Design and Behavioral Science Research in Premier IS Journals: Evidence from Database Management Research

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Abstract. In this article, we examine database management research that has been published in ISR, JMIS, and MISQ from each journal's inception to 2007. Our goal is to profile database research using a classification scheme that includes research paradigms, IT constructs, and research methodologies. The overall statistics obtained shows that information systems (IS) research in database management, which is widely recognized as part of the core knowledge of IS, is diverse in IT constructs, methodologies, as well as research paradigms. However, we also find that each journal has focused more on one research paradigm and some research methodologies. We summarize and discuss these results which can be useful to design science researchers in targeting their work in these three premier IS journals.

Keywords: Design Science, Behavioral Science, IS Research, Database Research, Research Diversity.

1 Introduction

Much of the long-standing debate over the nature of Information Systems (IS) focuses on whether or not research diversity in our field is desirable [6, 7]. Past studies have examined various aspects of diversity in our field including diversity in reference disciplines, research topics, and methodologies [3]. Among these discussions on IS research diversity, the issue of design versus behavioral science has recently gained much attention in our community. Prominent IS researchers have argued for more focus on design science research and for greater recognition of design science research among premier IS journals (see, for example [22] and [31]). The seminal work by Hevner et al. [22] argues that the design and behavioral science paradigms should co-exist alongside and even complement one another.

Since its inception, research in IS has drawn upon a "bewildering variety" of theoretical foundations and methodologies [40]. The pluralistic nature of our field is a consequence of our "varied origins" as founders of our field came from backgrounds that include Computer Science, Economics, Management Science, Physics, and Psychology [21]. This pluralism is our heritage and influences how we, as an academic field, have come to define ourselves [38]. At the first international

conference among IS scholars, for example, Keen [25] defined IS as "a fusion of behavioral, technical, and managerial issues." In his editorial statement in ISR, King [26] described IS as an "intellectual convocation of individuals from many fields…" In a more recent example, Galliers [17] not only recognizes that the "roots" of IS are found in a variety of reference disciplines, but also advocates that we should strive to become even more "trans-disciplinary." This "trans-disciplinary" ideal was also echoed by Myers [32] (as quoted in [30]) as a collaborative environment where IS scholars from different research perspectives and approaches work together "within the scope of a single research project or within a particular research area."

The focus of this study is on database research which is widely recognized as a quintessential part of the IS discipline [10, 34, 45]. We explore the diversity in database management research that has been published in the top three 'mainstream' IS journals. Specifically, we examine all database research articles that have been published in *Information Systems Research (ISR). Journal of Management Information Systems (JMIS)*, and *MIS Quarterly (MISQ)* since each journal's inception. We classify research diversity based on 1) research paradigms: design and behavioral science, 2) design science research outputs, as well as 3) research methodologies. Our overall empirical evidence from the three journals shows diverse research activities in both behavioral and design science paradigms as well as in research methodologies. Even though database research is often perceived to align with design science, our study demonstrates that there exists a great extent of diversity in database research that spans both design and behavioral science among IS scholars. This diversified research agenda could provide a fertile incubator for truly trans-disciplinary scholarly work that can help set us apart from other disciplines.

This paper contributes to the design science research community in several ways. First it reviews database research published in the three premier IS journals and shows that IS scholars engage in database research from various perspectives such as system efficiency and performance, user interfaces as well as organizational capability. In addition, this paper attempts to add to the discussion of research diversity and the important place of design science research in the IS discipline. As shown in our findings, IS scholars engage in research activities from a broad spectrum of methodologies and reference disciplines. As a result, the IS community is in a unique position to take advantage of the wealth and breadth of knowledge among our colleagues through collaboration that bridges across different, but potentially synergistic, perspectives. Finally, our classification of database research according to research paradigm, methodologies, and research outputs can guide future design science scholars in identifying the most appropriate outlet for their work among the three top-tier journals reviewed in this research. With the results presented in this paper, future researchers can also find novel avenues of enquiry by examining what was previously published.

2 Database Research in the IS Discipline

The area of database research has long been a quintessential part of the body of knowledge in the IS discipline. First, the study of databases (including topics on database management and database design) has been an integral part of the information

systems discipline. In fact, both the fields of database and information systems research have been in existence alongside one another since their inception in the 1960s [41, 48]. An assessment of early IS research submitted to the then-nascent *Information Systems Research* between 1987 and 1992 placed database research in two of the eight main thematic areas of IS research [44]. More recently, Vessey et al. [48] placed database research as one of the eight major topics pursued by IS scholars. In addition, most, if not all, IS researchers consider the field of data management and database management systems as part of the core knowledge of the IS discipline (see for example [10, 11, 34, 45]). The co-existence between database and IS research allows us to track the publication records of database research in IS journals since the early development of the IS community.

Second, not only has database management become an integral component of financial, accounting, and other business systems, but it has also become one of the most essential tasks performed by IS professionals [10, 20]. In fact, database management is one of the most fundamental topics taught in almost all undergraduate and graduate programs in IS [49]. In 2002, a task force of 40 prominent IS researchers put forth guidelines that include database management as one of the "key information systems concepts" that must be taught in business school curricula [23]. Database topics are also included in the IS curriculum guidelines recommended by the Association for Information Systems (AIS) at both graduate and undergraduate levels [19, 20].

The area of database research is also relatively well-defined, compared to other IS research topics. In order to distinguish database research from other IS research areas, we follow an approach similar to that by Vessey et al. [48] and Palvia et al. [37]. In particular, the classification of IS research subjects by Palvia et al. [37] classifies the study of databases and database management systems as one of the 33 main categories, distinctive from other topics such as decision support systems, knowledge management, multimedia, and systems development. Vessey et al. [48] also classified data management and databases in a separate category from other topics such as Decision Support Systems (DSS), process management, and systems management. Thus our approach to make a clear distinction between database research and other topics is in alignment with these oft-cited studies, as opposed to a more inclusive approach (e.g. [8]).

3 Database Research in Premier IS Journals

In addition to the IS discipline, Database research has also been defined as part of the computer science and engineering disciplines and "devoted to the study of the problems of managing large volumes of data" [27]. This overlapping of interests between IS and computer science/engineering researchers in the field of database offers opportunities for inter-disciplinary scholarship, but also poses a challenge among these researchers in terms of their choice of publication outlets. In addition to the main stream IS journals, such as *ISR, JMIS,* and *MISQ*, some other possible publication outlets for IS researchers include both journals that are classified as primary interest for computer scientists and journals that specialize in database management topics (e.g.. *Communications of the ACM, ACM Transactions on Database Systems (ACM TODS), IEEE Transactions on Knowledge and Data*

Engineering (IEEE TKDE), Data and Knowledge Engineering, and *Journal of Database Management (JDM)*). However, even with high-quality journals specializing in database research such as *ACM TODS* and *JDM*, the three mainstream IS journals (i.e., *ISR, JMIS,* and *MISQ*) remain the top three premier publication outlets for IS researchers in academia, especially for the purpose of tenure and promotion evaluation [15, 47]. Past studies also recognize these same three journals as among the most prestigious publication outlets in our field (see, for example, [8, 24, 39, 48]). As a consequence, we choose to include published articles from these three IS journals (*ISR, JMIS,* and *MISQ*) in our analysis. We obtain a copy of all research articles that have appeared in the IS journals from their inception to 2007. We exclude editor's notes/comments and interviews and retain only research articles. The remaining articles are then read and coded based on the classification scheme described below.

We first determine whether or not each article that appeared in the three journals is database research. To help distinguish database research from other topics, we use the subject classification specified in Palvia et al. [37]. This classification scheme is derived from extensive research published by Alavi & Carlson [1] and Barki, Rivard, & Talbot [5]. As we noted earlier, this classification framework separates research in databases and database management systems (our main focus) from other topics such as decision support systems, knowledge management, multimedia, and systems development. Table 1 presents the number of articles coded by the three researchers as database research. We went through several phases of coding and discussion to obtain the final list of database articles. We recognize that whether or not an article is database research may not be apparent from the article's title alone, therefore we take great care to consult with both the abstract and the actual text of the articles during our coding sessions.

Considering only the database articles, we then develop a classification scheme which includes the following dimensions: design versus behavioral science, design science research outputs, and research methodologies used. In order to provide broader insight into the profile of database research, we also present a cross-analysis for each of the three journals. In order to provide empirical evidence on these classifications, we use content analysis as the primary method.

Table 1. Total number of database articles by journal

Journal	ISR	JMIS	MISQ	Total
Number of database articles	19	38	19	76
Time period covered	1990-2007	1984-2007	1977-2007	1977-2007
Number of database articles per year	1.05	1.58	0.61	2.45
1990 – 2007				
Number of database articles	19	20	7	46
Number of database articles per year	1.05	1.11	0.39	2.55

4 Design Science and Behavioral Science Research

In this section, we focus on the design versus behavioral science research paradigms. In their seminal work, Hevner and colleagues [22] presented a guideline for conducting design science research in IS, adumbrating a decisive change for design science researchers within the mainstream IS community. Their work has been used by IS journals as a touchstone to help determine the validity of scholarly work for publication. This restored interest between design and behavioral science research has renewed discussion about expanding publication opportunities at some of our most prestigious journals in order to foster a more diverse research agenda (see, for example [43]).

Research in IS has been defined as dealing primarily with a complex system consisting of computer hardware, software, data, procedures, decision models and people [31]. IS research therefore focuses on "artificial" phenomena that involve tools, techniques, and materials designed and implemented by humans to achieve predefined objectives [9]. As pointed out by March & Smith [31], these artificial IS phenomena can be both "created and studied," placing the field of IS research at a crossroads between natural and design science. Yet, past studies have shown the apparent preference of mainstream IS journals for behavioral research (see, for example, [4, 28]). In recent years, many prominent IS researchers have argued for more focus on design science research and for greater recognition of design science research among mainstream IS journals (see, for example [22, 31]).

According to Hevner et al. [22], "IS research occurs at the confluence of people, organizations and technology; therefore two distinct and complementary paradigms are necessary to acquire the information required to improve information systems: (1) behavioral science and (2) design science." They describe these two paradigms as follows:

> "The behavioral-science paradigm has its roots in natural science research methods. It seeks to develop and justify theories (i.e., principles and laws) that explain or predict organizational and human phenomena surrounding the analysis, design, implementation, management, and use of information systems."[22, p.76].
>
> "The design-science paradigm has its roots in engineering and the sciences of the artifact ([42]). It is fundamentally a problem-solving paradigm. It seeks to create innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, and use of information systems can be effectively and efficiently accomplished ([46]; [13])."[22, p. 76].

Hevner et al. [22], March & Smith [31], and Nunamaker et al. [35] further describe the definition of IT artifacts that are essential outputs of IS research. These artifacts consist of four general outputs for design science research which include *constructs, models, methods, and instantiations*. Table 2 summarizes the description of the four research outputs.

Table 2. Design Science Research Outputs

Output	Description
Constructs	The conceptual "vocabulary and symbols used to define problems and solutions" of a domain [22]. They include "linguistic devices to define and communicate problems [8]."
Models	"A set of propositions or statements expressing relationships between constructs [28]."
Methods	A set of related procedural steps used to perform a task. Specifically, these steps are used to "define solution processes through formal algorithms or step-by-step procedures [8]."
Instantiations	An implementation of constructs, models and methods in a working or prototype system. [8, 28]

Although database research could fall under either design or behavioral science paradigms, the focus of database research is often perceived to align with the design science research paradigm. In fact, scholarly articles often use topics in database to demonstrate guidelines for design science research in IS (see, for example, [22, 28, 31]). This apparent association between database and design science research inadvertently places IS researchers with an interest in database topics at odds with the coverage of mainstream IS journals. Even though database research shares its roots with computer science and engineering, in what follows, we demonstrate that there exists a great extent of diversity in database research that spans both design and behavioral science among IS scholars. This diversified research agenda, like other research areas in IS, could provide a fertile incubator for truly trans-disciplinary scholarly work that can help set us apart from other disciplines.

In order to determine whether each database article is design science or behavioral science research, we follow the guidelines proposed by Hevner et al.[22]. Then, we use the definition of IT artifact outputs as described in [31] and further defined by Hevner et al. [22], Benbunan-Fich & Mohan [8], and Kuechler et al. [28]. To further

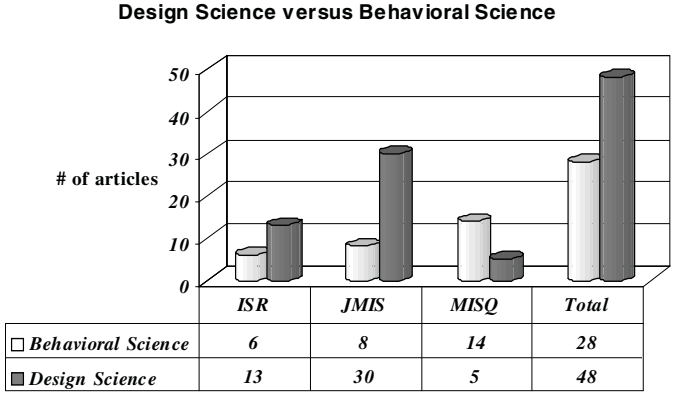

Fig. 1a. Number of Database Articles since Journal Inception to 2007

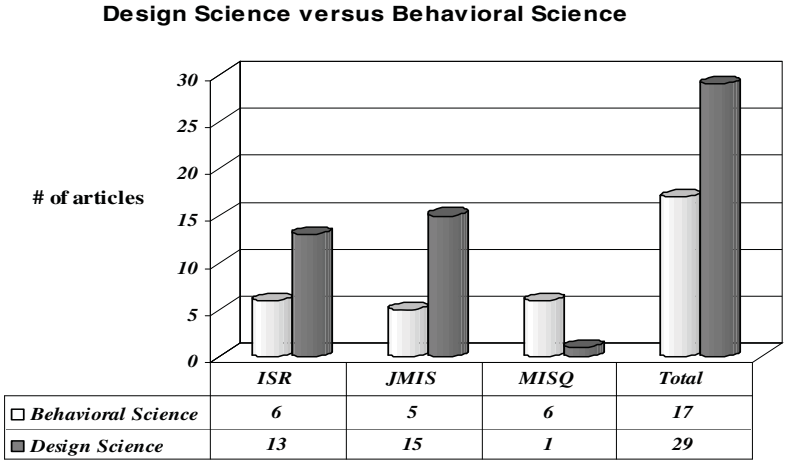

Fig. 1b. Number of Database Articles from 1990 to 2007

differentiate the design science research articles, we focus on the four primary outputs of design science research: constructs (vocabulary and symbols), models (abstractions and representations), methods (algorithms and practices), and instantiations (implemented and prototype systems). Some articles may present multiple IT artifacts as their research outputs. In such situations, we focus on the article's primary research objective and identify the article with only one of the four output categories. Fig. 1a and Fig.1b present the results of our coding for each journal.

As shown in Fig.1a, out of the 76 database articles, 48 articles are classified as design science research and the remaining 28 articles are classified as behavioral science articles.

In addition, Fig.1b shows that during the time period from 1990 to 2007, 29 database articles are design science research and 17 articles are classified as behavioral science research, totaling 46 database articles during this period. Furthermore, our examination of the design science outputs since the three journals' inception (see Fig. 2a) shows that 26 articles propose *methods* as their primary design science output, followed by *models* (12 articles), *instantiation* (7 articles), and *constructs* (3 articles). Furthermore, out of the 29 design science articles published since 1990, 17 articles propose *methods* as their primary output, followed by *models* and *instantiation* (5 articles each) and *constructs* (2 articles). Table 3 also shows the breakdown for each journal. For all three journals, we find *methods* to be the most common design science research output.

Combining the results from the three journals, we show that there exists diversity in terms of the two research paradigms. However, this evidence of diversity is not consistently found in all the three journals examined. As can be seen, while database research is primarily design science for *ISR* and *JMIS*, it is primarily behavioral in the case of *MISQ*.

Table 3. Design Science Database Research Output

Design Science Output (since journal inception to 2007)	ISR	JMIS	MISQ	Total
Constructs	1	2		3
Instantiation		6	1	7
Methods	10	13	3	26
Models	2	9	1	12
Total	13	30	5	48
Design Science Output (from 1990 to 2007)				
Constructs	1	1		2
Instantiation		4	1	5
Methods	10	7		17
Models	2	3		5
Total	13	15	1	29

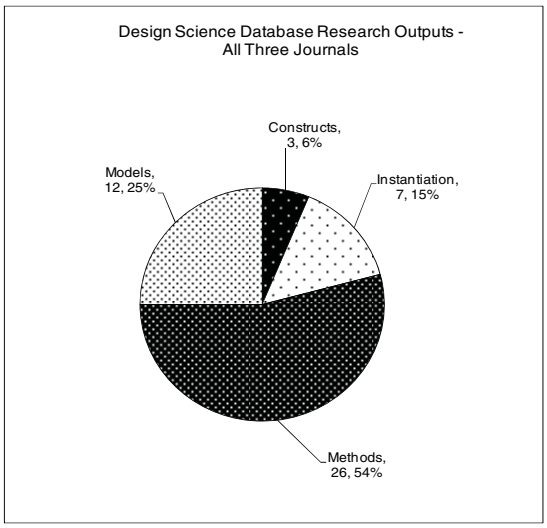

Fig. 2a. Design Science Database Research Outputs (since journal inception to 2007)

5 Research Methodologies in Database Research

We also classify the articles in terms of the research methodologies used. We include the classification on research methods in our study because research methods represent "the means for gaining knowledge" and "may be used with any epistemological perspective" [12].

Past studies (e.g., [1, 16, 48]) have identified several research methods that are commonly used in IS research. In order to capture all of the research methodologies represented in the three journals, we follow a more up-to-date classification framework proposed by Palvia et al. [37] as shown in Table 4. In addition, since it is possible that a research article may rely upon multiple methodologies, the coders

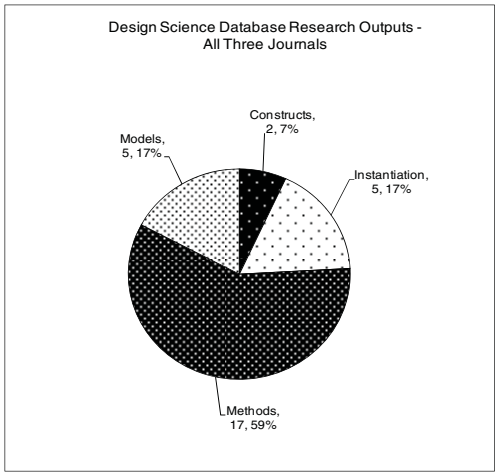

Fig. 2b. Design Science Database Research Outputs (from 1990 to 2007)

record up to two research methodologies for each article. A similar approach was employed by past studies on the epistemology of IS research [36, 37].

Tables 5 and 6 present the results of our coding for the primary research methodology, cross-tabulated with the research paradigms. As shown in the two tables, behavioral science database research primarily uses laboratory experiment and survey methods, whereas design science database research involves mathematical models as well as frameworks and conceptual models.

An examination of these results for each journal shows some interesting patterns (see Figures 3a and 3b). In *ISR*, one methodology clearly dominates each research paradigm - laboratory experiments in behavioral science research and mathematical models in design science research. Although the numbers are very small, the behavioral science research in *JMIS* has evidence of laboratory experiment and survey methodologies.

Table 4. Research Methodologies [37]

1. Speculation/commentary
2. Frameworks and Conceptual Model
3. Library Research
4. Literature Analysis
5. Case Study
6. Survey
7. Field Study
8. Field Experiment
9. Laboratory Experiment
10. Mathematical Model
11. Qualitative Research
12. Interview
13. Secondary Data
14. Content Analysis

Table 5. Research Paradigm and Primary Research Methodology (since inception to 2007)

Research Paradigm	Methodology	ISR	JMIS	MISQ	Total
Behavioral Science	Case Study			3	3
	Field Study			1	1
	Laboratory Experiment	5	2	5	12
	Library Research		1	2	3
	Literature Analysis		1	1	2
	Mathematical Model	1	1		2
	Survey		3	2	5
Behavioral Sc.Total		6	8	14	28
Design Science	Frameworks & Conceptual Model		10	5	15
	Laboratory Experiment		1		1
	Mathematical Model	13	19		32
Design Sc. Total		13	30	5	48
Total		19	38	19	76

In design science research, *JMIS* published articles that use frameworks and conceptual models, in addition to the most commonly used mathematical model methodology. The design science articles in *MISQ* all use frameworks and conceptual models as the research methodology. On the other hand, the behavioral science articles in *MISQ* include laboratory experiments, case studies, surveys, and library research. For the two research paradigms combined, mathematical models (44%) are the most commonly used research methodology in database research, followed by frameworks and conceptual models (15%) and laboratory experiments (17%).

Table 6. Research Paradigm and Primary Research Methodology (from 1990 to 2007)

Research Paradigm	Methodology	ISR	JMIS	MISQ	Total
Behavioral Science	Case Study			1	1
	Field Study				
	Laboratory Experiment	5	2	3	10
	Library Research				
	Literature Analysis			1	1
	Mathematical Model	1	1		2
	Survey		2	1	3
Behavioral Science Total		6	5	6	17
Design Science	Frameworks & Conceptual Model		3	1	4
	Laboratory Experiment		1		1
	Mathematical Model	13	11		24
Design Science Total		13	15	1	29
Total		19	20	7	46

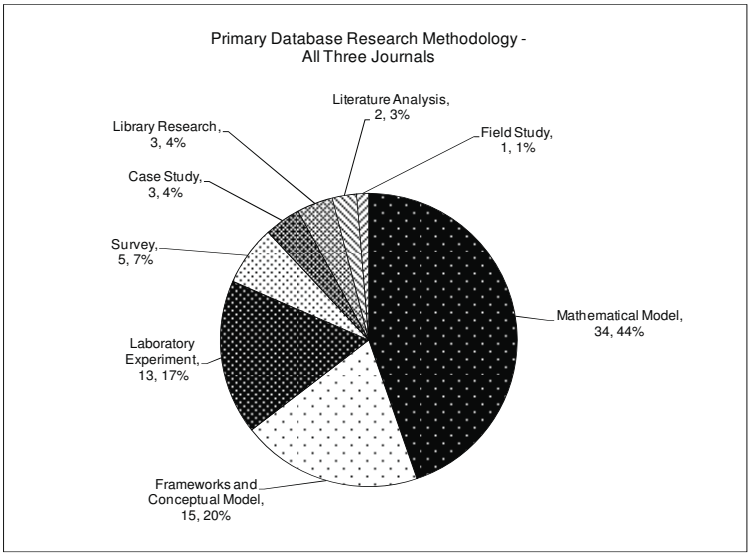

Fig. 3a. Primary Database Research Methodology (since inception to 2007)

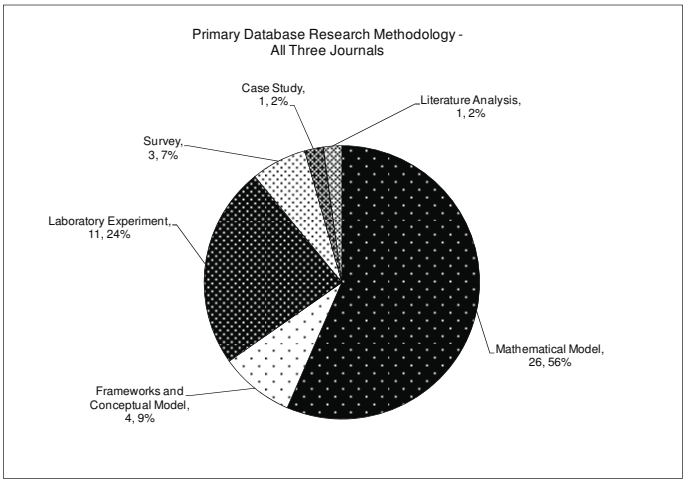

Fig. 3b. Primary Database Research Methodology (from 1990 to 2007)

6 Conclusion

In this article, we profile database research published in the top three premier IS journals. Our empirical evidence shows diversity in research methodology, IT construct, and research paradigm even within a specific, supposedly well-defined topic such as database management. In addition to showing the variety of database

research published in the three journals as a whole, this paper also provides some insights regarding the focus of each journal in terms of research paradigm and methodology.

This paper contributes to the design science research community in several ways. First it reviews database research published in the three premier IS journals (i.e., ISR, JMIS, and MISQ). Our empirical evidence shows diversity in research methodology, IT construct, and research -paradigm (i.e., design and behavioral science) even within a specific topic such as database management. Our result shows that IS scholars engage in database research from various perspectives such as system efficiency and performance, user interfaces as well as organizational capability. Future research can extend the current results into other IS journals and topics in order to provide more comprehensive insights into design science research. We also hope that our paper will add to the discussion of research diversity in IS and the important place of design science.

Finally, our classification of database research according to research paradigm, methodologies, and research outputs can guide future design science scholars in identifying the most appropriate outlets for their work. With the results presented in this paper, future researchers can also find novel avenues of enquiry by examining what was previously published.

This study has some limitations. The study focused on database management research and included only articles published in three premier journals until the year 2007. Our future research will extend the scope of this study and examine if the results hold for recent years and other premier journals and topics in the IS field.

References

1. Alavi, M., Carlson, P.: A Review of MIS Research and Disciplinary Development. J. Manage. Inform. Syst. 8(4), 45–62 (1992)
2. Applegate, L.M., King, J.L.: Rigor and Relevance: Careers on the Line. MIS Quart. 23(1), 17–18 (1999)
3. Ayanso, A., Lertwachara, K., Vachon, F.: Diversity or Identity Crisis? An Examination of Leading IS Journals. Commun. of the AIS 20, 660–680 (2007)
4. Bajaj, A., Batra, D., Hevner, A., Parsons, J., Siau, K.: Systems Analysis and Design: Should We be Researching What we Teach? Commun. of the AIS 15, 478–493 (2005)
5. Barki, H., Rivard, S., Talbot, J.: A Keyword Classification Scheme for IS Research Literature: An Update. MIS Quart. 17(2), 209–226 (1993)
6. Benbasat, I., Weber, R.: Research Commentary: Rethinking 'Diversity in Information Systems Research. Inform. Syst. Res. 7(4), 389–399 (1996)
7. Benbasat, I., Zmud, R.W.: The Identity Crisis within the IS Discipline: Defining and Communicating the Discipline's Core Properties. MIS Quart. 27(2), 183–194 (2003)
8. Benbunan-Fich, R., Mohan, K.: Research publications in Systems Development during 2000-2004. Commun. of the AIS 17, 373–390 (2006)
9. Davis, G.B.: Management Information Systems: Conceptual Foundations, Structure, and Development. McGraw-Hill, New York (1974)
10. Davis, G.B.: The Knowledge and Skill Requirement for the Doctorate in MIS. In: Proceedings of the First International Conference on Information Systems (ICIS), Philadelphia, PA, December 8-10, pp. 174–186 (1980)

11. Davis, G.B.: Information Systems as an Academic Discipline: Looking Back, Looking Forward, and Ensuring the Future. In: Proceedings of the IFIP International Federation for Information Processing: The Past and Future of Information Systems: 1976-2006 and Beyond, vol. 214, pp. 11–25 (2006)
12. DeLuca, D., Kock, N.: Publishing Information Systems Action Research for a Positivist Audience. Commun. of the AIS 19, 183–204 (2007)
13. Denning, P.J.: A New Social Contract for Research. Communications of the ACM 40(2), 132–134 (1997)
14. Dennis, A.R.: Relevance in Inform. Syst. Res. Commun. of the AIS 6, 1–6 (2001)
15. Dennis, A.R., Valacich, J.S., Fuller, M.A., Schneider, C.: Research Standards for Promotion and Tenure in Information Systems. MIS Quart. 30(1), 1–12 (2006)
16. Farhoomand, A.F., Drury, D.H.: A Historiographical Examination of Information Systems. Commun. of the AIS 1, 1–20 (1999)
17. Galliers, R.D.: Change as Crisis or Growth? Toward a Trans-disciplinary View of Information Systems as a Field of Study: A Response to Benbasat and Zmud's Call for Returning to the IT Artifact. Journal of the Association for Information Systems 4, 337–351 (2003)
18. Galliers, R.D., Meadows, M.: A Discipline Divided: Globalization and Parochialism in Inform. Syst. Res. Commun. of the AIS 11, 108–117 (2003)
19. Gorgone, J.T., Davis, G.B., Valacich, J.S., Topi, H., Feinstein, D.L., Longenecker, H.E.: IS 2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. Commun. of the AIS 11, 1–48 (2003)
20. Gorgone, J.T., Gray, P., Stohr, E.A., Valacich, J.S., Wigand, R.T.: MSIS 2006: Model Curriculum and Guidelines for Graduate Degree Programs in Information Systems. Commun. of the AIS 17(1), 121–195 (2006)
21. Guthrie, R.A.: The IS Core- V Defining the IS Core. Commun. of the AIS 12, 557–561 (2003)
22. Hevner, A.R., March, S.T., Park, J., Ram, S.: Design Science in Information Systems Research. MIS Quart. 28(1), 75–106 (2004)
23. Ives, B., et al.: What Every Business Student Needs to Know about Information Systems. Commun. of the AIS 9, 467–477 (2002)
24. Katerattanakul, P., Razi, M.A., Han, B.T., Kam, H.: Consistency and Concern on IS Journal Rankings. J. of Inform. Technol. Theory and Appl. 7(2), 1–20 (2005)
25. Keen, P.G.W.: MIS Research: Reference Disciplines and a Cumulative Tradition. In: McLean, E.R. (ed.) Proceedings of the First International Conference on Information Systems, pp. 9–18 (1980)
26. King, J.L.: Editorial Notes. Inform. Syst. Res. 4(4), 291–298 (1993)
27. Korth, H.F., Silberschatz, A.: Database Research Faces the Information Explosion. Commun. of the ACM 40(2), 139–142 (1997)
28. Kuechler, B., Vaishnavi, V., Kuechler, W.L.: Design [Science] Research in IS: A Work in Progress, Association for Information Systems (2008), http://ais.affiniscape.com/displaycommon.cfm?an=1&subarticlenbr=386#ISDRhistory
29. Landis, J., Koch, G.: The Measurement of Observer Agreement for Categorical Data. Biometrics 33(1), 159–174 (1977)
30. Lee, A.: Editor's Comments. MIS Quart. 25(4), v–xv (2001)
31. March, S.T., Smith, G.F.: Design and Natural Science Research on Information Technology. Decis. Support Syst. 15, 251–266 (1995)
32. Myers, M.D.: Qualitative Research in Information Systems. MIS Quart. 21(2), 241–242 (1997)

33. Neuendorf, K.: The Content Analysis Guidebook. Sage Publications, Thousand Oaks (2002)
34. Nolan, R.L., Wetherbe, J.C.: Toward a Comprehensive Framework for MIS Research. MIS Quart. 4(2), 1–19 (1980)
35. Nunamaker, J., Chen, M., Purdin, T.D.M.: Systems Development in Inform. Syst. Res. J. Manage. Inform. Syst. 7(3), 89–106 (1991)
36. Palvia, P., Mao, E., Salam, A.F., Soliman, K.S.: Management Inform. Syst. Res.: What's There in a Methodology? Commun. of the AIS 11, 289–309 (2003)
37. Palvia, P., Mao, E., Midha, V., Pinjani, P., Salam, A.F.: Research Methodologies in MIS: An Update. Commun. of the AIS 14, 526–542 (2004)
38. Peffers, K.: Editorial: IS Research Using Theory from Elsewhere. J. of Inform. Technol. Theory and Appl. 9(2), iii–vi (2008)
39. Peffers, K., Ya, T.: Identifying and Evaluating the Universe of Outlets for Inform. Syst. Res.: Ranking the Journals. J. of Inform. Technol. Theory and Appl. 5(1), 63–84 (2003)
40. Robey, D.: Research Commentary: Diversity in Inform. Syst. Res.: Threat, Promise, and Responsibility. Inform. Syst. Res. 7(4), 400–408 (1996)
41. Silberschatz, A., Stonebraker, M., Ullman, J.: Database Research: Achievements and Opportunities. In: The 'Lagunita' Report of the NSF Invitational Workshop on the Future of Database Research Held in (February 1990); SIGMOD RECORD 19(4), 6–22 (1990)
42. Simon, H.A.: The Sciences of the Artificial, 3rd edn. MIT Press, Cambridge (1996)
43. Straub, D.: Editor's Comments. MIS Quart. 32(1), iii–viii (2008)
44. Swanson, E.B., Ramiller, N.C.: Information Systems Research Thematics: Submission to a New Journal, 1987-1992. Inform. Syst. Res. 4(4), 299–330 (1993)
45. Teng, J.T.C., Galletta, D.F.: MIS Research Directions: A Survey of Researchers' Views. Data Base 22(1/2), 53–62 (1991)
46. Tsichritzis, D.: The Dynamics of Innovation. In: Beyond Calculation: The Next Fifty Years of Computing, New York, NY, Copernicus, pp. 259–265 (1997)
47. Valacich, J.S., Fuller, M.A., Schneider, C., Dennis, A.R.: Publication Opportunities in Premier Business Outlets: How Level is the Playing Field? Inform. Syst. Res. 17(2), 107–125 (2006)
48. Vessey, I., Ramesh, V., Glass, R.: Research in Information Systems: An Empirical Study of Diversity in the Discipline and Its Journals. J. Manage. Inform. Syst. 19(2), 129–174 (2002)
49. Vician, C., Garfield, M., Hoffer, J.A., Prescott, M., Rollier, B., Strong, D.M., Elder, K.L.: The AMCIS 2003 panels on IS Education-II the Chicken and the Egg Debate: Positioning Database Content in the Information Systems Curriculum. Commun. of the AIS 14, 147–157 (2004)

Appendix A: Reliability Measure in Content Analysis

For each journal, the three authors worked independently to code the articles, following the content analysis procedure outlined in [33]. The total numbers of reviewed articles since the inception of *ISR*, *JMIS*, and *MISQ* were 362, 809, and 805, respectively. The numbers of reviewed articles for *ISR*, *JMIS*, and *MISQ* since 1990 were 362, 659, and 472, respectively. We conducted content analysis to classify the 76 database research articles on the research methodologies, design versus behavioral science classifications, and the design science research outputs. Before the classification process started, we documented the definitions of each classification

categories as described above. The coders then discussed and came to an initial agreement on the interpretation of these definitions. The percentage of agreement and Cohen's kappa were used as measurement of inter-coder reliability.

Typically, kappa values between 0.61 and 0.80 are regarded as "substantial," and those greater than 0.80 are deemed "almost perfect" [29]. Table 7 presents the results of the inter-coder reliability analyses.

Table 7. Inter-rater Reliability Measures

Classification frameworks	*Percent of Overall Agreement*	*Kappa Statistics*
Design versus Behavioral Science	0.9474	0.8947
Design Science Outputs	0.8841	0.8454
Research Methodologies	0.9386	0.9339