Auditing
A Journal of Practice & Theory
Vol. 4, No. 1
Fall 1984

PRACTICE NOTE

Automation and Changes in the Audit Process

Miklos A. Vasarhelyi

MINICOMPUTERS, telecommunications, distributed processing, transaction-driven systems: these recent advances in data processing technology have created major challenges for auditors. Not only must these technological changes be assimilated into both corporate and public accounting EDP auditing units, but public accountants must also revise the way in which audits are performed on clients adopting new technology. The problems are compounded in public accounting by competition among firms for market position and audit fees. The audit firm that adapts to technological change has the potential to audit at lower cost and to convince clients and prospective clients that it possesses a relative competency advantage in audits of complex systems.

In this paper, we examine audit process changes that might result from automation. We begin by discussing the state-of-the-art in auditing and expose the need for and ways to integrate automation into the process. Audit process change is then analyzed in two dimensions: changes in the general environment and changes intrinsic to the process. The last section contains a summary.

STATE-OF-THE-ART AUDITING

The audit process is highly labor-intensive. Auditors often find themselves using manual methods to examine automated accounting systems. This technological limitation is a natural consequence of methods that have survived experimental and legal testing in an environment resistant to change. Currently, computer audit techniques reflect the direct computerization of manual audit methods instead of a reanalysis and redesign of the en-

---

Miklos A. Vasarhelyi is Associate Professor of Accounting at Columbia University.

The research assistance of Ms. Maura Hunter, Evelyn Faillace, and Desiree Kim was appreciated. The comments of Professors Richard Savich (University of Southern California), William Messier (University of Florida), James Loebbecke (University of Utah), Louis Qualkenbush (Marathan Oil), Nancy Preis and C. J. McNair (Columbia University), as well as two anonymous reviewers, are gratefully acknowledged.

tire audit process. This approach minimizes behavioral resistance to change but does not reap the full benefits of data processing implementation.

Conversely, designers of accounting systems have used technology extensively to improve the reporting function. Most major U.S. organizations now use databases, microcomputers, data networks,. and communication links in their management information systems. The combination of these factors has created a complex and exposure-rich environment for auditors [AICPA, 1982].

THE NEED FOR AUDIT AUTOMATION

Manual audit processes are inadequate in this increasingly complex environment. The AICPA, recognizing this fact, mandated the SAS #3 preliminary review [AICPA, 1973]. Cost escalation has compounded these problems, leading to decreased profit margins and an increasingly competitive professional environment. Finally, use of advanced information systems has mandated the integration of technology into the audit process. Phenomena such as automatic cash tellers have eliminated the source documents auditors are accustomed to. Consequently, auditors are requiring the generation of an equivalent machine-readable source document to capture data for audit trail purposes.

Audit usage of data processing has evolved from specific application programs, through the usage of generalized audit softwares, to the current state-of-the-art. In today's audit environment, auditors with widely differing levels of training in technological interface are employing a mixed set of audit tools. Among these tools are generalized audit softwares as well as indigenous utilities, sampling packages, and management science tools such as regression, microcomputers, and telecommunications.

These automation tools have been applied to a series of audit tasks, some of which are 1) the preparation of standardized documents (working papers, confirmations, engagement letters, proposals), 2) comparative analysis in analytical review (use of financial databases), 3) audit engagement scheduling, 4) internal control evaluation, 5) audit planning, and 6) self-contained and automated audit procedures (self-starting procedures).

The potential of automation is restricted by the human information processing limitations of the individual auditor. Consequently, the audit process is often too detailed and complex for comprehensive assimilation by an auditor. Because improved information supply is only beneficial to the extent that auditors can collect and use it, expert systems [Hansen & Messier, 1983] are being designed to aid the auditor as an expert judge. These systems incorporate the judgmental rules used by "expert auditors" to help other auditors in evaluating specific audit evidence.

AUTOMATION AND AUDIT PROCESS CHANGE

Intrinsic to the adoption of radically different technologies are process modifications in the activity being changed. Process changes in auditing are divided into two components: environmental and task-specific changes. Studies of automation indicate that unless some management processes are changed, the full impact of technological change is not absorbed. We shall now examine some of the potential changes in the *process of auditing*.

Environmental Changes

Environmental changes involve the relationships between the auditor, the location of the auditor, and surrounding factors that influence the audit task.

Physical Location of the Auditor. The auditor, particularly in a traditional EDP

setting, did not perform work at the client's site, but rather at the location of the client's EDP system. With audit workstations and teleprocessing, audits will be performed at the auditor's site, where source documents or their equivalents can be accessed directly. This will substantially increase auditor visibility and accountability while decreasing communication and transportation delays.

Time Required to Access Data. Auditors will have rapid access to the relevant client data. Random number generators can then be used to choose source documents for examination. Software can keep traces of specific machine-readable or machine-indexed documents selected, and record the result of multiple audit tests promptly. Once results are entered into a spreadsheet working paper, auditor-determined algorithms can be employed to determine the desirability and location of additional samples. Online auditing and recording permits the subsampling of different populations and identifies potential sources of systematic discrepancies. The use of optical scanning devices and/or voice recognition will further increase the speed of data access and the recording of traditional scource documents, thereby substantially reducing the time needed for information procurement and examination.

Audit Timing Issues. Currently, audits are planned for discrete time intervals and specific dates. This is a result of problems in scheduling, logistics, and cost constraints. Discrete time-interval audits decrease the deterrent power of the audit. If client source documents were kept in machine-readable form, unscheduled auditor time (such as a day) could be used for unannounced audits at the compliance and substantive levels. The audit research literature (e.g., Barefield [1975]) indicates that unannounced audits can serve as both a deterrent to client manipulation and part of the evidence collection process.

Treatment of Working Papers. Working papers follow general firm guidelines but vary substantially from office to office, engagement to engagement, and year to year. These discrepancies increase the difficulties in peer review, staff integration, and recall of events in a particular situation. The development of event data bases to facilitate research (and to avoid rediscovering solutions) within firms is complicated by this working paper variability.

Online technology will likely imply standardized but flexible working paper formatting and substantially increased indexing. Additionally, word processing software will be used for preparation, spelling checks, and standardized footnote comments. Mathematical aids will ease footing and subtotaling tasks.

A trend toward more voluminous documentation along with better "tying" of figures, improved indexing, and absence of footing errors is expected. This would imply more extensive documentation of evidential information with additional supporting schedules. Some of these schedules could be prepared automatically by imbedded programs. These programs gather random transactions, or transactions that fall within pre-specified criteria for sampling purposes.

Cross-indexing (tying) of numbers in schedules can be substantially aided by computer-based search procedures that find relationships without the page-flipping, colored-pencil, symbolized approach currently used. Current technology permits the use of multicolored displays and symbols. These will enrich the visual presentation of audit data in future years.

Internal audit departments have achieved some degree of intra-firm standardization in working paper formats. However, substantial inter-firm differences

complicate the development of standardized working paper management systems. For internal audit, working paper management systems should be both flexible and modular to allow for tailored formats and interface with data bases and communication systems.

Process change will result in extensive use of micro-based workstations during an audit, requiring that the auditor be well-versed in computer-based working paper techniques and aware of the unique exposures due to this environment, such as systematic errors, fraud, and data manipulation.

Technological Dependence. Auditors currently depend on the availability of the client's computer for part of their audit work. The evolution towards more advanced forms of auditing will depend upon changes in (1) audit decision aid access, (2) data communication links, (3) database access, and above all, (4) auditors' technical competence.

The fourth issue, auditors' technical competence, will be the principal cause of substantial changes in the audit process. Studies (e.g., Vasarhelyi & Pabst [1981]) indicate that EDP auditors are, on average, more experienced and more highly trained than their traditional counterparts. EDP training and experience is difficult to obtain; therefore, it takes more time for EDP auditors to become proficient and useful in audit engagements.

Consequently, to enable audit staffs to groom proficient, technologically-aided auditors, current career paths must be adjusted to compensate EDP auditors for their additional skills and also to lengthen the career path for these individuals. Furthermore, alterations to the present curricula for college accounting training will be necessary to include increased exposure to data processing, command over data base and communication interfaces, and increased knowledge about computerized business systems.

Process-Specific Changes

We shall now examine changes in the audit process vis-a-vis automation by considering its main elements: engagement definition, engagement planning, internal control evaluation, compliance and substantive testing, and attestation.

Repetitive Document Preparation. Large law firms that engage in repetitive contracts have established contract clause data bases in their word processors. The actual contract preparation usually entails paragraph selection, but seldom are paragraphs actually rewritten. Dictionaries of types of opinions, caveats, qualifications, restrictions of scope, etc. are being used by these law firms to decrease the legal expense of creating new wording on an *ad hoc* basis and of searching for similar precedents and established disclosure wordings. This same concept could be extended easily to audit contracts, engagement letters, and other engagement definition documents. Auditors could transfer some of the word processing technology they already employ in clerical tasks to the audit process, thereby spending less time and effort writing and recording standard documents and clauses.

Client Investigation (analytical review, database queries). A substantial number of databases are currently available for the examination of financial statements, stock prices, legal precedents and rulings, and other issues. These can be used for analytical review in both time-series and cross-sectional analyses. This database availability could result in a widened scope for analytical reviews at both client investigation and engagement planning stages.

Risk Assessment. A series of different methodologies has been proposed for the

assessment of audit risk. Automation would permit the usage of simulation, "what if . . . " models, and sensitivity analysis in audit risk assessment.

Planning Matrix (spreadsheet software utilization). Spreadsheet software (e.g., Visicalc™, Lotus 1-2-3™)[1] can be used to plan and schedule engagements. In addition, these plans can be incorporated into actual budgets and serve as audit control mechanisms. Multi-year models can then be used in personnel scheduling to improve audit management and decrease multi-year risk. The yearly choice of areas to be audited would be part of this risk minimization process.

Personnel Scheduling. Operations management systems and software such as linear programming have enhanced the art of resource utilization management [Balachandran and Steuer, 1982; Summers, 1972]. This knowledge can be applied in combining scientifically-based short- and long-term assignment management of auditing personnel. Stochastic techniques might be used for personnel "overbooking" and task completion estimation.

Computerized ICQ's and Automated Flowcharting. Internal controls are complex and interlinked. The automation of Internal Control Questionnaires (ICQ's) may provide a basis for "tailored" ICQ's based on industry, company size, and error experience. ICQ flowcharts can describe document flow and control points and can be compared to actual values in order to evaluate system integrity. ICQ's and flowcharts can be overlapped to form an "optimal set" or a critical set of controls. The large number of logical linkages and experience-based evaluation rules entailed in this process makes it a likely candidate for an expert system application [Messier & Hansen, 1982].

Multiple Sampling Plans. SAS #3 requires a preliminary review of EDP-audit-based systems to identify document flows. Automated tagging and tracing techniques will improve this process by automatically sampling from prespecified or random positions in the audit trail. Computationally complex sampling plans can become quite simple when used with state-of-the-art data processing. These plans can be linked directly to the compliance and substantive testing process. This will expand the scope of audits, aid in the documentation of audit costs, and increase audit reliability.

"Over the Shoulder" Supervision of Compliance. Most interactive systems allow the operator (or someone with high priority) to link visibly or invisibly with another terminal and observe the user/system interaction in process. This feature can be used for the audit of the user's alertness in interactive systems as well as his or her compliance with internal control rules. Internal auditors can then be integrated into the supervisory procedures and thereby serve as deterrents to exceptions. This unannounced supervision raises ethical issues that may be contested by unions and/or resented by the operations staff. Careful attention and open treatment of the issues can clear the road for "over-the-shoulder" supervision and audit.

Source Document Retrieval Automation. Modern storage technologies can lead to increased levels of source document storage for data-processable media. Software may be designed to retrieve these data according to some predetermined sampling plan and to generate tables of document availability, content, location, and updates.

---

[1] Trademarks of VisiCorp and Lotus Development Corporation, respectively.

The combination of word processing, recorded client files, and automated sampling plans will generate economies in the audit. This will improve the preparation of confirmations by gathering further evidential matter based on these improved costs/benefits.

Integration Algorithms. Expert systems [Hansen & Messier, 1983] may be used to supplement audit judgment. Knowledge bases and policy-based heuristics will be used regularly to aid in judgment, to decrease decision variance, and to ensure the consideration of particular issues. These "decision aids" will not replace the auditor but will be regular parts of an audit team's routine, thereby changing auditing's texture, hierarchy, supervisory quality, and review procedures.

Among these "expert helpers" in the immediate future, "sampling helpers" (for sample size and transaction choice), "ICQ evaluators" (for finding critical combinations of internal controls), and "accounting rule memory joggers" (for the identification of relevant accounting rules) show promise. Over the long run, more intricate systems, representing the knowledge of sophisticated and specialized auditors, will evolve.

CONCLUSIONS

In this paper we have examined the evolution of the audit profession and processes in light of the advent of automation. We have noted that the use of data bases, data communications, micro and minicomputers, expert systems, and management science techniques will affect the audit process substantially.

General process changes are likely to occur in 1) physical location of the auditor, 2) time required for data access, 3) audit timing, 4) working paper treatment, and 5) technological dependence.

The specific audit steps that will probably experience change are 1) engagement definition (contract preparation and client investigation), 2) engagement planning (risk assessment, planning matrix, and personnel scheduling), 3) internal control evaluation (automated ICQ's, flow charts, and audit trail sampling), 4) testing (multiple sampling plans, "over-the-shoulder" supervision, preparation of confirmations, and source document retrieval), and 5) attestation (evaluation, issuance of opinions, and management letters).

In summary, the auditor's required characteristics and tasks are changing and this change must be managed. Essential to the management of this change is the understanding of how this process might evolve and its implications.

REFERENCES

American Institute of CPAs, "The Effects of EDP on the Auditor's Study and Evaluation of Internal Control," Statement of Auditing Standards No. 3 (AICPA, December 1973).

_____, "Tentative Draft of the Committee on Data Base Audit" (AICPA, 1982).

Balachandran, K. R. and R. E. Steuer, "An Interactive Model for the CPA Firm Audit Staff Planning Problem with Multiple Objectives," *The Accounting Review* (January 1982).

Barefield, Russell M., "The Impact of Audit Frequency on the Quality of Internal Control" (American Accounting Association, 1975).

Hansen, J. V., and W. F. Messier, "Expert Systems for Decision Support in EDP Auditing," *Internal Journal of Computer and Information Sciences* (Vol. 11, No. 5, 1983).

Messier, W. F., and J. V. Hansen, "Decision Support for EDP Auditing," Working Paper, School of Business Administration, University of Florida (1982).

Summers, E. L., "The Audit Staff Assignment Problem: A Linear Programming Analysis, *The Accounting Review* (July 1972), pp. 443-453.

Vasarhelyi, M. A., and C. A. Pabst, "Practices, Standards Involvement, and the Usage of the Computer in EDP Audit: A Survey," *The EDP Auditor* (Summer 1981).