

# A Review of Expert System in Information System Audit

A. B. Devale<sup>#</sup>, Dr. R. V. Kulkarni<sup>\*</sup>

<sup>#</sup> Arts, Commerce & Science College,  
Palus, Maharashtra, India

<sup>\*</sup> Shahu Institute of Business Education & Research (SIBER),  
Kolhapur, Maharashtra, India

**Abstract-** The advent of leading edge auditing techniques which allow auditors to identify risks and evaluate the adequacy of controls over critical information systems in their organizations, has far reaching consequences for many areas of companies' activities. More and more organizations are moving to a computer-based audit approach that can be adapted to develop and improve the continuous audit process. This approach is used to assess risk and to assist an IS auditor's decision to do either compliance testing or substantive testing. In a computer based audit approach, IS auditors are not just relying on risk. They are also relying on internal and operational controls as well as knowledge of the organization. This type of computer assessment decision can help relate the cost/benefit analysis of the control to the known risk, allowing practical choices. A knowledge based approach to an Information Systems Audit will enable us to develop an overall and effective IS Audit plan which will consider all the potential weaknesses and /or absence of Controls and determine whether this could lead to a significant deficiency or material weakness. In order to perform an effective Risk Assessment, it is needed to understand the Client's Business Environment and Operations.

**Keywords:** Artificial Intelligence, Artificial neural network, EDP, Expert System, Decision tree,

## I. INTRODUCTION

Information system auditor's main objective is to formulate an opinion about the effectiveness and the contribution of information systems to enterprise objective. His or her judgment can be influenced by factors such as his knowledge of the organization information systems, and the degree of risk of misstatement through errors. More generally, the purpose of an information technology (IT) audit is to evaluate IT controls. IT auditor assesses and advises on the following aspects of information technology: effectiveness, efficiency, exclusiveness, etc. Although there is no common understanding regarding the appropriate evaluation theory, however, there are three main concepts that structure the audit process: information systems processes and domains, audit criteria, and audit framework. IT auditor should have IT, financial, and operational audit experience. The ideal IT auditor should be able to discuss IP routing with the network folks in one hour and financial statement disclosures with the controller in the next. And, as with all audit positions, communication and other soft skills are crucial as well. The growing complexity and vulnerabilities of computer networks requires that all auditors have some degree of technical expertise.

## The use of Computer Aided Audit Techniques in an IS Audit

The Information Systems Audit Standards require the course of an audit, the IS auditor should obtain sufficient, reliable and relevant evidence to achieve the audit objectives. The audit findings and conclusions are to be supported by the appropriate analysis and interpretation of this evidence. Computer Assisted Audit Techniques are important tools for the IS auditor in performing audits. They include many types of tools and techniques, such as generalized audit software, utility software, test data, application software tracing and mapping, and audit expert systems. Computer Aided Audit Techniques may be used in performing various audit procedures including: Tests of details of transactions and balances (Substantive Tests)

- Analytical review procedures
- Compliance tests of IS general controls
- Compliance tests of IS application controls

Computer Aided Audit Techniques may produce a large proportion of the audit evidence developed on IS audits and, as a result, the IS auditor should carefully plan for and exhibit due professional care in the use of Computer Aided Audit Techniques. The main difficulty and modelling and formalizing knowledge in the audit field is the complexity of information system audit, which requires performing of some expertise that use knowledge from separate or interrelated field of knowledge. The purpose of this paper is to examine the current state of expert systems and decision support systems in auditing. In so doing we will examine completed or prototype expert systems and decision support systems in both external and internal auditing, including special areas of focus such as EDP auditing and governmental auditing. This paper focuses on those auditing based systems those have appeared in the literature or have been presented at a conference or of which the authors are aware.

## II REVIEW OF LITERATURE

### Denning [1987]

He has discussed such a system designed to protect the operating system. That system is based on the hypothesis that exploitation of systems involves abnormal use of the system. Thus, by detecting abnormal use of the system, security violations can be detected.

**Kelly [1984, 1987]**

He developed a prototype model ICE (Internal Control Evaluation) to aid in the audit planning process. ICE featured a knowledge hierarchy of three different levels. The first level included knowledge about the industry, economy, management and the audit history. The second level focused on the client environment, the organization, planning manuals and accounting procedures. The third level focused on internal control functions in the purchasing process. ICE was developed using USP. Unlike most expert systems, ICE made use of both frames and rules.

**Selfridge and Biggs [1988]**

Through his research, it was reported that there were six categories of knowledge, including events, inter-event causality, company function (financial model and operations model), events/financial performance causality, measures of financial performance and going concern problems. In that model there were 140 event frames and 215 entity frames.

**Dillard and Mutchler [1986]**

They have done extensive work in the area of modelling the auditor's going concern opinion decision. Their system was developed on a DEC 2060 using a menu shell, XINFO. The system apparently employs approximately 450 decision frames or nodes in a decision tree. The intelligence in the system is in the decision structure and hierarchy.

**Bailey et al. [1985]**

He proposed first auditing-based system TICOM which was the to implement artificial intelligence techniques in the system. TICOM (The Internal Control Model) is an analytic tool that aids the auditor in modelling the internal control system and querying the model in order to aid the auditor in evaluating the internal control system. TICOM was implemented in Pascal.

**Arthur Young (1985)**

He has taken a single product, multiple component, middle-out strategy in the development of their decision support system, AY/ASQ. AY/ASQ is software designed to automate the audit process for manufacturing environments. AY/ASQ was developed in an Apple Macintosh environment. The operation for each of the applications is similar to the other applications. The system consists of several modules including Decision Support, Office, Trial Balance, Time Control and Data bridge

**Hall[1987]**

His research address the problem of determining "Which Organizations should be audited to achieve the maximum collection of monies due to the state of Pennsylvania?" The general research goal of the paper is to determine how a computer program can be programmed to learn. In order to accomplish that goal they chose a genetic learning approach. Genetic algorithms learn by employing different combining rules on responses, such as inversion and mutation. For example, the system may combine the two sets of characteristics abc and cde to form ace, in its search for a better set of characteristics.

**Vasarhelyi [1988]**

He argued that recent advances in hardware and software technology are engendering increasingly complex information systems environments, thus, requiring

increasingly complex audit approaches. He suggests that audit management utilize decision support systems, management information systems and management science models to identify and project the deterioration of controls that can occur between audit engagements.

**Denna, E. L., Hansen, J. V., Meservy, R. D.[1991]**

The authors evaluate research and development in the design of expert systems for the audit domain, providing an overview of the domain of expert judgment involved in the audit process. A framework used to present and analyse work to date and to guide future efforts is constructed. Methods of knowledge acquisition being used to develop audit applications are examined. The authors address knowledge representation for the audit domain.

**Zong-pu Jia, Zhi-lin Yao, [2005]**

They carried Network security research which is an important aspect of CSCW (computer supported cooperative work). It helps to make work environment essential and reliable. Access control security technology mainly includes firewall technology, intrusion detection technology, and security auditing technology. These technologies still have some problems and shortages though they are matured in some degree. The expert system for preventing and auditing intrusion is a series of software and hardware systems for reducing the risk of computer network security.

**K. Kozhakhmet, G. Bortsova, A. Inoue, L. Atymtayeva [1996]**

They commented that Information security auditing plays key role in providing any organization's good security level. Because of the high cost, time and human resource intensiveness, audit expenses optimization becomes an actual issue. One of the solutions could be development of software that allows reducing cost, speeding up and facilitating Information Security audit process. We suggest that fuzzy expert systems techniques can offer significant benefits when applied to this area.

**Davis et al. (1997)**

He presented a construction of a prototype, which integrated an ES and an ANN. The rules were contained in the ES model basic CRA heuristics, thus allowing for efficient use of well-known control variable relationships. The ANN provided a way to recognise patterns in the large number of control variable inter-relationships that even experienced auditors could not express as a logical set of specific rules. The ANN was trained using actual case decisions of practising auditors. The input variables were judgement cues/variables from general environment, computer processing, general computer and accounting controls. The ANN model provided the auditor with information on how close a risk category border was.

**Ramamoorti(1999)**

He used both quantitative (26 variables) and qualitative (19 variables) risk factors as input variables in the models. The risk was defined in an internal auditing context. The models were in the context of a public state university. The quantitative data were downloaded from the University of Illinois Financial and Administration System. The qualitative risk factor values were elicited from audit staff using a pre-defined scale from 0 to 9. The eventual number of variables selected to construct the models were in the 7

to 18 range. The research project included a Delphi study and a comparison with statistical approaches, and presented preliminary results, which indicated that internal auditors could benefit from using ANN technology for assessing risk.

#### **Moore(1995)**

He commented that to develop an ANN to serve as either a hand-written character or speech recognition device and to integrate the ANN with existing software (for example, word processor, spreadsheet, etc.) might be useful for authority checking. An auditor may analyse minutes and other documents of the entity with an ANN.

#### **Curry and Peel (1998)**

They provided an overview of the ANN modelling approach and the performance of ANNs, relative to conventional ordinary least squares (OLS) regression analysis, in predicting the cross-sectional variation in corporate audit fees (AF). The data was derived from a sample of 128 unquoted UK companies operating in the electronic industrial sector.

#### **Moeller (1988)**

He relates the audit of expert systems with existing audit literature, and discusses the relationship of Statement on Auditing Standards (SAS) as part of his discussion; he notes that "while there is a growing body of other literature covering the auditor's use of expert systems, there is very little published material on audit techniques for reviewing expert systems." Moeller's paper summarizes many techniques and points to a body of work on those techniques that has developed recently: the literature on verification and validation.

#### **Kick (1989)**

He discusses some of the risk exposures associated with expert systems resulting from a loss of strategic or competitive position, an inability to sustain growth, and a loss of strategic knowledge. The primary emphasis in his report is on ensuring that the auditor examine expert system applications to determine whether they are properly applied; are deployed to gain strategic advantage; are cost-effective; are well designed and operationally efficient; minimize exposure to fraud, poor decision making, and other consequences; are used by individuals who are properly trained; are easy to maintain; and are continually updated.

#### **Watne and Turney (1990)**

They briefly analysed expert systems as a target of an audit. They suggested that systems that directly impact the balances in the financial statements or that provide information to the auditor individually be the potential targets of audits. They also analyse some of the controls in expert systems using a structure based on general and application controls.

#### **McKee's (1991)**

His research suggested that AICPA Statements on Standards for Attestation Engagements (SSAE) , Attestation Standards might play a critical role in the audit of expert systems, and although it applies to independent CPAs, it may also provide useful guidance to internal auditors. Attestation Standards indicates that an audit should be done by someone who has adequate technical knowledge and proficiency, in this case in expert systems verification and validation, and in the specific domain.

### **III CONCLUSION**

Although the above mentioned auditing techniques are still in the early stages of development, most of the researches are based on security measures and applications such as accounting information system. A large proportion of the current research effort is limited to the researchers that are normally associated with professional associations and organizations related to information systems auditing. Computer programs, such as expert systems, can be used to improve the consistency of human responses and mitigate errors. Utilization of the expert system will lend consistency, thoroughness and verifiability to the audit opinion decision process. Certainly there is feasibility and the benefits of applying expert systems methodology to Information system auditing. As the system evolves, it can acquire more knowledge from experts in the field of Information System Auditing and gradually take over some additional, more judgmental, tasks. Similarly, according to above review less work has been done in the field of Information System Audit. Hence researchers propose a system as a start towards a longer-range goal of expert systems for information system audit and administration. The system will be one component in provision for risk assessment, maximizing security, and, its integrity will depend upon the soundness and completeness of the auditing procedures that it will implement. Also system will demonstrates the feasibility and scope of potential automation of the information system auditing procedures and exhibits underlying issues, limitations and concerns.

### **REFERENCES**

- [1]. Denning, D., "An Intrusion Detection Model," IEEE Transactions on Software Engineer-ing, Vol. SE 13, No.2, February 1987, pp. 222-232.
- [2]. Kelly, K P., "Modeling the Audit Planning Process," Expert Systems Review, Volume 1, Number 1, 1987.
- [3]. Selfridge, M. and Biggs, S., "GCX, A Computational Model of the Auditors Going Concern Judgment," Unpublished paper presented at the Audit Judgment Symposium, University of Southern California, February 1988
- [4]. Dillard, J.F. and Mutchler, J.F., "Knowledge Based Expert Computer Systems for Audit Opinion Decisions," Unpublished Paper presented at the University of Southern California Symposium on Audit Judgment, 1986.
- [5]. Bailey, AD., Duke, G.L., Gerlach, J., Ko, G, Meservy, RD., Whinston, AB., "TICOM and the Analysis of Internal Controls," The Accounting Review, 60, April, 1985, pp. 186-201.
- [6]. Arthur Andersen & Co., Financial Statement Analyzer, Unpublished report, December 1985.
- [7]. Hall, M., Meservy, Rand Nagin, D., "Audit Knowledge Acquisition by Computer Learning." Unpublished paper presented at the ORSNITIMS Meeting, New Orleans, May, 1987.
- [8]. Vasarhelyi, M., Halper, F., and Fritz, R., "The Continuous Audit of Online Systems," Unpublished Paper presented at the University of Southern California Audit Judgment Conference and the National Meeting of the American Accounting Association, 1988.
- [9]. E. L. Denna, J. V. Hansen, R. D. Meservy, Development and Application of Expert Systems in Audit Services, Published in: IEEE Transactions on Knowledge and Data Engineering archive, Volume 3 Issue 2, June 1991, Page 172-184
- [10]. Zong-pu Jia, Zhi-lin Yao, Computer Supported Cooperative Work in Design, 2005. Proceedings of the Ninth International Conference on 24-26 May 2005, Volume: 2 Page(s):852-855, Vol.2
- [11]. K. Kozhakhmet, G. Bortsova, A. Inoue, L. Atymtayeva, Expert System for Security Audit Using Fuzzy Logic , Kazakh-British Technical University, Tole bi st., 59 , Almaty, Kazakhstan
- [12]. Davis, J. T., A. P. Massey, et al. (1997). "Supporting a complex audit judgment task: An expert network approach." European Journal of Operational Research 103(2): 350-372.

- [13]. Ramamoorti, S., A. D. J. Bailey, et al. (1999). "Risk Assessment in Internal Auditing: A Neural Network Approach." *International Journal of Intelligent Systems in Accounting, Finance & Management* 8(3): 159-180.
- [14]. Moore, K., R. Burbach, et al. (1995). "Using neural nets to analyze qualitative data." *Marketing Research* 7(1): 34-38.
- [15]. Curry, B. and M. J. Peel (1998). "Neural Networks and Business Forecasting: An Application to Cross-Sectional Audit Fee Data." *International Journal of Commerce and Management* 8(2): 94-120.
- [16]. Moeller, R. "Expert Systems: Auditability Issues." Paper presented at the 1st International Symposium for Expert Systems in Business, Finance and Accounting, Oct. 1988. Publication forthcoming in *Expert Systems in Business and Finance*. New York: John Wiley.
- [17]. Kick, R. "Auditing an Expert System." *Expert Systems*. Summer 1989,33-38.
- [18]. Watne, D. and P. Turney. *Auditing EDP Systems*. Englewood Cliffs, NJ.: Prentice-Hall, 1990, 555-590.
- [19]. McKee, T. "An Audit Framework for Expert Systems." *Expert Systems Review*2 (no. 4, 1991).