walsham (1995a)	Interpretive case studies in is research—nature and method	<i>European Journal of Information Systems</i> , 4(2)	468
G. Walsham (1995b)	The emergence of interpretivism in IS research	<i>Information Systems Research</i> , 6(4)	190
G. Walsham & S. Sahay	GIS for district-level administration in India: Problems and opportunities	<i>MIS Quarterly</i> , 23(1)	134
Y. Wand, V. Storey, & R. Weber	An ontological analysis of the relationship construct in conceptual modeling	<i>ACM Transactions on Database Systems</i> , 24(4)	128
Y. Wand & R. Y. Wang (1996)	Anchoring data quality dimensions in ontological foundations	<i>Communications of the ACM</i> , 39(11)	189



Y. Wand & R. Weber (1990)	An ontological model of an information system	<i>IEEE Transactions on Software Engineering</i> , 16(11)	135
Y. Wand & R. Weber (1995)	On the deep-structure of information systems	<i>Information Systems Journal</i> , 5(3)	130
R. Y. Wang (1998)	A product perspective on total data quality management	<i>Communications of the ACM</i> , 41(2)	112
R. Y. Wang, V. C. Storey, C. P. Firth (1995)	A framework for analysis of data quality research	<i>IEEE Transactions on Knowledge and Data Engineering</i> , 7(4)	118
M. E. Warkentin, L. Sayeed, & R. Hightower (1997)	Virtual teams versus face-to-face teams: An exploratory study of a Web-based conference system	<i>Decision Sciences</i> , 28(4)	148
R. T. Watson, G. DeSanctis, & M. S. Poole (1988)	Using a GDSS to facilitate group consensus—some intended and unintended consequences	<i>MIS Quarterly</i> , 12(3)	144
J. Webster & P. Hackley (1997)	Teaching effectiveness in technology-mediated distance learning	<i>Academy of Management Journal</i> , 40(6)	141
J. Webster & J. J. Martocchio (1992)	Microcomputer playfulness—development of a measure with workplace implications	<i>MIS Quarterly</i> , 16(2)	300
J. Webster & L. K. Trevino (1995)	Rational and social theories as complementary explanations of communication media choices: Two policy-capturing studies	<i>Academy of Management Journal</i> , 38(6)	131
J. Webster, L. K. Trevino, & L. Ryan (1994)	The dimensionality and correlates of flow in human-computer interactions	<i>Computers in Human Behavior</i> , 9(4)	231
K. Weidenhaupt, K. Pohl, M. Jarke, & P. Haumer (1998)	Scenarios in system development: Current practice	<i>IEEE Software</i> , 15(2)	101
P. Weill (1992)	The relationship between investment in information technology and firm performance: A study of the valve manufacturing sector	<i>Information Systems Research</i> , 3(4)	279
S. P. Weisband, S. K. Schneider, T. Connolly (1995)	Computer-mediated communication and social information—status salience and status differences	<i>Academy of Management Journal</i> , 38(4)	118
R. Williams & D. Edge (1996)	The social shaping of technology	<i>Research Policy</i> , 25(6)	171
R. L. Wilson & R. Sharda (1994)	Bankruptcy prediction using neural networks	<i>Decision Support Systems</i> , 11(5)	194
J. Yates & W. J. Orlikowski (1992)	Genres of organizational communication—a structural approach to studying communication and media	<i>Academy of Management Review</i> , 17(2)	254
C. Young-Ybarra & M. Wiersema (1999)	Strategic flexibility in information technology alliances: The influence of transaction cost economics and social exchange theory	<i>Organization Science</i> , 10(4)	154
J. A. Zachman (1987)	A framework for information systems architecture	<i>IBM Systems Journal</i> , 26(3)	366
M. H. Zack (1999a)	Developing a knowledge strategy	<i>California Management Review</i> , 41(3)	392
M. H. Zack (1999b)	Managing codified knowledge	<i>Sloan Management Review</i> , 40(4)	313
A. Zaheer & N. Venkatraman (1994)	Determinants of electronic integration in the insurance industry—an empirical test	<i>Management Science</i> , 40(5)	109
I. Zigurs & B. K. Buckland (1998)	A theory of task/technology fit and group support systems effectiveness	<i>MIS Quarterly</i> , 22(3)	236
I. Zigurs, M. S. Poole, & G. L. DeSanctis (1998)	A study of influence in computer-mediated group decision-making	<i>MIS Quarterly</i> , 12(4)	135
R. W. Zmud (1979)	Individual differences and MIS success—review of the empirical literature	<i>Management Science</i> , 25(10)	298

R. W. Zmud (1982)	Diffusion of modern software practices—influence of centralization and formalization	<i>Management Science</i> , 28(12)	176
R. W. Zmud (1984)	An examination of push-pull theory applied to process innovation in knowledge work	<i>Management Science</i> , 30(6)	190

**APPENDIX B: COMPARISON OF CODING WITH SIDOROVA ET AL. (2008)**

This comparison involves 26 papers that appear in the five-factor solution (Sidorova et al. 2008, Appendix A, Table A2) and/or in the 13-factor solution (Sidorova et al. 2008, Appendix B, Table B2) and that are common papers in Sidorova (2008) and in the present study.

I conducted the comparison after coding the material in Tables 3-8. However, it led to a few changes in this coding. First, the comparison highlighted the omission of Moore and Benbasat (1991), which is not listed in the publications of either author in Web of Science, but requires a “cited reference search”. Second, as a result of the comparison, I coded Pitt et al. (1995) to belong, not only to the category “IT management”, but also to the category “IT/individual interaction”. Finally, I corrected the coding of Iacovou et al. (1995) to belong, not to the “diffusion” subcategory of IS implementation, but to the “adoption” subcategory.

As Table B-1 indicates, the coding of the 13 papers is clearly consistent with the factors that Sidorova (2008) identify. These cases are indicated by an asterisk (\*). Sidorova’s 13-factor solution distinguishes “IS adoption and use” and “IT use by individuals”. Most of the papers belonging to the first factor represent TAM research (e.g., Davis (1989)) and, therefore, actually address IT/individual interaction. Table B-1 includes five such instances, indicated by a double asterisk (\*\*). Furthermore, the 13-factor solution in Sidorova (2008) identifies “measurement instruments” as a separate factor. This would have been possible in the present work, too, but I decided code the papers based on the nature of the relationship the developed instrument attempted to measure. Two of the papers representing “measurement instruments” measure individual satisfaction with an information system (end user computing), and a third one measures satisfaction with the IT department. The former two are coded to address IT/individual interaction, and the third one also addresses IT management. These three cases are indicated by a triple asterisk (\*\*\*) .

Thus, there are five papers with potentially deeper contradictions in coding. Although Straub (1989) belongs to the factor “measurement instruments” in Sidorova et al. (2008), it does not propose new measurement instruments; instead, it discusses the validation of measurement instruments. Therefore, I coded it into the “IS meta-research” category.

I interpret the main contributions of Orlikowski (1996) and Robey and Bourdeau (1999) to lie in IT/organization interaction, even though these papers include reviews of past research (as do almost all papers) and propose guidelines for future research (as do most papers). I also coded Dos Santos et al. (1993) into IT/organization interaction, even though they belong to “value of IT” in Sidorova et al.’s (2008) 13-factor solution (since the value being measured is the market value of the firm).

Finally, Compeau and Higgins (1995a) belong to the factor “IT use by individuals” in Sidorova et al.’s (2008) 13-factor solution. Actually, Compeau and Higgins (1995a) explains not IT use, but the training of computer skills. Based on the paper’s abstract, it is not clear whether this training experiment includes any use of IT and, thus, whether it could be regarded as a CMEL (computer-mediated education and learning) piece of work. Since the paper would have required its own category, I decided to code it in the category “other”.

**Table B-1: Coding in Sidorova (2008) and in the Present Study**

Paper	Sidorova et al. (2008)		The present study
	5-factor solution	13-factor solution	
Bakos, J. Y. (1991). A strategic analysis of electronic marketplaces. <i>MIS Quarterly</i> , 15(3), 295-310.	IT and markets	IT and markets	IT/market interaction (Table 6)*
Brancheau, J. C., & Wetherbe, J. C. (1987). Key issues in information systems management. <i>MIS Quarterly</i> , 11(1), 23-45.		IS management	IT management (Table 5)*
Choudhury, V., Hartzel, K. S., & Konsynski, B. R. (1998). Uses and consequences of electronic markets: An empirical investigation in the aircraft parts industry. <i>MIS Quarterly</i> , 22(4), 471-507.	IT and markets	IT and markets	IT/market interaction (Table 8)*
Compeau, D. R., & Higgins, C. A. (1995a). Application of social cognitive theory to training for computer skills. <i>Information Systems Research</i> , 6(2), 118-143.		IT use by individuals	Other (Table 7)



Compeau, D. R., & Higgins, C. A. (1995b). Computer self-efficacy—development of a measure and initial test. <i>MIS Quarterly</i> , 19(2), 189-211.		IT use by individuals	IT/individual interaction (Table 7)*
Compeau, D. R., & Higgins, C. A., & Huff, S. (1999). Social cognitive theory and individual reactions to computing technology: A longitudinal study. <i>MIS Quarterly</i> , 23(2), 145-158.		IT use by individuals	IT/individual interaction (Table 8)*
Davis, F.D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. <i>MIS Quarterly</i> , 13(3), 319-340.	IT and individuals	IT adoption and use	IT/individual interaction (Table 5)**
Dennis, A.R. (1996). Information exchange and use in group decision making: You can lead a group to information, but you can't make it think. <i>MIS Quarterly</i> , 20(4), 433-455.		IT for group support	IT/group interaction – GW (Table 7)*
Doll, W. J., & Torkzadeh, G. (1988). The measurement of end-user computing satisfaction. <i>MIS Quarterly</i> , 12(2), 259-274.	IT and individuals	Measurement instruments	IT/individual interaction (Table 5)***
Doll, W. J., Xia, W. D., & Torkzadeh, G. (1994). A confirmatory factor-analysis of the end-user computing satisfaction instrument, <i>MIS Quarterly</i> , 18(4), 453-461.		Measurement instruments	IT/individual interaction (Table 7)***
Dos Santos, B. L., Peffer, K., & Mauer, D. C. (1993). The impact of information technology investment announcements on the market value of the firm, <i>Information Systems Research</i> , 4(1), 1-23.		Value of IT	IT/organization interaction (Table 6)
Igbaria, M., Zinatelli, N., Cragg, P., & Cavaye, A. L. M. (1997). Personal computing acceptance factors in small firms: A structural equation model, <i>MIS Quarterly</i> , 21(3), 279-305.	IT and individuals	IT adoption and use	IT/individual interaction (Table 8)**
Iacovou, C. L., Benbasat, I., & Dexter, A. S. (1995). Electronic data interchange and small organizations: Adoption and impact of technology, <i>MIS Quarterly</i> , 19(4), 465-485.		IT adoption and use	IT development (adoption) -IOS/EDI (Table 7)*
Jarvenpaa, S. L., & Ives, B. (1991). Executive involvement and participation in the management of information technology. <i>MIS Quarterly</i> , 15(2), 205-227.		IS management	IT management (Table 6)*
Johnston, H.R. & Carrico, S.R. (1988). Developing capabilities to use information strategically. <i>MIS Quarterly</i> , 12(1), 37-48.	IT and organizations		IT/organization interaction - competitive advantage (Table 8)*
Karahanna, E., Straub, D.W. & Chervany, N.L. (1999). Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs. <i>MIS Quarterly</i> , 23(2), 183-213.		IT adoption and use	IT/individual interaction (Table 8)**
Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. <i>Information Systems Research</i> , 2(3), 192-222.		IT adoption and use	IT/individual interaction (Table 6)**
Nunamaker, J. F., Chen, M. & Purdin, T.D.M. (1990-1991). System development in information systems research. <i>Journal of MIS</i> , 7(3), 99-106.		IS discipline development	IS meta-research (Table 5)*
Orlikowski, W.J. (1996). Improvising organizational transformation over time: a situated change perspective. <i>Information Systems Research</i> , 7(1), 63-92.		IS discipline development	IT/organization interaction (Table 7)
Pitt, L. F., Watson, R. T., & Kavan, C. B. (1995). Service quality—a measure of information systems effectiveness, <i>MIS Quarterly</i> , 19(2), 173-187		Measurement instruments	IT management, IT/individual interaction (Table 7)***
Robey, D., & Boudreau, M. C. (1999). Accounting for the contradictory organizational consequences of information technology: Theoretical directions and methodological implications. <i>Information Systems Research</i> , 10(2), 167-185.		IS discipline development	IT/organization interaction (Table 8)
Straub D. W. (1989). Validating instruments in MIS research. <i>MIS Quarterly</i> , 13(2), 147-169.		Measurement instruments	IS meta-research (Table 5)
Taylor, S., & Todd, P. A. (1995). Understanding information technology usage—a test of competing models, <i>Information Systems Research</i> , 6(2), 144-176.		IT adoption and use	IT/individual interaction (Table 7)**

Todd, P., & Benbasat, I. (1992). The use of information in decision-making—an experimental investigation of the impact of computer-based decision aids. <i>MIS Quarterly</i> , 16(3), 373-393.		Decision support systems	IT/individual interaction – DSS (Table 6)*
Webster, J., & Martocchio, J. J. (1992). Microcomputer playfulness - development of a measure with workplace implications. <i>MIS Quarterly</i> , 16(2), 201-226.		IT use by individuals	IT/individual interaction (Table 4)*
Zigurs, I., Poole, M. S., & DeSanctis, G. L. (1988). A study of influence in computer-mediated group decision-making. <i>MIS Quarterly</i> , 12(4), 625-644.		IT for group support	IT/group interaction – GW (Table 5)*

**APPENDIX C: TEN MOST CITED PAPERS IN THE SIX CORE RESEARCH AREAS**

**Table C-1: IS Meta-Research**

Author(s) and year	Paper title	Journal name, volume number, and issue number	Times cited
W. H. DeLone & E. R. McLean (1992)	Information systems success: the quest for the dependent variable	<i>Information Systems Research</i> , 3(1)	1722
H. K. Klein & M. D. Myers (1999)	A set of principles for conducting and evaluating interpretive field studies in information systems	<i>MIS Quarterly</i> , 23(1)	714
I. Benbasat, D. K. Goldstein, & M. Mead (1987)	The case research strategy in studies of information systems	<i>MIS Quarterly</i> , 11(3)	638
W. J. Orlikowski & J. J. Baroudi (1991)	Studying information technology in organizations	<i>Information Systems Research</i> , 2(1)	480
G. Walsham (1995)	Interpretive case studies in IS research—nature and method	<i>European Journal of Information Systems</i> , 4(2)	468
D. W. Straub (1989)	Validating instruments in MIS research	<i>MIS Quarterly</i> , 13(2)	464
M. L. Markus & D. Robey (1988)	Information technology and organizational change—causal structure in theory and research	<i>Management Science</i> , 34(5)	457
B. Ives & M. H. Olson (1984)	User involvement and MIS success—a review of research	<i>Management Science</i> , 30(5)	452
D. J. Thomas & P. M. Griffin (1996)	Coordinated supply chain management	<i>European Journal of Operational Research</i> , 94(1)	412
S. T. March & G. F. Smith (1995)	Design and natural science research on information technology	<i>Decision Support Systems</i> , 15	386

**Table C-2: IT Management**

Author(s) and year	Paper title	Journal name, volume number, and issue number	Times cited
J. A. Zachman (1987)	A framework for information systems architecture	<i>IBM Systems Journal</i> , 26(3)	366
J. C. Henderson & N. Venkatraman (1993)	Strategic alignment—leveraging information technology for transforming organizations	<i>IBM Systems Journal</i> , 32(1)	363
L. F. Pitt, R. T. Watson, & C. B. Kavan (1995)	Service quality—a measure of information systems effectiveness	<i>MIS Quarterly</i> , 19(2)	309
R. L. Nolan (1979)	Managing the crises in data-processing	<i>Harvard Business Review</i> , 57(2)	300
J. C. Brancheau & J. C. Wetherbe (1987)	Key issues in information systems management	<i>MIS Quarterly</i> , 11(1)	241
M. C. Lacity & L. P. Willcocks (1998)	An empirical investigation of information technology sourcing practices: Lessons from experience	<i>MIS Quarterly</i> , 22(3)	223
J. C. Brancheau, B. D. Janz, & J. C. Wetherbe (1994)	Key issues in information systems management: 1994-95 SIM Delphi results	<i>MIS Quarterly</i> , 20(2)	219

F. W. McFarlan (1981)	Portfolio approach to information systems	<i>Harvard Business Review</i> , 59(5)	202
D. F. Rockart, & L. S. Flannery (1983)	The management of end user computing	<i>Communications of the ACM</i> , 26(10)	202
A. H. Segars & V. Grover (1998)	Strategic information systems planning success: An investigation of the construct and its measurement	<i>MIS Quarterly</i> , 22(2)	201

**Table C-3: IS Development**

Author(s) and year	Paper title	Journal name, volume number, and issue number	Times cited
S. R. Chidamber & C. F. Kemerer (1994)	A metrics suite for object-oriented design	<i>IEEE Transactions on Software Engineering</i> , 20(6)	1078
R. B. Cooper & R. W. Zmud (1990)	Information technology implementation research — a technological diffusion approach	<i>Management Science</i> , 36(2)	588
T. H. Davenport, D. W. De Long, & M. C. Beers (1998)	Successful knowledge management projects	<i>Sloan Management Review</i> , 39(2)	571
M. L. Markus (1983)	Power, politics, and MIS implementation	<i>Communications of the ACM</i> , 26(6)	562
T. H. Davenport & J. E. Short (1990)	The new industrial engineering—information technology and business process redesign	<i>Sloan Management Review</i> , 31(4)	553
B. Ives & M. H. Olson (1984)	User involvement and MIS success—a review of research	<i>Management Science</i> , 30(5)	452
C. L. Iacovou, I. Benbasat, & A. S. Dexter (1995)	Electronic data interchange and small organizations: Adoption and impact of technology	<i>MIS Quarterly</i> , 19(4)	450
J. F. Rockart (1979)	Chief executives define their own data needs	<i>Harvard Business Review</i> , 57(2)	433
J. Hartwick & H. Barki (1994)	Explaining the role of user participation in information system use	<i>Management Science</i> , 40(4)	376
E. B. Swanson (1994)	Information systems innovation among organizations	<i>Management Science</i> , 40(9)	274

**Table C-4: IT/Individual Interaction**

Author(s) and year	Paper title	Journal name, volume number, and issue number	Times cited
F. D. Davis (1989)	Perceived usefulness, perceived ease of use, and user acceptance of information technology	<i>MIS Quarterly</i> , 13(3)	4278
F. D. Davis, R. P. Bagozzi, P. R. Warshaw (1989)	User acceptance of computer technology — a comparison of two theoretical models	<i>Management Science</i> , 35(8)	2744
G. C. Moore & I. Benbasat (1991)	Development of an instrument to measure the perceptions of adopting an information technology innovation	<i>Information Systems Research</i> , 2(3)	1350
S. Taylor & P. A. Todd (1995)	Understanding information technology usage — a test of competing models	<i>Information Systems Research</i> , 6(2)	1249
R. Kraut, M. Patterson, V. Lundmark, S. Kiesler, T. Mukopadhyay, & W. Scherlis (1998)	Internet paradox — A social technology that reduces social involvement and psychological well-being?	<i>American Psychologist</i> , 53(9)	990
D. R. Compeau & C. A. Higgins (1995)	Computer self-efficacy — development of a measure and initial test	<i>MIS Quarterly</i> , 19(2)	836
K. Mathieson (1991)	Predicting user intentions: Comparing the technology acceptance model with the theory of planned behavior	<i>Information Systems Research</i> , 2(3)	830

F. D. Davis, R. P. Bagozzi, P. Warshaw (1992)	Extrinsic and intrinsic motivation to use computers in the workplace	<i>Journal of Applied Social Psychology</i> , 22(14)	715
D. L. Goodhue & R. L. Thompson (1995)	Task-technology fit and individual performance	<i>MIS Quarterly</i> , 19(2)	670
E. Karahanna, D. W. Straub, & N. L. Chervany (1999)	Information technology adoption across time: A cross-sectional comparison of pre-adoption and post-adoption beliefs	<i>MIS Quarterly</i> , 23(2)	627

**Table C-5: IT/Group Interaction**

Author(s) and year	Paper title	Journal name, volume number, and issue number	Times cited
G. DeSanctis & M. S. Poole (1994)	Capturing the complexity in advanced technology use—adaptive structuration theory	<i>Organization Science</i> , 5(2)	792
S. Kiesler, J. Siegel, & T. W. McGuire (1984)	Social psychological aspects of computer-mediated communication	<i>American Psychologist</i> , 39(10)	726
G. DeSanctis & R. B. Gallupe (1987)	A foundation for the study of group decision support systems	<i>Management Science</i> , 33(5)	666
S. L. Jarvenpaa & D. E. Leidner (1999)	Communication and trust in global virtual teams	<i>Organization Science</i> , 10(6)	602
J. F. Nunamaker, A. R. Dennis, J. S. Valacich, D. R. Vogel, & J. F. George (1991)	Electronic meeting systems to support group work	<i>Communications of the ACM</i> , 34(7)	483
J. Siegel, V. Dubrovsky, S. Kiesler, & T. W. McGuire (1986)	Group processes in computer-mediated communication	<i>Organizational Behavior and Human Decision Processes</i> , 37(2)	433
C. A. Ellis, S. J. Gibbs, & G. L. Rein (1991)	Groupware—some issues and experiences	<i>Communications of the ACM</i> , 34(1)	381
G. P. Huber (1990)	A theory of the effects of advanced information technologies on organizational design, intelligence, and decision-making	<i>Academy of Management Review</i> , 15(1)	347
T. Connolly, L. M. Jessup, & J. S. Valacich (1990)	Effects of anonymity and evaluative tone on idea generation in computer-mediated groups	<i>Management Science</i> , 36(6)	264
A. R. Dennis, J. F. George, L. M. Jessup, J. F. Nunamaker, D. R. Vogel (1988)	Information technology to support electronic meetings	<i>MIS Quarterly</i> , 12(4)	262

**Table C-6: IT/Organization Interaction**

Author(s) and year	Paper title	Journal name, volume number, and issue number	Times cited
W. J. Orlikowski (1992)	The duality of technology—rethinking the concept of technology in organization	<i>Organization Science</i> , 3(3)	832
G. DeSanctis & M. S. Poole (1994)	Capturing the complexity in advanced technology use - adaptive structuration theory	<i>Organization Science</i> , 5(2)	792
L. Sproull & S. Kiesler (1986)	Reducing social context cues—Electronic mail in organizational communication	<i>Management Science</i> , 32(11)	663
T. H. Davenport (1998)	Putting the enterprise into the enterprise system	<i>Harvard Business Review</i> , 76(4)	573
M. L. Markus (1983)	Power, politics, and MIS implementation	<i>Communications of the ACM</i> , 26(6)	562
T. H. Davenport & J. E. Short (1990)	The new industrial engineering — information technology and business process redesign	<i>Sloan Management Review</i> , 31(4)	553

F. J. Mata, W. L. Fuerst, J. B. Barney (1995)	Information technology and sustained competitive advantage: A resource-based analysis	<i>MIS Quarterly</i> , 19(4)	501
T. C. Powell & A. Dent-Micallef (1997)	Information technology as competitive advantage: The role of human, business, and technology resources	<i>Strategic Management Journal</i> , 18(5)	487
E. Brynjolfsson & L. M. Hitt (1996)	Paradox lost? Firm-level evidence on the returns to information systems spending	<i>Management Science</i> , 42(4)	469
R. J. Boland & R. V. Tenkasi (1995)	Perspective making and perspective-taking in communities of knowing	<i>Organization Science</i> , 6(4)	433

## ABOUT THE AUTHOR

**Juhani Iivari** is Professor Emeritus at the Department of Information Processing Science, University of Oulu, Finland. During his career he has served as a professor at the University of Jyväskylä and at the University of Oulu. Before his retirement, he also worked for ten years as a part-time scientific head of INFWEST/INFORTE programs, which are joint efforts of a number of Finnish universities to support doctoral studies in IT. Juhani has also served in various editorial positions in IS journal, including *Communications of the Association for Information Systems*, *European Journal of Information Systems*, *Information Systems*, *Information Systems and e-Business Management*, *Information Technology and People*, *Journal of the Association for Information Systems*, *MIS Quarterly*, and *Scandinavian Journal of Information Systems*. His research has broadly focused on the theoretical foundations of information systems, IS development methods and approaches, organizational analysis, implementation and acceptance of information systems, and design science research in IS. He has published in journals such as *Communications of the ACM*, *Communications of the AIS*, *Data Base*, *European Journal of Information Systems*, *Information & Management*, *Information & Software Technology*, *Information Systems*, *Information Systems Journal*, *Information Systems Research*, *International Journal of Information Management*, *Journal of MIS*, *Journal of the AIS*, *MIS Quarterly*, and *Omega*.

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