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RESEARCH ARTICLE

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Research in information systems in China (1999–2005) and international comparisons[1]

Abstract The purpose of this study is to review the research activities in information systems (IS) in the mainland of China. We reviewed and analyzed a total of 859 research papers in information systems published in 18 leading academic journals in business and management in the mainland from 1999 to 2005. Applying the content analysis method, we first categorized the papers by their reference disciplines, research topics, research methods, and the units of analysis. The data were then compared with the results of similar Western studies. Results show that, among the published IS research papers in the mainland of China, IS research itself represents the primary theoretical reference discipline; organizational and system/software issues are the main topics of the focus; non-empirical studies were the dominant research method; and the majority of studies were conducted at the organizational and/or system level. Compared with the West, IS research in China demonstrates its own characteristics in theoretical foundations, research focuses, and research methods, and there are a number of areas that need to be improved.

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[1] The original published paper was based on the data from 1999 to 2003. The current paper is based on the data from 1999 to 2005

Keywords information systems, content analysis, research topic, research method, units of analysis

1 Introduction

Compared with other disciplines in business and management, Information Systems (IS) has a relatively short history of less than four decades (Huang et al., 2003; Vessey et al., 2002). In China, IS education and research started even later than that of the developed countries. Not until the mid-1980s was the first undergraduate MIS program established in a few leading universities in the country (Hu, 1999). In 1998, the Ministry of Education of the People's Republic of China combined five IS-related specialties into one single specialty, named Information Management and Information Systems (IMIS) (Zha, 2003). The development of IS research and education in the country has been impressive, especially in the past five years. For example, in 2005, the China Association for Information Systems (CNAIS), the first professional IS organization, consisting mainly of academics from universities, was founded. An increasing number of researchers have chosen IS as their primary research field. As a result, more and more IS research papers have been published in various academic business and management journals in the country. Despite the rapid development, there is no academic journal dedicated to the IS field, and there is generally a lack of knowledge about the past and current situation of IS research activities.

This study sets out to examine IS research activities in China through a systematic review of the IS research papers published in the leading academic journals in the past seven years ranging from 1999 to 2005. By providing an overview of IS research in the mainland, we hope to make a proper assessment of what has been achieved in the past and what needs to be accomplished in the future. The review of existing literature is an important and necessary step for such a discipline as IS to develop and create new knowledge (Alavi and Carlson, 1992; Alavi et al., 1989; Webster and Watson, 2002). We hope this study will serve as a basis for discussions and debates among IS researchers in China so as to allow them to understand the past and direct their efforts in the most productive manner in the future. Furthermore, for researchers in regions other than the mainland of China, we hope to help them to know and understand by shedding some light on IS research activities in the country. We also hope to identify the similarities and differences between the research in the country and that in other regions of the world, and explain the causes of these differences. Finally, we hope the findings of the study will contribute to the ongoing discussion of what constitutes the discipline of IS, a debate that has developed over the past decade or so (Banville ans Landry, 1989; Benbasat and Weber, 1996; Vessey et al., 2002).

2 Literature review

Since the establishment of the first IS academic program at the University of Minnesota in the late 1960s, the IS discipline has gone through a period of steady and often rapid growth. The discipline itself has been engaging in extensive self-examination (Benbasat and Zmud, 1999; Cheon et al., 1993; Grover et al., 1993; Huang et al., 2003; Nolan and Wetherbe, 1980; Paul, 2002; Vessey et al., 2002). A number of IS research review papers have been published over the past few decades in leading IS academic journals such as *Communications of the AIS* (*CAIS*), *Communications of the ACM* (*CACM*), *Decision Sciences* (*DS*), *The European Journal of Information Systems* (*EJIS*), *Information and Management* (*I&M*), *Information Systems Journal, Information Systems Research* (*ISR*), *Journal of Management Information Systems* (*JMIS*), *Management Science* (*MS*), *and MIS Quarterly* (*MISQ*). For example, Ives et al. (1980) developed a framework of IS research and used it to classify 331 IS doctoral dissertations in terms of research categories and methods. Culnan (1986) did a co-citation analysis of the IS literature of a period of over 10 years (1972 to 1982) and identified IS subfields, IS research themes and IS reference disciplines. Culnan and Swanson (1986) reviewed the papers published from 1980 to 1984 and found that IS had emerged as an independent discipline. Banker and Kauffman (2004) reviewed the IS literature published in *Management Science* over the past half century and identified five research streams. They stated that their five streams "incorporate different definitions of the managerial problems that relate to IS, the alternate theoretical perspectives and different methodological paradigms to study them, and the levels of the organization at which their primary results impact managerial practice" (Banker and Kauffman, 2004:281). Vessey et al. (2002) developed a comprehensive framework to empirically analyze the "diversity" of the IS field. Their analysis was based on reference disciplines, research topics, research methods, and units of analysis. Other studies discussed other aspects of IS, such as the "intellectual structure of MIS" (Alavi and Carlson, 1992; Paul, 2002), research methods, rigor, and the relevancy of IS research (Applegate and King, 1999; Benbasat et al., 1987; Benbasat and Zmud, 1999; Cheon et al., 1993; Dubé and Paré, 2003; Farhoomand and Drury, 1999; Galliers and Land, 1987; Hamilton and Ives, 1982; Lee, 1999; Lee and Baskerville, 2003; Lyytinen, 1999; Mingers, 2001, 2003; Swanson and Ramiller, 1993), the evolution of IS (Farhoomand and Drury, 1999, 2001), and the research tradition (Alavi et al., 1989). Since a comprehensive review of the development of the IS discipline is beyond the scope of this study, we believe that the aforementioned literature represents a reasonable list of IS review papers to enable us to form our analytical framework. We have thus included the following categories in our

framework—reference disciplines, research topics, research methods, and units of analysis.

3 Method and procedure

3.1 Journal selection

Unlike other business and management disciplines such as accounting and management sciences, there is no research journal specializing in IS in the mainland of China. IS papers typically appear in academic journals such as those for business and management, system engineering and system sciences, and information sciences. We therefore examined 20 leading academic journals in business, management, and system sciences and system engineering. The 20 journals were included in the list recommended by the Division of Management Sciences of the National Natural Science Foundation of China (NSFC), a leading academic authority in the field of business and management in the country. Of the 20 journals, 16 of them were found to have published IS research papers between 1999 and 2005. In addition to the 16 journals, two more journals are included in our study due to their extensive coverage of IS research papers although they are not on the list suggested by the NSFC. The two added journals to our list are: *China Soft Science* and *the Journal of Science and Management of Science and Technology.* Thus, a total of 18 journals are included in the study.

Table 1 List of the journals included in the study

	Journal title
1	*Accounting Research*
2	*China Soft Science*
3	*Chinese Journal of Management Science*
4	*Control and Decision*
5	*Forecasting*
6	*Journal of Industrial Engineering and Engineering Management*
7	*Journal of Management Science in China*
8	*Journal of System Engineering*
9	*Journal of the China Society for Scientific and Technical Information*
10	*Management World*
11	*Nankai Business Review*
12	*Research and Development Management*
13	*The Journal of Science and Management of Science and Technology*
14	*Science Research Management*
15	*Studies of Science of Science*
16	*System Engineering*
17	*System Engineering Theory and Methodology Application*
18	*System Engineering Theory and Practice*

Table 1 shows a complete list of the journals. We should point out here that all of the papers reviewed were published in Chinese. We did not include IS research papers published by IS researchers from the mainland of China in non-Chinese journals due to the scope of this study.

3.2 Categorization system

To develop a solid foundation for our review, we first decided on a categorization system that would help us classify IS research from various perspectives and at the same time enable our results to be comparable to those of other similar studies. We decided to adopt a similar categorization to the one used by Vessey et al. (2002). Vessey et al. (2002) reviewed a total of 488 research papers published in five IS journals (DS, ISR, JMIS, MISQ, and MS) from 1995 to 1999. They categorized the papers by reference disciplines, research topics, research methods, and units of analysis. We believe their categorization is comprehensive and commonly accepted in the IS field.

3.3 Categorizing reference disciplines, research topics and units of analysis

For reference disciplines, we adopted a method similar to that used in Vessey et al. (2002). We included nine categories. They are: 1) cognitive psychology; 2) social and behavioral science; 3) computer science; 4) economics; 5) information systems; 6) management; 7) management science and engineering; 8) other; and 9) not applicable. For social and behavioral science, we included communications (e.g., media richness theory) and social psychology (e.g., theory of reasoned action) literature. For computer science, we included artificial intelligence and software engineering. Information systems itself has been included as one of the reference disciplines since an increasing number of IS researchers are citing previous IS studies as the source of their theories. For management, we included organizational theory and management theory. We identified the reference discipline on which a paper is based by examining the theories and papers that the authors used to formulate their models and hypotheses; in other words, we classified a paper as belonging to a particular reference discipline when it predominantly cited other papers from that discipline as the source of its own theories. The category 'other' means that "a paper relied on a reference discipline other than one of those defined, such as marketing" (Vessey et al., 2002: 137). The category 'not applicable' means that "a paper either relied on a number of reference disciplines, none of which was dominant, or it did not rely on a reference discipline" (Vessey et al., 2002: 137). For research topics, we included eight top-level categories, each of which was divided into several subcategories (see Appendix 1). The eight top-level topics are: 1) computer concepts; 2) systems/

software concepts; 3) data/information concepts; 4) problem domain specific concepts; 5) systems/software management concepts; 6) organizational concepts; 7) societal concepts; and 8) disciplinary issues. To ensure a list of topics sufficiently broad so as to include all areas of IS research (for example, behavioral, technical, and organizational), Vessey et al. (2002) used several topics from the general discipline of computing. At the same time, they especially expanded the category of organizational concepts. As stated, "Prior studies that classified IS research, for example often determined the primary topic of a paper by examining the abstract, title, and keywords. This approach, however, is error prone because authors frequently refer to several topics in their keyword list/ abstracts." (Vessey et al., 2002: 142) We adopted the same approach used by Vessey et al. (2002) for determining the topic addressed by the paper, namely, by examining the contents of the entire paper. For units of analysis, we used the ten levels outlined by Vessey et al. (2002). They are: 1) society; 2) profession; 3) inter-organizational context; 4) organizational context; 5) project; 6) group; 7) individual; 8) abstract concept; 9) system; and 10) computing element.

3.4 Categorizing research methods

Alavi and Carlson (1992) developed a framework for categorizing IS research methods. The framework was subsequently applied in several other studies, e.g., Claver et al. (2000). The framework divides research methods into two categories —empirical and non-empirical. The empirical methods generally rely on systematic observation, and are further divided into nine subgroups: 1) lab experiment; 2) field experiment; 3) field study; 4) case study; 5) survey; 6) development of instrument; 7) ex post facto descriptions; 8) secondary data; and 9) description of objectives. Non-empirical methods are "those primarily based on ideas, frameworks, and speculations rather than on systematic observations" (Alavi and Carlson, 1992: 48). These methods can be conceptual, illustrative, or applied concepts. Detailed descriptions of each method are shown in Table 2. Similar to the research topic, we identified the research method by reviewing the contents of the entire paper.

3.5 Coding procedure

We first used the information provided by *China Journals Full Text Database* (CJFD). CJFD is the most comprehensive database containing publications of major academic journals in China. It includes all the eighteen journals selected for the study. We used "information systems" as key words to search the full text. Since not every paper with "information systems" in its text falls into the IS field, we reviewed the abstract of each paper to determine if it should be considered an

Table 2 Research methods (adapted from Alavi and Carlson, 1992: 59–62)

Method	Detailed description
Empirical	
Lab experiment	Manipulation of independent variables; controls for intervening variables; conducted in controlled settings.
Field experiment	Same as laboratory experiment, but in the natural setting of the phenomenon under study.
Field study	No manipulation of independent variables; involving experimental design but no experimental controls; carried out in the natural setting of the phenomenon of interest.
Case study	Single Case: examining a single organization, group, or system in detail; involving no variable manipulation, experimental design or controls; exploratory in nature. Multiple Case Studies: similar to single case studies, but carried out in a small number of organizations or contexts.
Survey	Involving large numbers of observations; the research using an experimental design but no controls.
Development of IS instrument	Description of the development of instruments, measurements or classification schemes.
Ex post facto descriptions	A report of project results after the completion of the project (or partial completion).
Secondary data	Research using data from secondary sources, that is, data collected by sources other than the researcher.
Description of objectives	Description of a type or class of products, technologies, systems, projects, or description of a specific application system, product, installation, software model, program, company, IS function.
Non-empirical	
Conceptual orientation	Description of frameworks, models, or theories and offer of explanations and reasons.
Illustrative	Intending to guide practice, often containing recommendations for action or steps to be followed in given circumstances.
Applied concepts	Placing an approximately equal emphasis on conceptual and illustrative elements.

IS paper. In cases where the reviewers felt the abstract could not provide enough information, the entire paper was reviewed. Each paper we judged to fall into the IS field was downloaded and then double-reviewed.

4 Results

A total of 859 papers from the 18 journals published between 1999 and 2005 was identified and coded according to the procedures described above. The number of IS papers appearing in each of the 18 journals are shown in Table 3. As shown in the table, the number of papers varies considerably according to the journal. Not

Table 3 Number of IS papers in the leading journals in China (1999–2005)

Journals	No. of papers	Percentage	Cumulative percentage
Journal of the China Society for Scientific and Technical Information	191	22.2%	22.2%
System Engineering Theory and Practice	103	12.0%	34.2%
China Soft Science	72	8.4%	42.6%
Science of Science and Management of Science and Technology	72	8.4%	51.0%
Chinese Journal of Management Science	70	8.1%	59.1%
System Engineering	55	6.4%	65.5%
Journal of Industrial Engineering and Engineering Management	52	6.1%	71.6%
Journal of Management Science in China	43	5.0%	76.6%
Science Research Management	35	4.1%	80.7%
Control and Decision	31	3.6%	84.3%
Journal of System Engineering	28	3.3%	87.5%
Research and Development Management	21	2.4%	90.0%
System Engineering Theory Methodology Application	18	2.1%	92.1%
Nankai Business Review	18	2.1%	94.2%
Management World	18	2.1%	96.3%
Accounting Research	14	1.6%	97.9%
Forecasting	9	1.0%	99.0%
Studies of Science of Science	9	1.0%	100.0%
Total	859	100.0%	

surprisingly, leading the list, with 191 papers (22.2%), is the *Journal of the China Society for Scientific and Technical Information* (Journal of CSSTI) due to its longer history compared with IS. The Journal of CSSTI is the official publication of CSSTI which has a much longer history (since 1964) (see CSSTI's official website at http://www.cssti.org.cn/english/english_index.htm). The CSSTI consists of professionals primarily in the fields of information science and informatics. As shown in Table 4, the number of IS publications is skewed towards the top 5 journals with 59% of papers, while less than 8% of the papers were published in the bottom five journals. The data shows that an increasing number of IS research papers were published between 1999 and 2003, with a slight decline from 2003 to 2005 (see Table 4). While the exact reason(s) for the decrease in the number of IS papers published in these journals in 2004 and 2005 compared with the previous years is not clear, we speculate that it might be due to the swift development of disciplines in other business and management fields such as marketing and finance. The journals have limited "space" for the number of papers. The increase in other fields may have led to the slight decrease in the IS field.

Table 4 Number of IS papers by year (1999–2005)

	1999	2000	2001	2002	2003	2004	2005	Total
Number of papers	92	107	112	143	150	144	111	859
Percentage	10.7%	12.5%	13.0%	16.6%	17.5%	16.8%	12.9%	100.0%

4.1 Reference disciplines

Table 5 shows the results of the reference discipline criterion. The fourth column of the table shows the proportion of the papers in the Vessey et al. (2002) study for comparison. As shown, nearly 40% of the reviewed papers had used information systems as their principal reference discipline, followed by computer science with 18.5%, management with 13%, and management science with 11.6%. Three reference disciplines examined with less than 5% are economics (a total of 38 papers or 4.4%), social and behavioral science (a total of 3 papers or 0.3%), and cognitive psychology (a total of 1 paper or only 0.1%). As shown, the gap between our data in these three reference disciplines and Vessey et al.'s (2002) sample seems to be very large.

Table 5 Papers by reference disciplines (1999–2005)

Reference discipline	Frequency	Percentage	Vessey et al.'s (2002) study
Information systems	341	39.7%	27.2%
Computer science	159	18.5%	8.8%
Management	112	13.0%	18.0%
Management science	100	11.6%	6.6%
Other	62	7.2%	3.7%
Not applicable	43	5.0%	4.9%
Economics	38	4.4%	11.1%
Social and behavioral science	3	0.3%	9.0%
Cognitive psychology	1	0.1%	10.7%
Total	859	100.0%	100.0%

The results show that there is no one single reference discipline. Many IS researchers in China were trained originally in other disciplines, particularly in systems engineering and information and library science. As a result, they usually borrow and learn from the theoretical foundations, formal methods, and examples of good researches in multiple reference disciplines. Multiple reference disciplines contribute greatly to the intellectual development of IS and the body of its knowledge (Robey, 1996). Compared with Vessey et al.'s (2002) findings, information systems, computer science, management and management science are the major contributing disciplines in China (82.8% vs. 60.6%). In contrast,

cognitive psychology and social and behavioral science, which were frequently presented in Vessey et al.'s (2002) study, were rarely found in our samples.

4.2 Research topics

The results for the heading 'research topics' are shown in Table 6. The fourth column is the proportion of the topics found in Vessey et al.'s (2002) study. As shown, 79% of the papers fall into the following three categories: organizational concepts (43.2%), systems/software concepts (26.2%), and problem domain specific concepts (9.5%). In Vessey et al.'s (2002) study, these three topics are also the top three. But organizational topics have a higher proportion (65.6%), while systems/software is lower, accounting for 7.4%. Our data shows that 3 papers (0.3%) under the topic of "computer concepts" in the time frame are examined as compared with 0 papers in Vessey et al.'s (2002) sample.

Table 6 Papers by general topic (1999–2005)

General topics	Frequency	Percentage	Vessey et al.'s (2002) study
Organizational concepts	371	43.2%	65.6%
Systems/software concepts	225	26.2%	7.4%
Problem domain specific concepts	82	9.5%	11.1%
Data/information concepts	74	8.6%	3.1%
Systems/software management concept	57	6.6%	7.0%
Disciplinary issues	25	2.9%	4.2%
Societal concepts	22	2.6%	1.6%
Computer concepts	3	0.3%	0.0%
Total	859	100.0%	100.0%

Organizational topics far outweighed other topics in both studies. This reflects, as many leading IS researchers have argued, the fact that there has been a general shift in IS research from technological to managerial and organizational issues (Benbasat et al., 1987). Because of the high concentration of topics in the category of organizational topics, we examined organizational topics in more detail (see Table 7). Among the 12 organizational sub-categories, the most popular topic is IT usage/operation (21%), followed by organizational alignment (20.5%), and organizational learning/knowledge management (16.7%). In all, they represent 58.2% of the papers under the category of organizational topics. The lesser-researched areas were organizational structure (2.4%), technology transfer (1.9%), legal/ethical/cultural/political implications (0.8%), and change management (0.3%). Compared with Vessey et al.'s (2002) study, IS researchers in China have done proportionally more researches on organizational alignment and knowledge management. But some topics, such as technology transfer, IT

Table 7 Papers by organizational topics (1999–2005)

Organizational topics	Frequency	Percentage	Vessey et al.'s (2002) study
IT usage/operation	78	21.0%	24.4%
Organizational alignment (including BPR)	76	20.5%	6.9%
Organizational learning /knowledge management	62	16.7%	4.4%
Strategy	39	10.5%	6.6%
IT Impact	35	9.4%	15.3%
IT implementation	25	6.7%	1.6%
Management of "computing" functions	21	5.7%	11.6%
Computing/information as a business	15	4.0%	0.0%
Organizational structure	9	2.4%	5.0%
Technology transfer (including innovation, acceptance, adoption, diffusion)	7	1.9%	19.4%
Legal/ethical/cultural/political implications	3	0.8%	3.4%
Change management	1	0.3%	1.6%
Total	371	100.0%	100.0%

impact and management of "computing" functions, have been less frequently researched.

4.3 Research methods

Table 8 lists the number and proportion of the research methodologies used in the papers reviewed. The last three columns show the proportion of empirical and non-empirical research methods used in the previous studies. As shown, the non-empirical method accounts for the majority of the studies with 83.2%. Only 16.8% of the papers are empirical. The data also shows that there has been a shift from non-empirical to empirical studies over time in the IS field in other studies and our data. This is consistent with Alavi and Carlson's (1992) finding that since the mid-1980s, research efforts went through a change from theoretical to empirical as the IS field matured (Alavi and Carlson, 1992). Since the IS field is relatively new in China, it will take time for more empirically-oriented papers to be published.

Table 8 Papers by research methods: empirical vs. non-empirical (1999–2005)

	Frequency	Percentage 1999–2005	Alavi & Carlson's (1992) study 1968–1988	Claver et al.'s (2000) study 1981–1997	Vessey et al.'s (2002) study 1995–1999
Empirical	144	16.8%	48.1%	68.7%	72.9%
Non-empirical	715	83.2%	51.9%	31.3%	27.1%
Total	859	100.0%	100.0%	100.0%	100.0%

Next, we examined the methods in detail. As shown in Table 9, the most popular method in our sample was illustrative (42.6%), followed by conceptual orientation (23.3%) and applied concepts (17.3%). The top three were all non-empirical based studies (over 83%). For empirical studies, the most popular one was the description of objectives (9%), followed by survey (3.3%), case study (2.2%), and secondary data (1.6%). Ex post facto description methods, lab experiments, and field studies were rarely used (with a total of 6 papers out of 859). Field experiment and the development of IS instruments were not present in our data. Compared to Alavi and Carlson's (1992) study, the major difference seems to exist in research methods. Our data shows that most studies did not employ empirical methods. Furthermore, we found only one study that used the field studies method in our sample. On the other hand, Alavi and Carlson (1992) found that field studies accounted for 16.1% of the methodology from 1968 to 1988 in North America. Moreover, in Vessey et al.'s (2002) study, the field study was found to be the most popular research method (26.8%) between 1995 and 1999.

Table 9 Papers by research methods: detailed methods (1999–2005)

Research method	Frequency	Percentage	Vessey et al.'s (2002) study
Illustrative	366	42.6%	31.8%
Conceptual orientation	200	23.3%	17.6%
Applied concepts	149	17.3%	2.4%
Description of objectives	77	9.0%	10.8%
Survey	28	3.3%	3.5%
Case study	19	2.2%	4.4%
Secondary data	14	1.6%	0.8%
Ex post facto descriptions	3	0.3%	2.0%
Lab experiment	2	0.2%	7.3%
Field study	1	0.1%	16.1%
Field experiment	0	0.0%	2.0%
Development of IS instrument	0	0.0%	1.3%
Total	859	100.0%	100.0%

4.4 Units of analysis

Table 10 presents the findings by units of analysis. The fourth column shows the proportion of each "unit of analysis" in Vessey et al.'s (2002) study. As shown, the most frequently analyzed unit in our sample is organizational context (32.6%), followed by system (28.9%) and society (11.2%). Group and individual were two units that were rarely used (each with less than 1%). Compared with Vessey et al.'s (2002) findings, our data shows that IS researchers in China conducted many more studies at the system level (28.9% vs. 7.2%). These findings are consistent with

the findings of reference disciplines. For example, because IS researchers in the country do not seem to engage in researches at group or individual levels, they do not need cognitive psychology as a reference discipline. Similarly, they seem to focus more on systems/software issues, and therefore did proportionally more researches at the system level.

Table 10 Papers by units of analysis (1999–2005)

Units of analysis	Frequency	Percentage	Vessey et al.'s (2002) study
Organizational context	280	32.6%	25.6%
System	248	28.9%	7.2%
Society	96	11.2%	3.1%
Computing element	87	10.1%	4.9%
Abstract concept	57	6.6%	8.8%
Project	33	3.8%	8.8%
Profession	29	3.4%	1.8%
Inter-organizational context	20	2.3%	5.1%
Individual	5	0.6%	23.8%
Group	4	0.5%	10.9%
Total	859	100.0%	100.0%

5 Discussion

Our objectives for the study are, through the review of the existing literature on IS research in the mainland of China, to understand the characteristics of IS research activities and to identify the similarities and differences in IS research between the mainland of China and the Western countries. We wish to identify the strengths and the weaknesses of IS researchers in the mainland, find the causes of the strengths and weaknesses, and propose solutions to the weaknesses. For referencedisciplines, our data leads us to conclude that, similar to other Western studies, IS research in China does not demonstrate a reliance on any single theory. Most young disciplines have the need to initially rely heavily on their reference disciplines before developing theories of their own. As pointed out by Farhoomand and Drury (1999: 20), "although reliance on reference disciplines helps shape the foundation of a new field of studies, by itself it is not a sign of maturity of the discipline… indeed, mature disciplines rely on specialized research publications rather than borrowing from other disciplines." However, for a young discipline, the initial use of existing theories from reference disciplines is inevitable (Vessey et al., 2002). This is the case in IS not only because of the training of IS researchers in various disciplines, but also because IS is an applied discipline similar to engineering. As shown in Table 5, information systems, computer science, management, and management science seem to contribute proportionally

more researches in China (82.8% in our sample as compared with 60.6% in Vessey et al.'s (2002) sample). This might be an indication that, in general, many IS researchers in the country are good at using economic or mathematical models, such as data-mining techniques and decision-making models, in research. Interestingly, similar results were found by another study conducted by Kim et al. (2005). According to their study, a higher percentage of papers relating to IS technology, system/software, and system analysis using computer simulation, computing elements such as algorithm, were published in the *Journal of MIS Research* (a leading IS research journal in Korea) compared with the international journals. Similar to Vessey et al.'s (2002) findings, our study shows that a significant amount of IS research used itself as the reference discipline (39.7%). Interestingly, our data shows that Information Systems itself forms proportionally more researches in China compared to the findings of other studies. However, this finding should be interpreted with caution. We do not think that, based on this, we can conclude that IS research in China is more mature than that in the West. Many IS studies in our sample did not use existing disciplines as references, which may be explained by the fact that the majority of the studies included in our sample were illustrative, conceptual, and applied concepts in nature (as shown in Table 9). For research topics, we found that IS research in China is clearly focused on organizational concepts (43.2%), system/software concepts (26.2%), problem domain specific concepts (9.5%), and data/information concepts (see Table 6). On the one hand, the great emphasis (compared with other studies) on system/software, problem domain specific concept, and data/information concept topics may be the result of an early development cycle of IS (Banville and Landry, 1989) in the country. For example, we had to include several engineering (systems and industrial)-oriented journals in our journal selection due to their extensive inclusions of IS research papers, i.e., *System Engineering Theory and Practice*, *System Engineering*, and the *Journal of Industrial Engineering and Engineering Management*. Many systems/software and data/information concept papers were published in these journals. In fact, many researchers in the mainland of China view information systems as an extension of systems and industrial engineering. The "general shift" from technical to organizational and managerial issues has not yet been completed. On the other hand, similar to research topics, this may indicate the strength of IS researchers in the mainland of China, i.e., their strong knowledge and skills in mathematical modeling, engineering, and science. For research methods, we found major differences between our sample and samples of other Western studies. The proportion of non-empirical studies among the papers we examined is extremely high compared with other Western studies (see Table 8). On the one hand, it strongly indicates that the IS field in the mainland is still a very young discipline due to the short history of IS education and research in China. As mentioned earlier, the IS discipline had not been established until the mid 1980s in universities in the country. In fact, the first formal MIS course was

introduced and taught by a visiting US professor in 1980 at the executive training program of the National Center for Industrial Science and Technology Management (at Dalian). This phenomenon is not unique to the mainland of China. In other Asia-Pacific countries where the IS history is relatively short, such as Korea, a similar result was found (Kim et al., 2005). In fact, evidence shows that even in the US, the percentage of empirical studies gradually increased over the years. For instance, it was found that the percentage of empirically-based IS research papers went from 50% to 75% in MISQ from the 1970s to 1990s (Farhoomand and Drury, 1999, 2001). On the one hand, this phenomenon may be the result of the interpretive research tradition in Chinese culture, the lack of formal training in research methods among the IS researchers, and journal editors' preferences in the mainland of China. As shown by some previous studies, culture, national or organizational, plays a role in the choice of research methods (Mingers, 2001, 2003). Individuals' formal training and education backgrounds might also influence their preference of research methods. Many researchers prefer to follow the methods commonly used in their disciplines. Business and management research and education, including IS, have a relatively short history in the mainland of China. Many researchers who work in business schools and in the IS field received their formal training, i.e., undergraduate and graduate education, in engineering. Furthermore, the lack of empirical studies may be the result of the lack of "supportive" research infrastructure. For example, it was reported that some leading university presidents in the country believe that Western researchers place too much emphasis on "empirically-based" studies, and that there is not enough value placed on "intuition" (Zhou and Zhan, 2004[2]). Finally, the lack of formal training in research methods of the IS researchers in China, particularly in behavioral and social science research methods, was due to the relatively short history of the country's opening to the outside world. Prior to the 1980s there was very little social science research, such as in behavioral science for example, in the country. As a result, many IS researchers in the mainland as well as their graduate students lack the formal and systematic training in the research methodology that is commonly used by IS researchers in the West. In addition, journal editors' lack of formal training in research methods may have prevented empirically-based papers from being published. Many editors of the top journals in the mainland of China also lack formal training and knowledge in the empirical study. They may not recognize or do not value empirical research papers. Similarly, in business and management graduate programs, many graduate students who conduct empirical studies tend to face more criticisms due to the lack of training of the committee members in research methods. Finally, besides the

[2] Zhou Lei and Liao Lei. Chinese university presidents challenge "doubtful spirit" (in Chinese). Retrieved on September 20, 2004 from http://news.xinhuanet.com/school/2004-08/10/content_1751976.htm.

lack of training in research methods, the IS researchers in the country generally face more challenges in terms of resources and research "environment" when attempting to conduct empirical studies. This is not only due to the lack of funding, but also due to the less desirable research "infrastructure" and less supportive "environment." For example, China does not have any existing company information database, or any well-established third-party (e.g., consulting companies) support, and the practitioners in industry do not cooperate. In the research community, there is a lack of well-developed research tools, such as measurement instruments, for IS researchers to conduct empirical studies. Non-empirical studies, as indicated by Alavi and Carlson (1992), are appropriate for the early years of IS. With the maturity of the field, empirical studies are more suitable for providing theories from what already exists in practice, or building theories based on empirical facts. With regard to detailed research methods, we found that there was only 1 paper reported to have used the field study method. In comparison, this method was one of the most popular research methods cited in other studies (Claver et al., 2000; Vessey et al., 2002). In addition to different sociological paradigms and research traditions, we believe that this might be due to the fact that most IS researchers in China are simply not familiar with this method.

Similar to research topics and methods, the units of analysis is also a sign of the immaturity of IS research in China. The IS researchers in the country almost never conduct any research at the group or individual level. In Vessey et al.'s (2002) study, they accounted for 34.7%. On the one hand, this phenomenon may reflect Chinese culture. On the other hand, it may imply that IS research in the country is still at the "macro" level and insufficient attention has been paid to the "micro" level such as group and individual issues.

The findings of this study can be helpful for IS researchers in China in positioning their research, not only from the viewpoint of topics, but also with regard to the sources of appropriate theories, the choice of research methods, as well as the units of analysis. IS researchers might wish to identify major areas where little research has been conducted and adopt proper research methods for their studies. For example, our data clearly showed and supported the claims of some well-known researchers (Huang et al., 2003; Wang and Jin, 2000) that the biggest obstacle for IS researchers in the mainland of China wanting to publish their research papers in international quality journals is perhaps not the lack of "good English writing skills," but the absence of formal training and knowledge in research methods and research methodologies. Similarly, as our data suggests, the IS researchers in the country might try to conduct more studies at individual and group levels, and seek theoretical foundations in social and cognitive psychology.

For the academic community, i.e., universities, academic journals, and research grant funding agencies, the findings of this research might provide some solutions

to deal with the shortcomings of the IS research in the country. Specifically, we recommend the following.

1) Business schools and/or IS departments of universities in China should set research methodology as a compulsory course for their graduate students, and IS faculty should also be provided with professional training in research methodology, while universities should recognize the value of conducting empirical studies and promote the publication of more empirical studies. 2) Top academic journals in China should emphasize the importance of empirical studies and invite reviewers who have the necessary skills and knowledge in the empirical study on to their editorial board. 3) Research grant funding agencies, such as the Division of Management Science of the National Natural Science Foundation of China (NSFC), should value and encourage more empirical research applications. On the aforementioned three recommendations, we are pleased to see that efforts are being made by universities and government research agencies in the country. For example, realizing the lack of training in research methodology of IS and management, many top universities and the National Natural Science Foundation of China have taken actions to address the problems. As a result, many universities have started putting the course of research methodology in their graduate programs. In addition, special workshops on research methodology have been organized and special funding programs created to support research in research methods of business and management.

For IS researchers in regions other than the mainland of China, we hope the findings may be useful for them to better understand the IS researchers and IS research activities in the country. Specifically, the data might be useful to show them what has been achieved by IS researchers in China, the similarities and differences between their own research projects and those of the mainland of China, to understand the unique characteristics of IS research activities, and to know the strengths and weaknesses of IS researchers in the country. Ultimately, this understanding might promote better collaborations in IS research between IS researchers in the mainland of China and the rest of the world in the future. Finally, the findings of the study will add value to our understanding of what constitutes the discipline of IS from a global perspective, which has been part of an ongoing quest over the past few decades.

We are aware of the limitations of the study due to the range of its samples and methods. In other words, we selected only IS research papers published in academic journals in the mainland of China and did not include any papers by researchers from the country published in international journals. Since there is a growing number of IS researchers from the mainland of China who have successfully published their research papers in international quality journals recently, our conclusions should not be viewed as universally applicable to all the cases of IS research in the country.

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Appendix 1 IS research topics (adapted from Vessey et al., 2002: 139–141)

1.0 Computer concepts

Computer/hardware principles/architecture
Inter-computer communication (networks, distributed systems)
Operating systems (as an augmentation of hardware)
Machine/assembler-level data/instructions

2.0 Systems/software concepts

System architecture/engineering
Software life-cycle/engineering (incl. requirements, design, coding, testing, maintenance)
Programming languages
Methods/techniques (incl. reuse, patterns, parallel processing, process models, data models...)

Tools (incl. compilers, debuggers)
Product quality (incl. performance, fault tolerance)
Human-computer interaction
System security

3.0 Data/information concepts
Data/file structures
Data base/warehouse/mart organization
Information retrieval
Data analysis
Data security

4.0 Problem domain specific concepts
Scientific/engineering (incl. bio-informatics)
Information systems (incl. decision support, group support systems, expert systems)
Systems programming
Real-time (incl. robotics)
Edutainment (incl. graphics)

5.0 Systems/software management concepts
Project/product management (incl. risk management)
Process management
Measurement/metrics (development and use)
Personnel issues

6.0 Organizational concepts
Organizational structure
Strategy
Organizational alignment (incl. business process reengineering)
Organizational learning /knowledge management
Technology transfer (incl. innovation, acceptance, adoption, diffusion)
Change management
IT implementation
IT usage/operation
Management of "computing" function
IT Impact
Computing/information as a business
Legal/ethical/cultural/political (organizational) implications

7.0 Societal concepts
Cultural implications
Legal implications
Ethical implications
Political implications

8.0 Disciplinary issues
"Computing" research
"Computing" curriculum/teaching