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Evolution of Information Systems Research

Ting-Peng Liang
Chinese University of Hong Kong and National Sun Yat-Sen University

Deng-Neng Chen
National Sun Yat-Sen University

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Ting-Peng Liang
Chinese University of Hong Kong and National Sun Yat-sen University
tpliang@baf.msmail.cuhk.edu.hk
Deng-Neng Chen
National Sun Yat-sen University
Kaohsiung, Taiwan

Abstract

The field of information systems (IS) has evolved along with the development of information technology and applications over the past twenty years. It is important to understand how the research issues have evolved in the past and what are the driving force underlying the evolution. An excellent area for exploring these issues can be found in research articles published in IS-related journals. We surveyed 3841 papers published between 1980 and 2001 in eight major IS journals. The papers were categorized according to their research themes and the theories they adopted. We found an increase in human-related research and a decline in systems-related research. Two major trends are identified: one driven by system design issues (1980-1993) and the other driven by human factors and system applications (1993-2001). Two underlying forces behind the research have been new technology development and organizational needs. Our examination of the theories used in the published papers revealed a substantial increase in human-related theories such as the technology acceptance model (TAM) and social cognitive theory (SCT) but a lack of attention to such systems theories as media richness theory and task-technology fit (TTF).

Keywords

Information Systems Research, Information Systems Theory, Multidimensional Scaling

1. Introduction

The field of information systems (IS) has evolved along with the development of information technology and applications over the past twenty years. Even though IS research is often defined as an interdisciplinary field of study that stretches across computer science, management science, and organizational science (e.g., Swanson, 1984), the field has become more mature and demands to be a reference discipline for

other business areas (Baskerville and Myers 2002). Toward this end, many researchers have drawn attention to the evolution of research focus, diversity of research issues and methods, and theory development in information systems. A better understanding of its evolution allows us to identify the driving forces that underlie IS research and makes trends in future research more predictable.

To date the evolution of IS research has been examined from different perspectives. For example, Ein-Dor and Segev (1993) used attributes of information systems to identify two major paths of evolution: applied artificial intelligence and human interface. Benbasat & Weber (1996) and Robey (1996) found that IS research borrows many theories from other disciplines, which resulted in an increased diversity of theories and research methods and a need to build core IS theories.

Farhoomand and Drury (1999) survey the topics and research methods of the papers published in eight IS journals between 1985 and 1996 and find that (1) the survey method was the most popular mode of data collection, and (2) technical research topics, including IS development, IS management, and IS, had declined substantially. Claver, et al. (2000) report a similar finding in papers published in MIS Quarterly and Information & Management. Lee, et al. (1999), comparing articles published in academic and practitioner journals and finding significant differences, call for a distinction between rigorous and relevant research. A more recent article by Orlikowski and Iacono (2001) IS research identify five different views in the literature: the tool view, proxy view, ensemble view, computation view, and nominal view. They call for more studies in theorizing the IT artifact. All these works indicate that we need to have a better understanding of what has been done in the past and what our focus should be in the future.

In this study, we surveyed the topics and theories in 3841 papers published between 1980 and 2001 in eight major journals. Topics of the papers were classified using a three-level scheme. The first level had five areas (human-related, systems, technology and analysis models, management, and research methods and theories). The second level had 10 categories, and the third level covered 41 major issues. These data were analyzed to find the evolution of research interests. The relative popularity of IS theories was also investigated. Table 1 shows the distribution of sample papers.

2. Changes in Research Topics

The papers were coded by their research topics and adopted theories. A cluster analysis shows that the distribution of research topics can be grouped into four major clusters: Years 80-84, 85-91, 92-98, and 99-01, which happen to show four stages of evaluation, as shown in Figure 1.

Table 1. Paper Distribution

Journal	First issued	Collected periods	Paper count	Percentage
I&M	1977	1982~2001	914	23.8%
DSS	1985	1985~2001	685	17.8%
JMIS	1984	1984~2001	535	13.9%
MISQ	1977	1980~2001	512	13.3%
CACM	1960	1985~2001	499	13.0%
ISR	1990	1990~2001	233	6.1%
MS	1954	1981~2001	239	6.2%
Dec.Sci.	1977	1980~2001	224	5.8%
Total			3841	100%

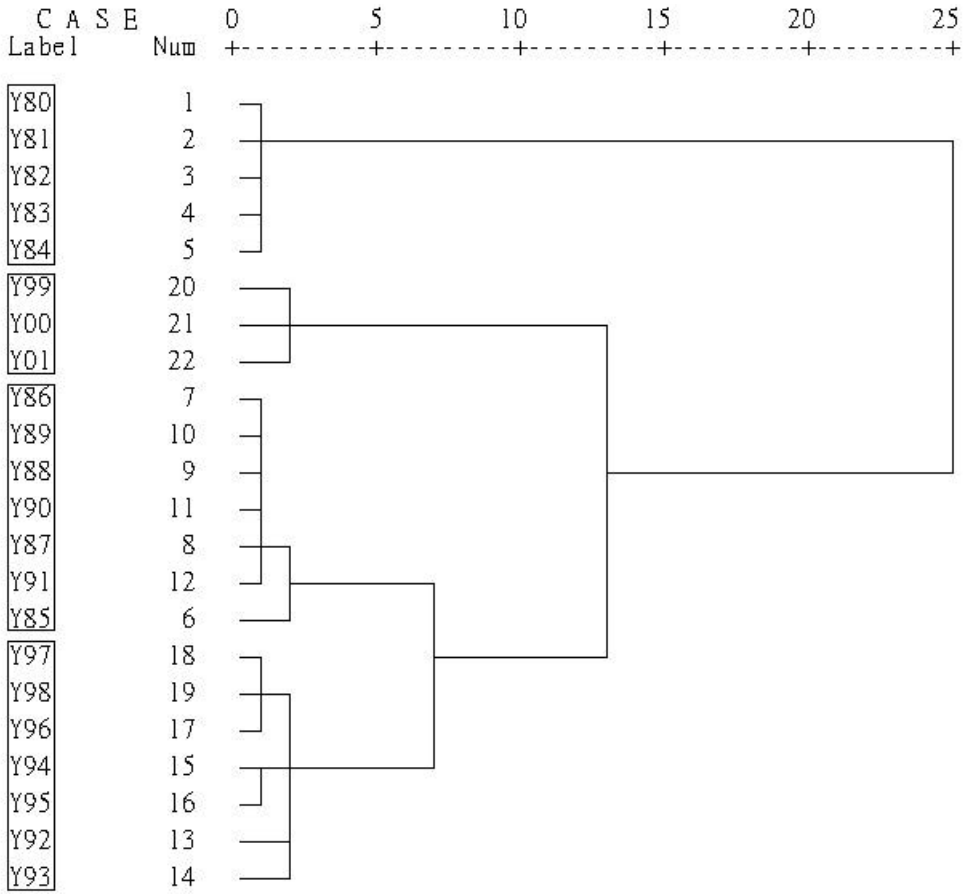


Figure 1. Hierarchical Cluster Analysis Results

If we compare the distribution of research topics at different stages in Table 2 and Figure 2, we can see clear trends, the most noticeable being that human-related issues in research are gaining momentum, whereas system design issues are losing. A Chi-square test shows statistically significant difference among these stages ($p<.001$).

Table 2. Distribution of research topics in different stages

	Human		System		Technology & Analysis Model		Management		Research Methodology and Theory	
	Paper counts	%	Paper counts	%	Paper counts	%	Paper counts	%	Paper counts	%
1980~1984	85	18.0%	231	49.0%	38	8.1%	65	13.8%	52	11.0%
1985~1991	398	17.2%	1027	44.4%	262	11.3%	414	17.9%	212	9.2%
1992~1998	740	20.9%	1358	38.4%	467	13.2%	595	16.8%	378	10.7%
1999~2001	531	26.6%	670	33.6%	283	14.2%	327	16.4%	186	9.3%

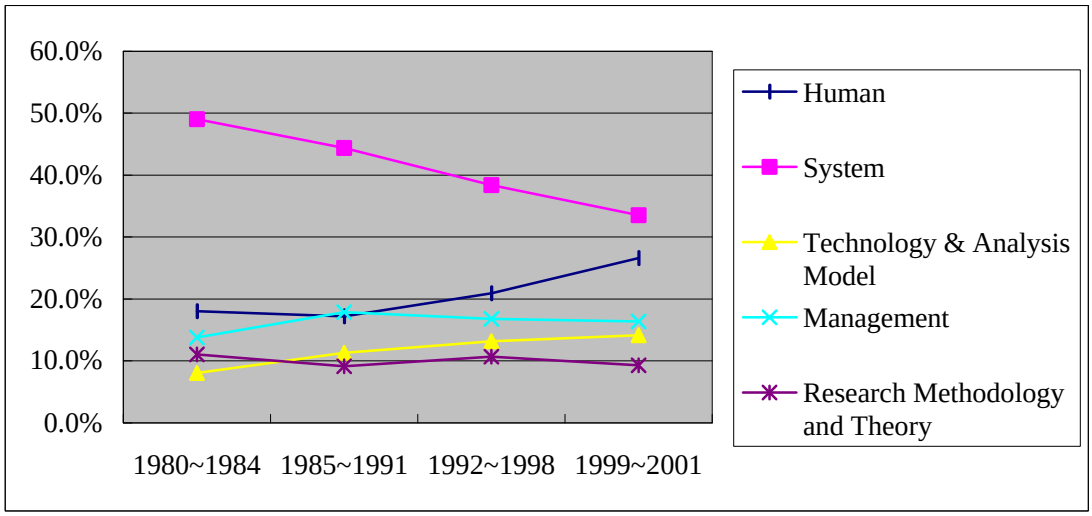
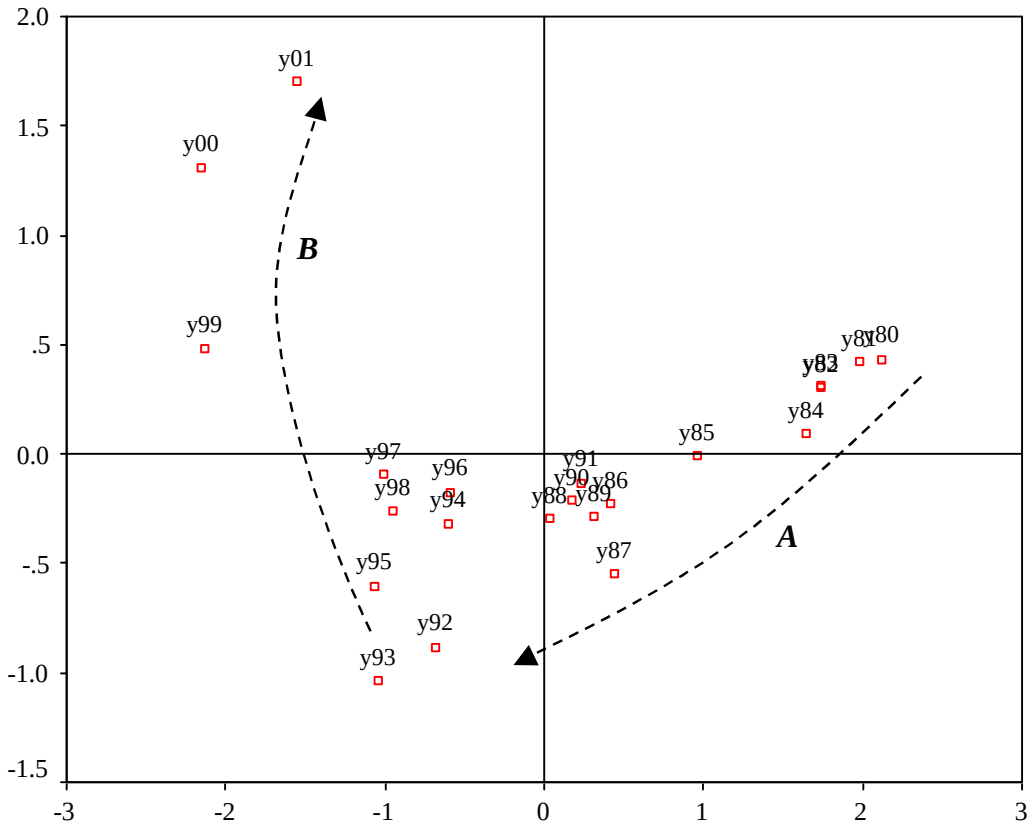


Figure 2. Trends in five research areas

We further used the multidimensional scaling method to explore the general trends in research topics. Multidimensional scaling is a statistical technique that projects high dimensional data into lower dimensions while trying to preserve distances or relationships among data items (Kruskal and Wish, 1978). The result, as shown in Figure 3, shows two clear trends. Trend A takes place from 1980 to 1991; Trend B from 1992 to 2001. The distance on the chart indicates the difference in research topics. For example, year 92 is closer to year 93 than year 87 in the chart, meaning that research topics in 1992 were more similar to those in 1993 than those in 1987.

In order to see the difference among research topics in these trends, we further compared their topics in the three beginning and three ending years. That is, we compared issues studied in 1980-1982 and 1989-1991 for Trend A and issues studied in 1992-1994, and 1999-2001 for Trend B at the level three to see which issues experienced the most gains and losses. The results are shown in Table 3.



Note: Symbol y80 stands for the year of 1980. The coefficient of stress is 0.075

Figure 3. Two major trends in IS evolution

Table 3. Major driving forces behind the trends.

Trend A			***Trend B***		
Rank	Themes	Diff.	Rank	Themes	Diff.
1	System Design Issues	+73	1	Applications in Industries or Functions	+109
2	DSS/ESS/EIS	+66	2	DSS/ESS/EIS	-64
3	Methodologies/Philosophy	+63	3	Technology Infrastructure	+60
4	Managerial Issues	+56	4	Theories	+53
5	IS Performance Evaluation	+55	5	Organizational Resource / Knowledge Management	+39
6	New Software Technologies	+41	6	Perception and Attitudes	+38
7	Intelligent Systems	+40	7	New Software Technologies	+37
8	Telecommunication Systems	+35	8	Methodologies/Philosophy	+34
9	Analytical Models and Tools	+33	9	Managerial Issues	+30
10	IS Strategic Planning	+33	10	Group Support	+29

In Trend A, major issues that gained popularity were related to system design, e.g. system design issues, DSS/ESS/EIS, and intelligent systems, a finding consistent with that of Ein-Dor and Segev (1993), who reported two major trends: applied artificial intelligence and user interface. In Trend B, however, major issues shifted to applications and technology infrastructure and away from DSS/ESS/EIS, which had a major drop in paper publication. There was also a substantial increase in interests in theories and human-related research. These findings indicate that the driving force behind IS research has changed from the design of good systems to the power of technology infrastructure and user-organization requirements.

With regard to the diversity of research topics that were discussed in Benbasat and Weber (1996) and Robey (1996), use the Simpson's index in ecological studies (Simpson, 1949) to measure the topic diversity and find, except for a slight downturn after 1999, an increase in topic diversity (Figure 4). A higher value indicates a higher level of diversity.

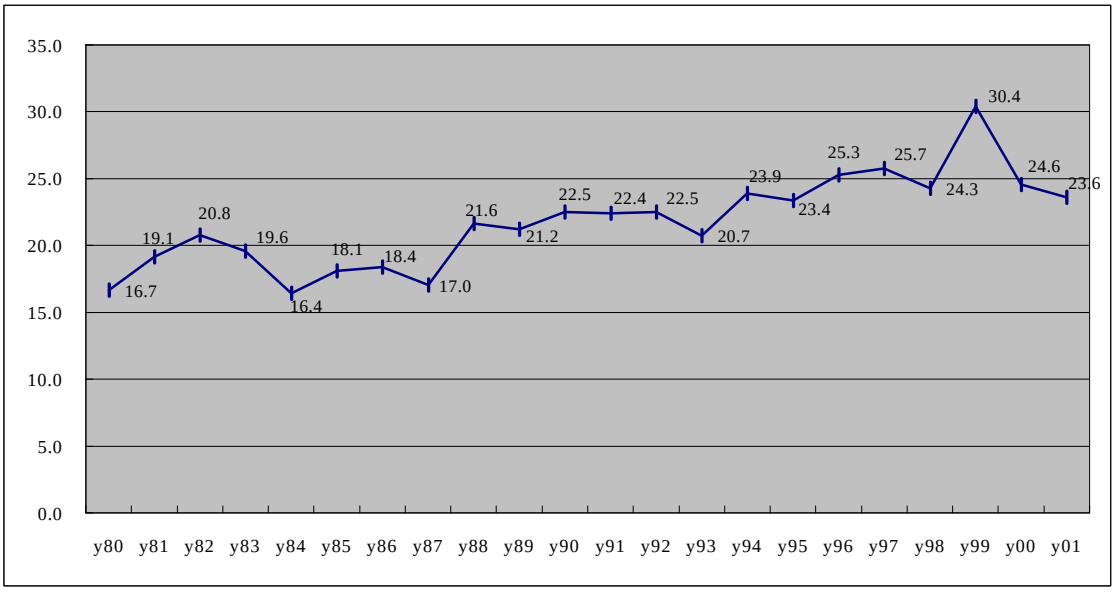


Figure 4. Trend in research diversity

3. Uses of Theories

The use of theories in IS research has also increased since 1993. Figure 5 shows the number of papers using ten major theories in different years. A total of 308 papers, less than 10%, had clear theoretical frameworks. The theories used in these papers can be classified according to their fields of origin. The transaction cost theory, diffusion theory, and network externality are economic theories. Media richness and task-technology fit (TTF), mostly related to the nature of the system, are considered system-related theories. The technology acceptance model (TAM) is

based on individual psychology. The remaining was either organizational and societal. The chart shows that human-related theories such as TAM and resource reliant theory were popular, whereas system-related theories such as media richness and TTF were less popular. Among all theories, the Technology Acceptance Model (TAM) was found to be the most popular. Of the 69 papers we found to use TAM, more than half had been published over the last five years. Most of the papers that used TAM treated IT as a blackbox without taking into account individual features of the system. Papers adopting TAM were found to have changed from user acceptance of IT (broad) in early 1990 to user acceptance of GSS and e-shops (narrow) in year 2002, with little incremental contribution to new knowledge.

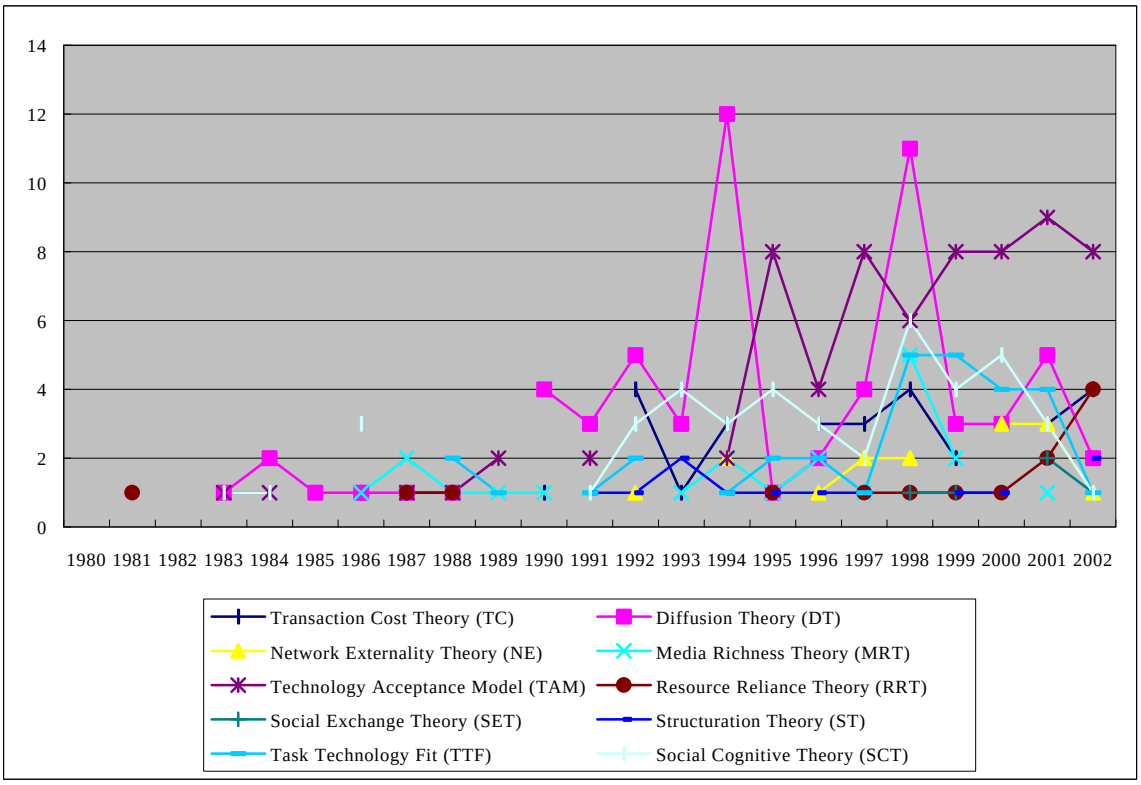


Figure 5. Frequency of theories in IS research

5. Conclusion

In our survey of 3841 papers published in eight major IS journals from 1980 to 2001, we identified two evolutionary trends in IS research. The driving force underlying the first trend from 1980 to 1991 was system design, including new systems such as DSS and EIS. The driving forces underlying the second trend after 1993 are technology infrastructure and demand for applications in organizations.

The change in focus took place between 1991-1993, a period in which the Internet was opened for commercial use. We also found an increase in research diversity before 1999 and a decline afterward. The use of theory in IS research has increased in recent years, particularly the use of TAM. This increased interest in TAM ran parallel to decreased research diversity. Of the 24 theory-based papers published in 2002, eight adopted TAM as a framework. We believe that this may be unhealthy and the field should examine the impact of concentrating on only a limited number of theories and whether such theories, e.g. TAM, can adequately represent the kind of core IS knowledge that can carry the whole discipline in the long run.

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