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전문가 시스템의 영향, 사용자 만족도 및 교육에 대한 고찰

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SURVEY OF EXPERT SYSTEM IMPACTS, USERS' SATISFACTION AND TRAINING IN ORGANIZATIONS

In spite of the importance that MIS researchers place in Expert Systems, there is no agreement as to whether Schools of Business should include this topic in their curriculum. To answer this question, this study presents a survey of the use and impacts of Expert Systems in Organizations. The study also assesses the impact of training on users ' perceptions and use of Expert Systems. The survey indicates that Expert Systems are being used in several areas of industry and that Business schools would serve their student body better by exposing thenm to these tools.

The study also reviews the alternatizes used by IBM MoIS Grant Schools for incorporating Expert Systems in their curriculum. A discussion of the cases where each alternative would be more appropriate is included.

I. Introduction

Expert Systems, or Knoweldge-Based Systems, are computer programs that apply substantial knoweldge of specific areas of expertise to the problem-solving process [Bobrow, Mittal and Stefik, 1986]. Researching, developing and teaching Expert Systems has traditionally been the job of people working on Artificial Intelligence, a subfield of Computer Science [Harmon and King, 1985]. However, a survey of MIS researchers' views found that Artificial Intelligence is among the top five current areas of MIS research, and is also one of the top three areas warranting more emphasis [Teng and Galletta, 1990].

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In spite of the importance that MIS researchers place in the field, there is no agreement as to whether Schools of Business should include this topic in their curriculum. The ACM's curriculum recommendation [Nunamaker, Couger and Davis, 1980] does not include a course on Expert Systems, nor does it include Expert Systems as a topic in any of its courses. A review of course syllabus from the 13 IBM MoIS Grant Schools shows that not all of them have courses on this area. Only six schools reported a course dealing in depth with Expert Systems, and two more report including this topic as a major component of another course [Frand, et al., 1990-1; Frand, et al, 1990-2](1).

According to AACSB standards, Business Schools should provide a basic understanding of the concepts and applications of Management Information Systems (MIS), including computer applications [AACSB, 1990]. Form Davis and Olson's [1985] definition of MIS, Expert Systems should be considered part of MIS as long as they are used to assist in providing information to support the operations, management, analysis and decision making functions in an organization. To answer the question posed by this article, it is necessary to assess the impact of Expert Systems in organizations, and to determine if business students would benefit from receiving training in this field.

This study uses a survey of industry to assess the impact of Expert Systems and the background of users. The study measures the level of penetration of Expert Systems technology in organizations, and measures the level of end-user satisfaction of those systems. To identify the current contribution of educational institutions, the survey requests the source of user training, and the users' self reported level of understanding of Expert Systems. The paper also includes an analysis of the alternatives used by various schools to incorporate Expert Systems into their curriculums. It concludes with a discussion of the possible courses of action that Business Schools can take in light of the findings of this study.

Ⅱ. Methodology

The main data collection instrument was a written survey. The instrument included background questions about the respondents' position, function, role with respect to Expert Systems, and previous training and knowledge of Expert Systems Technology. The instrument also measured satisfaction with Expert Systems on five components: content, accuracy, format, ease of use, and timeliness (based on Doll and Torkzadeh [1988]). The survey concluded with a request for the respondents' opinions of the effects of expert systems on their jobs and their forecasts for the future of the technology.

The survey was oriented towards the person in charge of Expert Systems in organizations that hired Business School Graduates. To find these organizations, the survey was distributed to Evening MBA students of the university of Detroit (Most evening MBA students work for large organizations in the Detroit Metropolitan Area). The MBA students were asked to forward the survey to the person responsible for the use

or development of Expert Systems in their firm or organizational unit.

Two hundred questionnaires were distributed. Forty five valid responses were received. The low response rate was expected because only one response was being sought from each organization, or user area, and the instrument only asked for responses from organizations who used Expert Systems. Several MBA students may work for the same firm, and not all firms may use Expert Systems. There was no effort to screen the distribution of the survey to account for those two factors.

Ⅲ. Findings

1. Background

Forty five valid responses were received. 32 of those (76%) corresponded to users of expert systems. The rest were developers (12%), support personnel (2%), knowledge source (7%), administration (2%) or other (2%). Users of Expert Systems work in different departments: Accounting, Engineering, Finance, Manufacturing, Sales, etc. People of the computer or data processing departments indicated that their involvement with Expert Systems was not as users but more in the role of designer, system administrator or technical support.

Table 1. Respondents' Role With Respect to Expert Systems

Category	Number of Respondents	Percentage
End-User	32	71.1
System Design & Development	6	13.4
Knowledge Source	3	6.7
Computer Support	1	2.2
System Administration	1	2.2
Other	2	4.4
Total	45	100

Table 2. Respondents' Department

	USER	NON USER
Department	Number	Number
Engineering	9(28%)	2(20%)
Accounting	4(13%)	0(0%)
Finance	3(9%)	1(10%)
Manufacturing	3(9%)	1(10%)
Sales	2(6%)	0(0%)
Systems	0(0%)	5(50%)
Others	11(35%)	1(10%)
Total	32(100%)	10(100%)

2. Training

Most users received training in Expert System from training programs(59%) or self thought (22%). Only two users reported having received training in school (6% of users, 5% of the sample). Developers and administrators are generally self taught (66%). The majority of respondents report regular understanding of how their Expert System works (4.6 on a 7 point scale). However, over half of them (53%) could not identify the method used by their system to measure uncertainty.

3. Systems in use

Respondents identified eleven different Expert Systems. Over sixty percent of the responses are divided between two of those systems: Intellect is in use by 44% of the sample, and FMEAS (Failure Mode Effect Analysis) reported by 18%. Three other systems are in use by more than one respondent: Expertax (a sales tax compliance system) reported by 9%, Financial Analyzer (a capital investment analysis system) reported by 9%, and Risk Advisor reported by 4%. Six other systems were mentioned by only one respondent each.

Table 3. Respondents' Training Background

	USER	NON USER
Training Program	19(59%)	2(22%)
Schools	2(6%)	0(0%)
Self	7(22%)	6(67%)
Others	4(13%)	1(11%)
Total	32(100%)	9(100%)

Table 4. Expert Systems in Use

Systems name	Respondents	Percent	Period of use
Intellect	20	44%	0-24+ months
FMEAS	8	18%	0-24 months
Expertax	4	9%	0-6 months
Financial Analyzer	4	9%	0-12 months
Risk Advisor	2	4%	0-6 months

Other Systems(reported only once):

A10N
Duplicate Processing
Inbound Transportation System
Parametric Engineering Truck Frame Design
Sales Pro
Tech Memory

Expert Systems have been in use for less than 24 months. Only one respondent indicated having used Expert Systems for more than two years. This is a short time compared with the average portfolio age of 7 years reported for other types of systems [Everest and Alanis, 1992].

Users and developers of Expert Systems are generally satisfied with the systems' contents, accuracy, format, ease of use, and timeliness. Values range from 5.5 to 6.1 on a 7 point Likert-type scale, where 1 means extremely poor and 7 represents extremely good. Survey respondents found a reduction in turnaround time the major benefit of using Expert Systems. Respondents are generally satisfied with the results of Expert Systems. However, users who understand Expert Systems better reported more satisfaction and found the results more timely. Table 5 summarizes the findings of the user satisfaction assessment.

Table 5. Level of End User satisfaction with Expert Systems

Satisfaction Component	Overall	By Role	
		User	Other
Content	5.93	5.86	6.03
Accuracy	5.63	5.74	5.45
Format	5.60	5.59	5.60
Ease of Use	5.57	5.55	5.66
Timeliness	5.76	5.52	6.10

Satisfaction	By Respondents' Department						
Component	Acc.	Eng.	Fin.	Com.	Man.	Sales	Other
Content	5.08	6.22	5.44	6.28	6.17	6.00	5.81
Accuracy	5.00	5.75	5.50	5.42	5.75	6.50	5.68
Format	5.00	6.00	4.75	5.50	6.00	6.00	5.57
Ease of use	5.23	5.98	5.37	5.27	5.65	4.74	5.60
Timeliness	4.75	6.33	6.17	6.17	5.88	5,50	5.57

Major Benefit	Number of Respondent
Less turnaround time	18(40%)
Cost saving	9(20%)
More user knowledge	9(20%)
Increased service	2(4.4%)
Other	3(6.7%)
No answer	4(8.9%)

When asked to assess the effect of the use of Expert Systems in the simplification of their jobs, respondents averaged a 5.5 on a 7 point scale. To a question about how much they though Expert Systems will expand in their organizations, respondents averaged 5.6 on a 7 point scale, and only one respondent predicted little expansion.

Ⅳ. Implications of the Findings

Expert Systems are relatively new tools in industry. Most of currently commercialized systems have been in use for less than two years. However, the survey indicates that they are in use by many different departments for various applications in organizations. This study shows that users see Expert Systems as cost saving tools that reduce the turnaround time for obtaining information and the level of user satisfaction with the Expert Systems is generally high, and there are signs of an increase in the role of Expert Systems for the future (Table 5).

Universities have not agreed on whether to teach Expert Systems to their Business Students, and on the level of such training. Industry has generally had to absorb the cost of training users in Expert Systems. Most survey respondents received training from a training program or learned about Expert Systems by themselves. However, in support of the value of training, it is important to note that users who reported a better understanding of Expert Systems found their results more timely and took better advantage of the benefits of the technology.

Schools of business have a responsibility to teach the characteristics and users of Expert Systems to their Management students, and to prepare their IS specialists to deal with a growing demand and application of those systems in all areas of industry. The following section discusses the alternatives currently in use to incorporate Expert Systems into the Business School curriculum.

Ⅴ. Alternatives for Incorporating Expert Systems in the Business Schools' Curriculum

The 13 IBM MoIS Grant Schools have had substantial resources to develop their IS curriculum. An analysis of the syllabus of the courses of the courses they offer provides guidance of the alternatives available for incorporation Expert Systems in IS. There are three major alternatives:

1 - Including a complete course on Expert Systems.

2 - Including Expert Systems as a major topic in a course

3 - Including Expert Systems as one of many topics in a course

Six Schools offer courses on Expert Systems. The focus of those courses is generally to intr-oduce Expert Systems to Management Students and to prepare specialists in the development of Expert Systems technology and Knowledge Representation. There is no agreement on the text books or tools to use. Every course uses a different text book, and those who use Expert

Table 6. Schools Offering Courses on Expert Systems

University	Course Code	Course Name
Univ. of Arizona	MIS-589	Introduction to Expert System
UCLA	270E	Expert Systems for Management
Univ. of Georgia	Man-878	Development of Knowledge Based Systems in Business
Georgia St. Univ.	CIS-875	Expert Systems
Univ. of Illinois	BA-490E	Expert Systems for Decision Support
Univ. of Minnesota	DSCi-5040	Expert Systems: Knowledge for Competitive Advantage

Systems Shells to give a hands-on approach to the course, do not use one standard tool.

Including Expert Systems as a major topic in a course is generally done on two different types of courses: a course on Artificial Intelligence or knowledge representation, and a course on decision support systems. The AI course is generally similar to the AI course that one would expect from a Computer Science department. The major difference is that Business Schools may focus more on the applications than on the theory. Four Universities offer this alternative.

Table 7. Schools Including Expert Systems as a Major Portion of a Course that also addresses other topics

School	Course code	Course Name
Univ. of Arizona	MIS-680	Artificial Intelligence and Expert Systems
Georgia stat. Univ.	CIS-874	Artificial Intelligence
Georgia State Univ.	CIS-876	Knowledge Representation and Reasoning
Univ. of Illinois	Acct-493	Decision Support Systems
Univ. of Illinois	BA-490D	Artificial Intelligence and Knowledge Base Management Systems
Univ. of Rochester	CIS 481	Decision Support Systems
Univ. of Texas Austin	DPA381.12	Artificial Intelligence and Expert Systems
Univ. of Texas Austin	BA390E	Human Information Processing and Information Requirements Analysis

Including Expert Systems as a major portion of a course on Decision Support Systems focuses on the uses of Expert Systems to support unstructured or semi-structured decisions. Two universities dedicate three weeks, or more, to Expert Systems in these courses.

Including Expert Systems as one of many topics in a course is generally done in two courses:. an introduction to MIS (IS3 in Table 8), and a course on Decision Support Systems (IS7). Those courses generally dedicate one session to Expert Systems. However, depth of coverage varies from a small discussion to several sessions, a couple of readings and a case study. Other courses can also include Expert Systems as a topic in one of their sessions. Table 7 reviews all the courses that mention Expert Systems taught at the 13 MoIS Grant Schools. It is organized around the ACM Curriculum Recommendations [Nunamaker, Couger and Davis, 1982].

Table 8. Courses that include Expert Systems as a topic

Code	Course	School	Depth of Coverage
IS1	Computer Concepts and Software Systems	U. of Arizona MIT	One session
IS2	Program, data and File Structure	Claremont	Two lectures introducing AI and ES data structures
IS3	Information Systems in Organizations	U. of Georgia U. of Illinois U. of Minnesota U. of Pittsburgh U. of Rochester U. of Texas Austin	1 to 2 sessions introducing the issues
IS4	Database management Systems	U. of Arizona	1 session overviewing expert DBMS
IS5	Information analysis	UCLA	2 sessions surveying Applications of ES
IS7	Modeling and Decision Systems	UCLA Claremont MIT U. of Pittsburgh U . of Texas Austin	1 session to 3 weeks discussing applications and issues
IS8	Systems Design Process	U. of pittsburgh	2 sessions discussing ES design problems

Including the topic in the IS1 introductory course would assure that all Business Majors benefit from knowing, at least briefly, the characteristics and uses of Expert Systems. This way, the concept will not be completely new when it is introduced in their departments. Including the topic in IS7 would give those specializing in IS a deeper understanding of the issues and opportunities involved. If the Schools' objective is to prepare specialists capable of developing Expert Systems, it is necessary to spend more than a few sessions discussing the topic. In those cases, a complete course, or at least a major portion of one should be dedicated to the development of Expert Systems. Readers are encouraged to review the specific course syllabi for more details on each alternative.

VI. Limitations of the Study

One assumption drives this study: that industry has decided to adopt Expert Systems because it realizes benefits from their use. However, because of the relatively small time that those systems have been in use, it is conceivable that they would only be in the pilot stages, and users have not passed the learning stages. Questions about the expected future of Expert Systems are based on the respondents' opinions and are not corroborated by other measures. However, the results indicate that Expert Systems are widely in use and that industries are realizing benefits from their use, even if those are only perceived benefits.

This study was not an exhaustive sample of industry. The constrained geographical location of the respondents may have biased the responses to those form manufacturing industries (prevalent in the Detroit area). However, the results reflect the needs of at least one primary segment of industry. The study does not attempt to identify those departments and industries that do not use expert systems and cannot be used to explain the factors that make Expert Systems use successful or unsuccessful.

The discussion of the alternatives for teaching Expert Systems are based only on an analysis of those options already in use by IBM MoIS Grant Schools. The group was selected based on the assumption that they had substantially more resources to develop new courses and improve their curriculums (which was one of the objectives of the grant). However, the list of available possibilities is comprehensive and presents at least one example of all possible alternatives.

VII. Conclusions

This study presented a survey of industry that indicates that:

1. Expert Systems are tools used in several areas of businesses.
2. Expert Systems use is expected to grow in the future.
3. Industry has generally had to absorb the cost of training people in Expert Systems technology.

This implies that Business schools would serve their student body better by exposing them to

these relatively new tools. The study reviewed the alternatives used by IBM MoIS Grant Schools to incorporate Expert Systems in their curriculum. Three alternatives are available:

1. Dedicate a full course to Expert Systems
2. Make Expert Systems a major topic in a course
3. Include Expert Systems as one of many topics in a course

To expose the general business student to Expert Systems, a School may choose to include the topic in the introductory class to MIS, which is required of most General Business students. To prepare specialists capable of supporting of developing Expert Systems at least a major portion of a course is required. Alternatives two of three are recommended depending on the depth of coverage and career path desired of a School's graduates.

Further studies may include a larger sample with an unbiased selection method to identify the real level of penetration of Expert Systems Technology in industry. The study may also question the type of involvement of the respondent with the Expert System, and the way in which the system was selected. This could be helpful in determining level of coverage required for the topic for the general and specialists courese.

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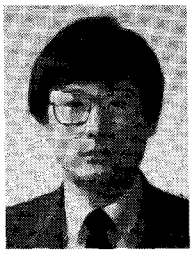
End Notes:

1-The analysis of IBM MoIS schools' programs and courses was based on the syllabus presented in [Frand, et al, 1990-1].

◇ 저자소개 ◇



저자 양경훈은 Univ. of Georgia에서 경영학석사, Purdue Univ.에서 경영학 박사학위를 취득하고 Univ. of Detroit에서 조교수를 역임하였으며 현재 중앙대학교 산업정보학과 조교수로 재직중이다. 그의 관심분야는 전문가시스템과 경영과학기법의 결합, Modelbase mangement Systems, Fuzzy Logic 이론의 경영분야 응용, Neural Network의 경영분야 응용, 정보통신을 이용한 Distributed Decision Support Systems의 구축 등 이다.