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A PROFILE OF RESEARCH IN EXPERT SYSTEMS

Introduction

If the field of Expert Systems (ES) is viewed in terms of a life cycle, the past decade represents the growth phase of its development. Sophistication of ES has increased rapidly, and the use of ES to solve more complex problems has maintained a similar pace. Numerous forces have driven this development including the rapid changes in computer technology. As the field has matured, the body of published research in ES has grown substantially.

Those interested in ES, whether students, researchers, or practitioners, are frequently faced with questions which may be addressed in ES research. More knowledge of ES research literature would be helpful to these people as they seek answers to their questions. Relevant information about the literature includes:

1. Which areas of ES research have received the most attention? some attention? Which have never been addressed?
2. What type of journal is most likely to publish ES research?
3. What are the leading journals in ES research?
4. Who leads in developing the body of ES knowledge, academics or non-academics?
5. Which academic institutions are producing the most ES research?
6. What trends and directions in ES research can be identified?

Through the study of published ES research, this article provides useful answers to these questions. The scope of our study is limited to the description and analysis of ES research in journals published in the United States from 1980 to 1988.

ES Research Categories

For purposes of clarity and usefulness, ES research was classified in the following categories:

Principles - Includes ES overview, framework, planning and development concepts, and speculation on the future of ES.

Survey - Includes ES research using observations, questionnaires, and/or interviews to examine the importance and effectiveness of installed ES.

Applications - Includes case studies describing experiences in developing and/or implementing ES, and descriptions of ES packages, generators, and tools.

Analysis of the published articles reveals that 74% were principles research, 20% were in the applications category, and 6% were surveys.

Journal Selection

Twenty-eight journals were chosen for this study. Two types of journals were selected, those noted for publishing MIS research and those publishing research on functional areas of business in which ES is applied. The latter category included the areas of accounting, management, marketing, and finance. A complete search of the following journals for the period 1980 through 1988 was conducted:

MIS Journals - Communications of the ACM, Data Base, Data Management, Datamation, Decision Sciences, Interfaces, Journal of Information Systems Management, Journal of Management Information Systems (JMIS), Journal of Systems Management (JSM), MIS Quarterly, and Operations Research.

Accounting Journals - Accounting Review, Computers in Accounting, Journal of Accountancy, Journal of Accounting Research, and Management Accounting.

Management Journals - Harvard Business Review, Journal of Management, Journal of Management Studies, Management International Review, and Sloan Management Review.

Marketing Journals - International Marketing Review, Journal of the Academy of Marketing Science, and Journal of Marketing Research.

Finance Journals - Financial Computing, Financial Planning, Journal of Finance, and Journal of Financial Research.

After the search was completed, journals with one or no ES articles during the time period of the study were eliminated. Thus the number of journals included in the study was reduced to fourteen. Figure 1 lists the fourteen journals, the number of ES articles in each, and the total number of contributing authors to these articles.

The five leading journals in the publication of ES research, all MIS journals, were: Datamation, JSM, Interfaces, Communications of the ACM, and JMIS. These five, representing 36% of the journals in the study, account for 63% of the total number of articles and 63% of the authors. Ten of the fourteen journals included, or 71%, were MIS journals. Taken together, these ten journals account for 85% of the total body of ES research studied.

ES Research by Institution

The results presented in this study reflect 102 instances of ES research published over a nine year period, 1980 through 1988, in the fourteen selected journals. The published research represents contributions from 157 authors. Thirty-eight percent of these authors are from academia and 62% work in non-academic institutions. (See Figure 2.)

Figure 3 presents the universities with two or more authors contributing to journals in this study. Authors from three schools, Harvard Business School, MIT, and University of Arizona account for 34% of the total research published by authors from academia. As illustrated in Figure 2, authors from academic institutions have a preference for publishing in certain journals. Fifty-five percent of the academic authors published in four journals, JMIS, JSM, Sloan Management Review, and Data Base.

The data also reflect a preference by some of the journals for publishing the ES research of certain authors. For example, all of the ES articles published in the Harvard Business Review were written by authors from the Harvard Business School; Seventy percent of the ES articles in the Sloan Management Review were written by authors from MIT; and the four authors from University of Arizona all published in Data Base. Of course, these statistics may also reflect a bias of certain authors to submit their research to particular journals.

Authors from non-academic institutions seem to prefer a different set of journals for publishing their ES research.

Conclusion

Analysis of published ES research for the period 1980 through 1988 has clearly identified the leading journals and institutions contributing to ES research. It also provides insight to and understanding of the past trends in ES research and implications for its future direction. The following conclusions have been drawn from the analysis:

1. An examination of literature within the past five years should be adequate for most purposes. Very little ES research was published prior to 1984. The few articles published during the first part of the decade focused on principles of ES.
2. Published ES research has increased dramatically since 1984. Most of this research falls in the principles and applications categories.
3. An overwhelming majority of reported ES research has been published in MIS journals. The research is reasonably concentrated in the top five of these journals.
4. Non-academics have contributed more to the body of ES research than academics.
5. ES research written by academics tends to be published in a different set of journals than research published by non-academics. The research of both groups, however, is concentrated in a limited number of journals.
6. Principles research dominates the body of research published to date. This is a predictable pattern in a developing field. As expected, applications research began to gain momentum in the latter part of the decade and should continue to grow at an

increasing pace until it surpasses principles research, assuming a normal pattern of maturation.

7. ES survey research was first published in 1986, but this area has received little attention. Since the number of ES applications is still limited, the research environment does not yet lend itself to this method of research. As the field matures, more survey research is expected.

<u>Journal</u>	<u>Number of Articles</u>	<u>Number of Authors</u>
<u>Datamation</u>	24	31
<u>Journal of Systems Management</u>	15	20
<u>Interfaces</u>	9	17
<u>Communications of the ACM</u>	9	17
<u>JMIS</u>	7	14
<u>Journal of Inf. Sys. Mgt.</u>	6	7
<u>MIS Quarterly</u>	5	6
<u>Data Base</u>	5	9
<u>Journal of Accountancy</u>	5	6
<u>Decision Sciences</u>	4	6
<u>Sloan Management Review</u>	4	10
<u>Harvard Business Review</u>	4	5
<u>Data Management</u>	3	5
<u>Management Accounting</u>	2	4
Total	102	157

Figure 1. Journals Included in the Study

<u>Journal</u>	<u>Authors From Academia</u>	<u>Non-Academic Authors</u>	<u>Total</u>
<u>Datamation</u>	2	29	31
<u>Journal of Sys. Mgt.</u>	9	11	20
<u>Interfaces</u>	3	14	17
<u>Comm. of the ACM</u>	0	17	17
<u>JMIS</u>	10	4	14
<u>Sloan Management Review</u>	7	3	10
<u>Data Base</u>	7	2	9
<u>Journal of Inf. Sys. Mgt.</u>	3	4	7
<u>MIS Quarterly</u>	5	1	6
<u>Decision Sciences</u>	5	1	6
<u>Journal of Accountancy</u>	0	6	6
<u>Data Management</u>	0	5	5
<u>Harvard Business Review</u>	5	0	5
<u>Management Accounting</u>	4	0	4
Total	60	97	157

Figure 2. Number of Authors by Type of Institution

<u>University</u>	<u>Number of Publishing Authors</u>
Harvard Business School	9
MIT	8
University of Arizona	4
Arizona State University	2
New York University	2
Texas A&M University	2
University of Hawaii	2
Other Universities	31
Non-Academic Institutions	97
Total	157

Figure 3. Leading ES Research Publishing Institutions

<u>Year</u>	<u>Principles</u>	<u>Survey</u>	<u>Applications</u>	<u>Totals</u>
1980	1	0	0	1
1981	0	0	0	0
1982	1	0	0	1
1983	1	0	1	2
1984	10	0	3	13
1985	6	0	0	6
1986	18	2	3	23
1987	17	2	8	27
1988	22	2	5	29
Total	76	6	20	102

Figure 4. Distribution by Research Category Over the Time Period of the Study

<u>Research Category</u>	<u>Authors From Academia</u>		<u>Non-Academic Authors</u>	
Principles	65%	39	83%	80
Survey	6%	4	5%	5
Applications	29%	17	12%	12
Total	100%	60	100%	97

Figure 5. Distribution by Type of Institution and Research Category