

DISCUSSION OF Automated Dynamic Audit Programme Tailoring: An Expert Systems Approach

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The choice of audit planning¹ and program tailoring as the arena for the application of expert system technology is a fortunate one. Audit practice tends to use predecessor working papers and company practice as well as auditor experience as the primary source of procedure determination. The Grant Thornton approach to this problem in the development and preliminary implementation of ADAPT (Automated Dynamic Audit Programme Tailoring) has been a mixture of their audit procedures guides with a pragmatic implementation of approaches drawn from the academic literature.

The area of procedure planning is rich in knowledge and experience. Knowledge bases can be drawn from actual working papers, audit guides, and the knowledge of individuals. The ADAPT system is among the second generation of systems with embedded expertise that public accounting firms have developed for audit practice. The first generation² of systems focused on problems of narrower domain and used an evolving software technology. The second generation is using a richer set of software tools and the background of awareness of successful applications of expert systems in many domains of knowledge.

This discussion focuses on specific issues raised by the paper. ADAPT seems to be a well thought-out system that brings together the best of practice and a series of academic concepts that allow for the automation of the process. While the paper and the underlying system are clearly among the most interesting and promising works in the area, the ultimate test is its acceptability in practice and the quality of audit plans it generates under use.

Experience with the first generation of systems indicates enthusiasm and investment in the products and subsequent lack of implementation on a firmwide basis for most of the products. The reasons for this phenomenon are multiple and difficult to diagnose, but resistance to change, lack of confidence in machine-generated knowledge, systems that do not focus on the real problems, and developers' lack of comprehension of the practice environment are often cited as causes.

The ensuing comments are mainly geared to the paper and some issues it raises. From an academic prospective, simply the fact that these points are raised and potentially examined is already a great achievement. Gillett and Grant Thornton should be commended.

ON CONCEPTUALIZATION

The objectives of ADAPT can be summarized into the statement that it aims to produce a program that provides the **adequate** amount of evidence. "Optimal evidence" level is not an operationalizable concept at the current level of audit technology. This statement, however, can

¹Price Waterhouse has also focused in the area of audit planning and program development as a site for expert systems development. Their approach is somewhat different from Grant Thornton's in terms of user interface and the methodology for programmatic development (Hodgson 1992).

²Systems such as Coopers & Lybrand's *ExpertAX* (Shpilberg and Graham 1986) and Peat Marwick and Main's *CFILE* (Kelly et al. 1986) were the pioneers in the application of expert systems in accounting and auditing.

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be taken that it aims to avoid over- or under-auditing.

The system contains knowledge about financial statement areas, transaction streams (flows), assertions, audit procedures, and links between level and flow statements as well as between assertions and relevant audit procedures.

Assertions are placed in a hierarchy where (1) overall audit risk leads to (2) financial statement items, (3) to assertions, (4) to sources of audit reliance and ultimately to the outcome, (5) audit procedures.

In using the system, the auditor answers a series of questions about the client and loads necessary files. Then he or she proceeds to generate or tailor an audit program by selecting a financial statement area. A list is created by the system specifying relevant assertions. These procedures are related to a certain degree of "derivable assurance" that can be obtained by their application and the relevance of this procedure. The concepts of Reliability, Evidential Power, Scope, Maximum Derivable Assurance and Evidential Value are also defined and incorporated in the scheme (Boritz and Wensley 1990). Evidence is then aggregated to support analysis along the Audit Risk Model. These steps lead ultimately to the selection of an audit program tailored to the auditor's view-of-the-world and using the firm's knowledge base.

ON IMPLEMENTATION

The author states that there is no need for the auditor to understand ADAPT's internal method of operation. Clearly, a complex set of methods used to infer the audit program may be too much for the ordinary audit senior. On the other hand, the literature in the implementation of operations research seems to indicate that if a manager does not understand a black box model, he/she will be hesitant to use it.

ADAPT is designed as a tail-end/front-end in other Grant Thornton audit-automation programs. In the long range it would be desirable that most of these tools be fully integrated to the point where functions interact. Probably, this approach will have to wait for the third generation of ES tools.

The system keeps records on questionnaire answers for past audits, flags certain answers given by the auditee, and prepares certain reports to help in the review process. This book-keeping process is probably of great value for documentation and continuity purposes.

The system's control panel allows for the tailoring of different factors related to programmatic choice, among which are included choice of rules aggregating direct assurance, the consideration of diversity, choice of method aggregating indirect assurance, choice of rules for combining direct and indirect assurance, and the ability to modify the overall audit risk used to plan the audit work.

The system was well engineered with excellent user interfaces, operable on a portable microcomputer, and of modular structure with knowledge-base, data and the inference engines separate and well maintainable. Of particular interest are the assessment bars and the ways the auditor communicates with the system to see choices or to state judgments. These are very user-friendly and seem to be intuitive for auditors.

Current PC technology provides an interesting set of trade-offs. Systems of this type are very demanding in terms of cycles and data storage. Consequently, they are greatly handicapped by the requirement of running on a PC or, even better, a portable. On the other hand, its portable availability and a PC delivery devices seem to be essential for the CPA firm deployment. Therefore, compromises have to be made on the scope of the instrument and the hardware capability. Recent developments in technology and availability of CD ROM and more powerful chips already allow for more comfortable compromises than the ones made in ADAPT that were started over three years ago.

VALIDATION

This paper describes an implemented expert system. This description was supplemented at the USC audit symposium by a demonstration of the system and a generic verbal description of the status of development. The fact that the system exists and functions is already a lim-

ited form of validation. It linked a set of empirically-based knowledge to a series of methods advocated by researchers³ to deal with assertions and to incorporate opinion into the audit risk model as well as to resolve ambiguities.

The testing and validation performed by the author and the firm are just the start of a long process of cleansing, testing, and operational adaptation. Many systems have been abandoned at this stage as they did not resolve the real problem of practice, under certain conditions presented absurd results,⁴ were too threatening to the users, required too large a continuing investment for its full deployment, had an inadequate knowledge base, the inferencing mechanisms were inadequate, etc.

At this stage the system needs to be carefully deployed and its usage monitored. The ultimate evaluation of this type of system is its acceptance on a firmwide basis. On the other hand, even without successful usage, this type of work advances the state-of-the-art.

OPINIONS AND GENERIC ISSUES

The knowledge elicitation and representation methods described in the paper are a mix of traditional methods of gathering knowledge associated with good behavioral practice to obtain participation and acceptance. A series of other studies in the audit area have used variations on the methods or ways of knowledge representation. On the other hand, the issue of usage of panels of experts as opposed to individual experts is described as "creation of knowledge." Despite the assertion of the author, this is not unusual in these systems when the domain of knowledge is *diffuse*.⁵ In this case experts are complementary and add to each other's knowledge, with the knowledge engineer serving as the catalyst and recorder.

Another complicating factor in this formalization of knowledge is that in addition to **fac-**

tual and **experiential** knowledge, systems are now including **mathematical or statistical models** as a part of their knowledge mix. How to integrate these models into the knowledge mosaic is an area still open for research and consideration. The ADAPT approach uses a mix of empiricism and logic to mix the Boritz and Wensley Bayesian formalism with heuristic rules and capricious auditor choice. Much still needs to be learned in creating these hybrid structures.

Another interesting issue concerning systems of this type is the nature of their usage. They can be used purely as **advisory** and all alterations to the program accepted; or they can be viewed as **operational**, where auditors have to justify variations to the suggested program and the tool is used as a way to maintain homogeneity in the audit practice. This second type of usage requires great confidence in the tool and typically a more mature type of audit organization that has been using decision aids for many years, unlike our typical major CPA firm.

CONCLUSION

This is one of the emerging second generation expert systems. Its implementation is a long process and this paper describes only the first steps. Loose integration with other audit-related tools will rapidly give way to integrated sets of tools and maybe impounded audit processes, leading to a continuous process audit methodology. Regardless of its implementation stage and success of the work in practice, its value to the literature is great.

³Mainly Boritz and Wensley (1990) but also Leslie et al. (1986).

⁴The system did not have a gracefully declining domains of knowledge or self-insight in the resolution of ambiguities.

⁵See Vasarhelyi and Halper (1991) for a discussion of the capture of diffuse knowledge in the comprehension of large software systems.

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