

CAATs Benefits and Opportunities

This chapter discusses the benefits of CAATs and the steps that can be taken to capitalize on them, both for audit organizations and mainstream organizations. The benefits of information technology are found in all phases of the audit process, from planning through to reporting, as well as in the administration of the audit function itself. The case studies in this chapter show how the use of automated tools and techniques has improved the value, efficiency, and effectiveness of the audit function. Because results will vary for each organization, the examples focus on the techniques rather than the results achieved.

The first section discusses the rationale and inevitability of CAATs; the later sections describe the benefits of their application to audit. The final sections discuss recognizing opportunities for the use of CAATs and the transfer of audit technology.

The Inevitability of Using CAATs

The use of the computer in audit is no longer an option—it is a necessity. For example, primary audit skills may now include the ability to perform background research using database search queries and the navigation of the Internet (Alexander [1995]). Thus, embracing the use of automated tools and techniques offers auditors numerous benefits while planning and conducting audits and reporting audit results. For example, CAATs can be used to:

- Increase audit coverage by evaluating a larger audit universe
- Improve the integration of audit skills (for example, accounting skills with financial system information skills)
- Increase the independence from information system functions (programmers)
- Foster greater credibility for the audit organization

- Increase the cost-effectiveness through the development of reusable computerized techniques
- Improve the management of the audit function
- Improve the structure of the audit organization (reengineering)
- Provide real-time audit opinions

Virtually all business organizations are now using, and are somewhat dependent upon, computer systems. The widespread use of technology has changed the internal audit environment and poses new challenges and opportunities for internal audit organizations. Today's auditors face an abundance of options, with software products ranging from data analysis and fraud detection to tools that facilitate compliance with the Sarbanes-Oxley Act (Jackson [2004]). Obviously, the application of CAATTs to audit can improve the quality of an audit dramatically. The challenge to auditors, therefore, is to determine how the electronic aspects of the data can be used as an advantage rather than a liability.

Using audit software requires more effort than simply going out and buying an appropriate package. Finding the best way to equip the audit staff and accomplishing this within budget can be a difficult task (Jackson [2004]). You must be able to identify opportunities for the application of CAATTs. A basic starting point would be to consider any task that is currently being performed manually as a candidate for automated tools and techniques. However, every effort should be made to reengineer the audit process. CAATTs offer audit management an opportunity to review critically, not just how audits are being performed, but what steps are being done and why.

Data analysis and audit software, in particular, have been used successfully as audit tools for many years. Initially, the use of these packages was confined to financial areas. Auditors used audit software to perform tasks such as verifying trial balances and selecting random samples of financial transactions. More recently, audit is applying CAATTs to audits in nonfinancial areas as the utility and use of CAATTs continues to expand. Almost 15 years ago, a survey of auditors reported that 93 percent of respondents felt that the role of computer technology is likely to increase greatly over the next five years. The survey also identified mission-critical software as software most needed and depended upon by internal audit to achieve its goals and fulfill its mission. The top three mission-critical software categories were: word processing, spreadsheet, and data analysis/extraction (Prawitt and Romney [1996]). With the increase in technology and the timely reporting requirements of Sarbanes-Oxley, computer technology plays an even greater role today.

It is up to the auditor to determine how CAATTs can be used to support the objectives of each audit. More and more auditors are stepping outside traditional boundaries associated with the use of CAATTs and seeking new

ways to use these tools to improve their efficiency and effectiveness. With auditors increasingly being asked to make critical evaluations and decisions in real time, it is fortunate that audit software can support them in this endeavor. The interactive nature of CAATTs can assist organizations that must meet the Sarbanes-Oxley requirement for disclosure to the public in a rapid and current basis of material changes to financial conditions or results of operations—an impossible task without the aid of data analysis.

The tools allow auditors to react to what the data is telling them. For example, Will and others have been discussing the idea of auditing as “listening to the data.” The best uses of CAATTs will most often result when there is a healthy interaction between the auditor, the data, and the audit software, requiring a natural auditor/information systems interface (Will [1983]). Thus, the ability to ask questions and obtain appropriate answers and follow newly discovered paths to their conclusion is a major advancement of audit technology, particularly during the last 15 years.

The New IM Environment

For many years, hardware and software were treated as separate departmental responsibilities—they even had distinct procurement functions and support organizations. Those responsible for hardware and software had little to do with the business data stored in the applications, and even less contact with manual, noncomputerized business operations. Today, Enterprise Information Management (EIM) includes the hardware (IT), the software and business applications (IS), the management and administration of the data in business terms, the preparation and distribution of information, and the business processes.

Thus, there has been a change in how information is viewed and treated. It is now commonly valued as a strategic resource, and all the tools and skills required to manage that resource are typically brought under one authority. It is therefore time that auditors also change the way they look at information and utilize all the information technologies represented by CAATTs.

The New Audit Paradigm

Everyone has heard the phrases “if it ain’t broke, don’t fix it” and “don’t reinvent the wheel.” These adages are useful to remember, but too often we find ourselves constrained by mental barriers that we create for ourselves. Methods that worked well in the past become entrenched in our way of thinking. Sometimes this is good; past experiences can help us avoid pitfalls

and maximize the use of our time. However, strict reliance on past experiences can result in trying to force familiar solutions to different problems or cause us to overlook new or more efficient approaches to old problems. Even when we utilize our standard tools, such as data analysis and audit software, we must try to find new approaches to address new situations. Data analysis and audit software provide us with an opportunity to be more creative in our approach to problem solving. A shift in the audit paradigm and a corresponding change in the meaning of CAATS to Computer-Aided Audit Thought Support has been suggested (Will [1995]). This knowledge-based approach to accounting, controllership, and auditing demonstrates that the available audit software does not only become smarter with use, but also makes the auditor/user smarter as well.

Case Study 15 shows how analysis software can be used in a new way. It is an example of an approach to source code review, which is possible if the new audit paradigm of thought support is adopted.

Case Study 15: Source Code Review

A new financial system was being developed, and audit had been conducting a System Under Development Review. To date, the review had concentrated on the project management aspects of the development project and an assessment of the adequacy of the identification of user requirements. Now audit was performing a rudimentary review of a computer program. The program contained more than 370,000 lines of source code and, in order to reduce the time and effort involved, the auditors decided to use data analysis software to identify the logic points, such as the "IF/ELSE," "FOR," and "DO CASE/WHILE" statements. First an electronic copy of the source code was obtained and all "IF" or "DO CASE" statements were extracted (depending on the programming language used, other logic statement types may need to be identified). This provided the auditors with all the key decision or logic points in the program. Printing out the statement, line number, and page number allowed the auditors to easily locate the appropriate block of source code for each of the "IF" or "DO CASE" statements on the hard-copy version when more details were required. With this information and the system flowchart and narrative, the auditors were quickly able to understand the basic flow of the program and select the lines they wanted to review in detail. In this manner, the task of analyzing hundreds of thousands of lines of code was considerably simplified, and the auditors were able to focus on key logic points in the program.

This approach could also be used intelligently by auditors to identify all “ASSIGN” or “LET” statements for critical variables such as “LET DEPOSIT_AMT = DEPOSIT_AMT + 100.00” or “ASSIGN OVRTME_RATE = OVRTME_RATE+.20” or to extract all comment statements. It is also easy to calculate the percentage of comment lines compared to the total number of lines of code. This percentage can be compared to industry standards, providing a measure of the source code’s understandability and maintainability. If you do not have data analysis software, most word processors or text search software packages can be used to search for a given string.

Most audit software packages and a number of utility-type packages can also be used to compare two files. This capability can help review two versions of the source code, line by line. The official version can easily be compared to the working version (i.e., the version used to generate the object code) to identify discrepancies. Within minutes the auditor can identify new, changed, or deleted lines of code. By joining the two text files using the line number as the key field, the official and working source code copies can be combined into one file. This file would contain two fields: the first field containing the official version of the code for that line, and the second field containing the working version of the code for the same line number. A simple command to list the record if field 1 is not equal to field 2 will identify all lines that have changes, additions, or deletions—not only once, but every time this programmed approach is used.

Case Study 16: Analyzing System Logs

The technique described for reviewing source code can also be used to analyze various mainframe system-generated log files such as the Job, Problem, Change, and Configuration logs. Analyzing these files can provide audit with a great deal of useful information. For example, by using the Problem Log, the auditor can track the history of a specific problem, including the dates and nature of the corrective responses taken.

The repair/replacement activity and times for various pieces of equipment can be determined as part of an audit of backup and recovery or as part of an audit of purchasing practices. The auditor can also use date and time information to calculate the mean time to failure for specific pieces of equipment. The Configuration Log can be used to review the history for a specific piece of hardware, identifying all changes or modifications.

System activity can be examined by analyzing Job or Operator logs. Auditors can search for attempted security violations or failed logons and use the time and date information to identify patterns or trends. For example, it would be easy to determine if invalid password responses between 1:00 A.M. and 2:00 A.M. were higher than at other times of the day.

Job submissions can be reviewed by program name, programmer name, and type of activity to identify potential inappropriate use of the computer resources. Jobs can also be examined to review the time submitted and the CPU utilization in order to identify jobs that are using large amounts of resources. These may be inefficiently coded and could be using more resources than required. At one installation, a job that ran for more than six hours was reduced to less than two hours, simply by changing the input order for two databases that were being compared.

The main point being illustrated in Case Studies 15 and 16 is that data analysis, various utility-type packages, or text search software can be used to review virtually any type of file. The review can easily be repeated, particularly if a script or macro is created that can be rerun any time and anywhere. The search for specific strings like “access refused” or “invalid password” can easily be performed using the computer. Instead of having to read through thousands of lines of text, the auditor might only have to review a hundred lines or less. Using these techniques is similar to receiving a printed list with all the important lines highlighted for you, but with the added advantage that all nonhighlighted lines have been deleted. The key is to think about the audit problem in a new way and recognize that modern audit technology facilitates this shift in the audit paradigm.

Other case studies in this chapter cover a variety of types of audits including financial, personnel, and inventory audits. They demonstrate not only the flexibility and power of CAATs, but also the intellectual power gained (or expected of) any auditor using CAATs and modern audit technology.

Expected Benefits

According to the System Auditability and Control (SAC) report produced by the Institute of Internal Auditors Research Foundation (IIA [1991]), the use of information technology in audit offers numerous benefits:

- Improved efficiency and effectiveness of individual audits and of the audit department

- Ability to evaluate a larger universe and increase audit coverage
- Increased analytical capabilities
- Improved quality of activities performed during the audit
- Consistent application of audit procedures and techniques
- Increased cost-effectiveness through the reusability and extensibility of computerized techniques
- Improved integration of financial/information systems audit skills
- Increased independence from information systems functions and greater credibility for the audit organization
- Greater opportunities to develop new approaches
- Better management of audit data and working papers

The implementation of CAATTs can benefit any audit department, regardless of its size or current technology. The degree or level of CAATTs may vary considerably, and still the organization will gain certain efficiencies. It is not necessary to develop complex audit routines, embedded audit modules, or employ programmers. Simple uses of the computer can achieve a quick payback in time and resources. In fact, many significant benefits can be obtained at a marginal cost. The advantages realized from using CAATTs range from saving time to being able to perform an analysis that would have been next to impossible to do manually. Finding time to think critically is another significant benefit.

The benefits of CAATTs can occur at all stages of the audit (planning, conduct, reporting, and follow-up). The benefits can also be accrued during more efficient management of the audit process. Studies done by the Canadian Institute of Chartered Accountants (CICA [1994]) and the EDP Auditors Association, Toronto Chapter (EDPAA [1990]) also discuss the benefits of using CAATTs.

Planning Phase—Benefits

Risk analysis and audit universe software can assist management in selecting areas to audit and in identifying and assessing initial risks and determining preliminary objectives. A proper risk analysis of the audit universe directs the scarce audit resources to the areas deserving the most attention. However, during the planning phase of an audit, the audit program is not cast in stone; so the objectives, scope, and lines of inquiry can still be modified. The audit project leader must be able to see the big picture. Decisions made at the planning stage often set the direction for the early part of the audit and are usually critical to the ultimate success of the project. Accessing historical data for the client area, previous audit reports, and results can help focus the audit. The ability to easily reuse all (or part) of previous audit programs can significantly reduce the planning time, while maintaining high-quality audits.

Case Study 17: Research and Development Audit

During an audit of research and development activities at a major laboratory, the auditors were unsure as to which projects they should review first. In order to determine the financial risks of each project, the audit team extracted data from the three separate cost-tracking systems. Using the project code as a key, the three files were then matched to create a single record of information for each research activity, providing financial information on labor expenditures, materials and parts, and specialized equipment-on-loan. The resulting data helped the audit team identify the total financial cost, highlighting projects with high risk and materiality. This allowed them to make a more informed choice as to which research projects should be reviewed.

The matching of the data also allowed for a comparison of the integrity of the three independent sources of data. The resulting files were also of interest to senior management and were handed over at the end of the audit. The analysis produced a significant savings of time and effort since the audit team was able to focus its activities on projects based upon a realistic consideration of the risks and materiality.

As shown in Case Study 17, CAATTs can be used to improve the research performed during the planning phase to improve audit effectiveness. Risk and materiality considerations can also be evaluated in deciding whether or not an audit should be conducted. Text search and retrieval capabilities can identify previous audit programs and findings, which may identify lines of inquiry for the current audit, thereby reducing the planning time. Further, initial data can be gathered electronically and analyzed to determine significant lines of inquiry.

Case Study 18: Audit of the Personnel Function

For an audit of the personnel function, an electronic questionnaire was sent to personnel officers across the country via e-mail. The officers completed the questionnaire and e-mailed their responses back to the audit department. The data collected from questionnaires was used during the preliminary survey phase of the audit to identify trends and potential areas of risk. The results of more than 320 responses to 60 questions were further analyzed and summarized using audit software. The analyses identified specific lines of inquiry for the conduct phase of the audit.

Audit-related databases containing previous findings and audit programs can reduce the time required to develop an audit program and can provide new auditors with a better sense of corporate history. Further, more focused planning will scope the audit more accurately, reduce the overall resource costs, and improve the allocation of resources to projects, thereby decreasing nonproductive time and increasing audit effectiveness and efficiency.

Case Study 19: Inventory Controls

An audit of the controls over inventory purchases, handling, and distribution used the computer to identify the location of the warehouses and to calculate the total value of their inventory. Data was also extracted to determine the amounts purchased and the distribution and use of the inventory. The analyses helped the auditors decide which locations should be visited, the types and quantities of items expected to be found at each warehouse, and the purchase, redistribution, and inventory turnover patterns and rates for each warehouse.

Many organizations have built electronic working papers that contain references such as federal regulations, sample audit programs for various types of audits, and other useful information. These can be easily incorporated into the current audit program, saving the auditor much time. Other companies have developed extensive intranets that provide auditors with instant access to corporate policies, procedures, business plans, and more. The intelligent use of company intranets preserves and enhances corporate memory and can be used by audit to become more efficient and effective.

Using the Internet, auditors can conduct research around the world to search for background information, pertinent research studies, and even audit programs developed by other auditors. In minutes, auditors can perform worldwide searches, consult other audit organizations, and examine best practices, dramatically reducing the planning phase of the audit. For example, searching the Internet prior to one audit found a study on Best Practices for Invoice Processing and a report by the National Performance Review on cutting government red tape. The ideas contained in these documents were useful and innovative, allowing the auditor to make better recommendations.

During audit planning, with the support of CAATTs, auditors can formulate hypotheses, develop tests, and evaluate results quickly and easily. This allows the team leader to develop a better audit program that supports relevant audit objectives.

Conduct Phase—Benefits

CAATTs provide a means to be flexible and innovative in the performance of audits. The application and use of interactive tools and techniques during the conduct phase can help auditors to adjust their initial approaches in response to real-time findings. They allow the auditor to apply thinking and reasoning, rather than adhere to a strict predetermined set of manual audit steps. The auditor is free to follow new lines of inquiry, often leading to unexpected findings. These capabilities maximize the auditor's time, particularly during the conduct phase of the audit.

Traditionally, CAATTs have seen more use during the conduct phase than any other phase of the audit. The use of technology supports improved data analysis, increased audit coverage, better use of audit resources, continuous auditing, and improved results.

Data Analysis

CAATTs have been used to select statistical samples or to improve the effectiveness of a judgmental or directed sample. Now, microcomputer-based automated tools can also perform 100 percent verification of the transactions to assess the total risk and materiality of the audit findings. Many tasks such as sorting, merging, and comparing can be performed by the computer in a fraction of the time it would take to do manually.

Case Study 20: Audit of Gasoline Costs

As part of an audit of gasoline costs, financial transactions for gas purchases were selected and reviewed to determine if sales tax had been paid correctly. The audit identified a significant amount in overpaid tax and, because of the timely identification of the error, the company was able to recover the overpayment.

Increased Coverage

Advances in audit technology, including knowledge-based systems, can provide audit organizations with the ability to conduct audits that were not previously possible. Systems containing millions of transactions or business applications with numerous remote locations are difficult, if not impossible, to audit using manual methods. Reviewing hundreds of thousands of transactions manually could take weeks of audit time. With computers, one can

analyze, look for trends, sort, compare, and verify hundreds of thousands of transactions in minutes.

Case Study 21: Interest Charges on Overdue Accounts Payable

The company was having a problem with interest charges on overdue accounts payable. Invoices were paid at approximately 50 invoice-processing offices, which were spread across the country. The audit objective was to review the invoice-processing procedures to find ways to reduce the interest costs being paid on overdue accounts.

The auditors used the headquarters' financial system to identify all invoices with late-payment charges. Summarizing the data, they determined the:

- Total interest paid over each of the last four years
- Amount of interest paid at each invoice processing office
- Number of days overdue (30, 60, 90, and 120) and the total dollar value of the interest charges for overdue payments
- Average number of days it took to pay an invoice

A review of interest charges on overdue payments calculated the average number of days required to pay an invoice in various payment offices. This review identified the invoice-processing offices that were taking long periods of time to pay invoices and thus were incurring unnecessary interest charges. The analysis also showed that three invoice-processing offices were responsible for 94.5 percent of the late payment charges, warranting further attention from audit.

Days Aged: Summary of Payments on Overdue Accounts

Office	Number of Transactions	Percentage		Interest Charges
		Number	Amount	
Dallas	190	25.47%	61.28%	396,703.23
New York	416	55.76%	24.97%	161,667.78
Houston	30	4.02%	8.30%	53,751.95
Washington	104	13.94%	2.40%	15,509.93
Boston	1	0.13%	1.78%	11,550.00
Chicago	5	0.67%	1.27%	8,205.52
Totals:	746	100.00%	100.00%	647,388.41

The audit team also calculated the overall average time to process an invoice and the average processing time for each invoice processing office. Further, it was determined that a small number of large-dollar invoices were incurring the majority of the interest paid. The analysis showed that 1.6 percent of the invoices that were paid late accounted for more than 37 percent of the interest charges.

Interest Charges at Dallas Office
(Summary of Days Aged and Payments on Overdue Accounts)

Days	Number of Transactions	Percentage		Interest Charges
		Number	Amount	
0 to 29	98	51.58%	26.07%	103,430.06
30 to 59	60	31.58%	21.53%	85,428.58
60 to 89	11	5.79%	5.61%	22,259.33
90 to 120	19	10.00%	10.81%	42,873.09
over 120	2	1.05%	35.97%	142,712.17
Total:	190	100.00%	100.00%	396,703.23

At the Dallas office, two late invoices resulted in interest payments totaling more than \$142,700, about 36 percent of the total interest paid at that office.

The auditors selected the top three interest-paying invoice offices for their on-site review and selected a sample of transactions handled by these invoice-processing offices. This led to the discovery of inefficiencies in the invoice payment process and also identified instances of over and underpaid interest.

This on-site review determined that all invoices were processed on a first-come-first-served basis. As a result, a large-dollar invoice would be processed later than a number of small-dollar invoices, simply because the small-dollar invoices had been received first. The audit recommended that high-dollar invoices (more than \$50,000) be processed first and that less attention be focused on the low-dollar/low-risk invoices. The auditors also suggested that additional staff be hired during year-end, the peak invoice-processing period.

By sorting the charges by industry sector and by supplier, the audit also identified business areas where interest charges were a problem

(e.g., storage and moving charges). The audit recommended the development of a process to monitor large-dollar invoices and regular reports on the amount of interest charges incurred by each invoice-processing office.

As a result of the implementation of the audit recommendations, the invoice-processing time was improved, and interest charges on late payments were reduced by almost 75 percent in the first year and dropped a further 10 percent the next year. The savings in the first year more than paid for the audit costs, and the savings continued to be realized in future years.

The use of the computer in Case Study 21 allowed the auditors to perform most of the required analysis without even leaving the audit office. The results of the analyses were used to select the sites for the on-site work, thereby reducing travel costs and the time required to perform the audit. Computer analyses were also responsible for isolating the systemic problems related to processing invoices in the order of arrival (first in, first out). Given the large number of invoice-processing offices and the number of invoices processed at each office (more than 100,000 per office), the audit could not have been performed as quickly, easily, or with the same degree of accuracy, comprehensiveness, and success without the aid of computer-based analysis.

The proper consideration of risk and materiality means that audit coverage is the intelligent assignment of audit resources, not simply an audit of every operation every two years. Some areas may warrant a higher frequency, others a lower one. Automated early-warning systems and risk analysis software can focus audit attention on the areas of greatest concern, thus improving audit coverage.

Better Use of Auditor Resources

Increasingly, the knowledge and skill level of auditors is rising to keep pace with the complex demands of comprehensive audits. Automation will allow the auditor to spend more time on activities requiring the application of auditor judgment. By having the computer handle repetitive tasks, the use of the more expensive auditor resources can be maximized. (Also, freeing auditors from routine tasks can increase job satisfaction.)

Case Study 22 shows how a manual task can be made easier through the use of automation.

Case Study 22: Confirmation Letters

In previous years, the production of confirmation letters had taken more than two weeks. Now, using audit software, the names and addresses of all clients are extracted from the customer database directly to a Word secondary merge file. The names and addresses are then merged with a standard confirmation letter to automatically create individualized confirmation letters.

Improved Results

Audit software enables the auditor to conduct a thorough analysis of all transactions within shorter time frames. In minutes, volumes of data can be sorted, matched, recalculated, and analyzed to identify the causes of problems or errors. Log files maintained by modern audit software allow results to be easily reviewed for accuracy. Scripts or macros can also be created to make the analyses and tests replicable. And statistical sampling can be performed, limiting the amount of audit testing while maintaining valid, supportable results.

Using CAATTs during the conduct phase allows auditors to make better, more critical, and informed decisions, while increasing their efficiency and effectiveness.

Reporting Phase—Benefits

During the reporting phase, the use of automated tools can result in more effective audit reports with fully developed statements of significance. Sample error rates can be extrapolated to the entire population; presentation software can be used to prepare the results for final debriefing; graphics software can be used to produce tables and charts, which can be included in the final report; and word processing software can be used to produce the final reports.

The end result is a report that is more accurate, complete, timely, and easier to read and understand. This directly contributes to the overall acceptance of the audit findings and the image of the audit organization. Further, methodologies, findings, and final reports can be captured in audit knowledge databases, providing auditors with access to the information. This can improve the planning process for other audits and assist in the follow-up audits.

Case Study 23: Findings Database

Audit management felt that they were contributing to the company's continued well-being by conducting timely and important audits. However, they were having difficulty in managing and following up on the results. To assist audit, they developed a findings database to track management responses to significant recommendations. Audit can now easily review the status of all management actions and institute follow-up audits if required.

Follow-up audits can access the original audit's findings, recommendations, and final report; the current status of management actions; and the original audit program. Further, audit management also sends quarterly reports to the audit committee and senior management outlining the number of findings and the status of the action plans. The development of the findings database has improved the quality of the audit function.

The reporting phase can be made less time-consuming and more informative and clear through the use of CAATTs. Future audits can benefit from the knowledge gained by current audits, and audit can improve the management of audit findings and recommendations.

Administration of the Audit Function—Benefits

Tools are available that permit more effective management of day-to-day work, management of information on performance versus plans, and timely reporting on the status of in-progress, planned, and completed audit work (EDPAA [1990]). Tasks previously done manually are now supported electronically. Project management software, risk analysis and audit universe tools, and groupware can reduce the time and effort required to manage an audit or the entire audit function.

Automated time-tracking and billing systems can be used for invoice purposes and to track the performance of the audit organization, audit teams, and individual auditors. Even the review of audit working papers can be made more efficient through the implementation of electronic working papers, which manage documents, perform version control, and support hypertext links.

CAATTs can also be used to support audit project leaders in managing their audits. The consistency of an audit conducted simultaneously at several locations by different sets of auditors can be a major concern for the project

leader. Further, the requirement to make changes to the audit program can force the project leader to consider pilot audits, lengthening the planning phase. The difficulty for the project leader to review ongoing results and provide each team with advice and direction when required can be almost insurmountable if attempted without CAATs.

The use of technology can help overcome these concerns. Historical data, initial extracts of critical information, the ability to query data files and examine results, can all help the team leader establish appropriate lines of inquiry. In some cases, questions may arise that were not identified during the initial risk assessment. The project leader, armed with the results of preliminary analyses, can safely proceed with the development of an audit program, confident of the direction the audit will be taking. Sufficient analyses can be done during the planning phase to determine the population, the sampling approach, and other key factors that will also impact on the resources required to perform the audit.

Further, specific audit sites, sample transactions, and other relevant information can be determined, saving time and money. The value of this type of approach can be seen in Case Study 24.

Case Study 24: Audit Program Administration

As part of a countrywide, concurrent, multisite audit of branch operations, five audit teams were being sent to different sites. The audit project leader wanted to ensure consistency across sites and maintain control over the audit.

During the planning phase, the project leader performed an initial analysis of the data extracted from key business systems for each branch. Based on the results of the analyses, the project leader developed a series of questions that, when answered by the auditors on-site, would address the audit's objectives. Visual Basic, an object-oriented programming language, was used to develop an electronic questionnaire that led the auditors in the field through the steps in the audit program, skipping questions or even sections depending on the answers to previous questions. For example, the series of questions related to automated application controls would be automatically bypassed if the answer related to "Type of operations—manual or automated?" was answered "manual." The program produced a data file for each completed questionnaire, including a unique identifier, a time and date stamp, the initials of the auditor and branch location.

Because the results were to be collected and processed each night by the project leader, a program was developed to assist the teams in uploading their results to headquarters. Each night, the five on-site audit team leaders connected their laptops to the corporate intranet and ran the program. All of the day's data files, updates made to any of the previous day's data files, and the working paper files were uploaded and combined into a single database. This file was used to produce a summary report that quickly showed the project leader the overall status of the audit. The database was also used to provide details on the current status of each audit team and to identify systemic weaknesses occurring across all sites. This helped keep all teams informed of the preliminary results. The project leader also reviewed the uploaded working paper files and electronically sent each team additional instructions as required.

Case Study 24 is an example of a simple expert system that can be used to support the management of the audit. The automated audit program reduced the workload of auditors by guiding them, step-by-step through the audit program in a logical and controlled fashion and by automatically producing the required data files. The program also helped the project leader to ensure consistency across the five audit teams and in the coordination and analysis of the final results. The use of an intranet and FTP software facilitated the transfer of the data, allowing the project leader to review all data files and working papers and to easily monitor the progress and quality of the work of all the teams.

Reduced Costs

Ultralight portable computers with Inter/intranet capabilities and printers can increase the effectiveness and efficiency of the field audit activity. Auditors can carry the required audit software and hardware to field offices. By obtaining field data prior to leaving headquarters, the audit team can conduct a preliminary analysis of the field operations. Auditors can even select a statistical or directed sample before leaving the office and send a request to the field office to pull the required transactions. As a result, more field time can be spent conducting analyses of the transactions rather than selecting and pulling samples. In the event that additional information is needed from headquarters, auditors can download the data from headquarters directly to their portable computers.

Case Study 25: On-the-Road Auditing

Headquarters' auditors performed many audits at the local or branch offices. Audit senior management wanted to take advantage of computerized tools and techniques to improve the efficiency and effectiveness of these audits.

A few years ago, the first attempts at automating the audit function focused on the analysis of the local offices' data at headquarters during the preliminary phase of the audit. To the maximum extent possible, data for a particular office was extracted from the central mainframe, downloaded to the microcomputer, and analyzed by the auditors prior to leaving headquarters. Using this data, summary reports, detailed analyses, and the sample selection transactions were performed at headquarters. These initial attempts at automating the audit function achieved significant improvements in the efficiency and effectiveness of the audit assignments.

Today, auditors working at remote offices are equipped with laptop computers. These laptops are loaded with software for automated working paper generation, data analysis, telecommunication, flowcharting, and accessing the Internet. The auditors have all the necessary tools and the data files from the preliminary analysis to perform any additional analysis and to keep in touch with headquarters. FTP software is used to transfer data files between headquarters and the local office, to send the working papers back to headquarters for supervisory review, and to access reference materials in remote databases. The project leader can easily review the working papers—daily, if necessary—and is able to provide additional instructions to the audit team, again electronically via a modem. This is extremely useful when dealing with more than one audit team conducting concurrent audits at different sites.

The main benefits from the on-site use of laptops include the improved efficiency and effectiveness of the audit through the on-site analysis of data, access to remote libraries and databases, the receipt of timely instructions from the project leader, a reduction in the length of the disruption to the client, and a reduction in the hotel and meal allowance costs as a result of performing the preliminary analyses at headquarters.

Increased Performance

Computers can do many tasks better, faster, and easier than a person can perform manually. Sorting, searching, performing repetitive calculations,

aging, and so forth are ideally suited to automated tools. For an inventory audit, the average turnover was calculated for thousands of items of stock. Calculating the inventory turnover rate for all items in a warehouse could involve weeks of auditor time and effort, but only minutes of computer time. Several hundred items proved to have a very long turnaround time and were discovered to be of no use. By identifying these obsolete items, the audit reduced the overall inventory storage costs. In addition, once standard routines have been developed, they can be reused at minimal cost and with significant savings in time.

Case Study 26: Environmental Audit

The company was concerned with the potential damage to the environment caused by the disposal of environmentally hazardous materials. One of the audit's objectives was to review the controls over the procurement, distribution, storage, and disposal of hazardous materials.

During the planning phase of the audit, data was obtained from the inventory system, which contained information on all items held at every warehouse across the country. To identify the audit population, all transactions related to the purchase, transfer, storage, and disposal of hazardous materials were extracted from the system and several reports were produced.

The first report identified the quantities and type of dangerous goods stored at each warehouse. The second calculated the difference between current stock levels and maximum levels to highlight items that were candidates for disposal because they had stock levels higher than the maximum. And the third identified the top five sites that had disposed of hazardous materials in the past year, potentially creating an environmental problem.

The results of these initial analyses were used to select sites for the on-site phase of the audit and, based on the types of goods held at each location, to determine applicable government regulations. Using the Internet, the audit team accessed and downloaded all applicable storage and handling information from a site containing government environmental regulations.

The auditors were able to identify the high-risk/high-materiality sites and generated transaction lists for the on-site manual review. The computer analysis was also used to identify sites where no hazardous materials were stored. These sites were removed from the list of sites to

be visited, avoiding needless travel time and costs. By obtaining the appropriate environmental regulations in advance of visiting the sites, the auditors were also better prepared to review the management of hazardous materials. As a result of the audit, local management was able to minimize the risks associated with hazardous materials and prevent further environmental problems.

Increased Time for Critical Thinking

Saving time for thinking is probably the greatest benefit of CAATTs (Will and Brodie [1991]). An auditor's greatest asset is the ability to review information critically, determine cause and effect, and arrive at objective recommendations, which can be implemented and will address the problems at hand, not simply the symptoms. Then audit recommendations can address restructuring the organization or any of its systems.

If auditors are bogged down with manual and nonproductive tasks, such as manual completion of timesheet data for each 15 minutes spent on a project, manual review of paper-based working papers, using adding machines to calculate trial balances, and so on, they will have little time left to reflect on the information and arrive at the significant issues. The use of information technology can free the auditor from the routine tasks, maximizing the time they can spend on thinking.

Case Study 27: Paper File Review

A possible incident involving fraud was brought to the attention of the audit manager. Allegations about kickbacks had surfaced and needed to be examined carefully. All paper files related to several large-dollar contracts were seized, and the audit team was attempting to reconstruct events that occurred over a period of several years, by examining paper files, letters, and other correspondence. The auditors had access to two file cabinets containing all the key hard-copy documentation, but were experiencing problems coping with the sheer volume of paper information. Every time they needed an answer to a question, they had to search through mounds of paper. In the process of considering their problem, they realized that the computer could be used to simplify the file review process.

The auditors spent the next week electronically entering key information about each piece of correspondence into a text file, such as file number, date, to, from, title, and keywords describing the context of the correspondence. When they were finished entering the data, the auditors were in a position to review all correspondence from various perspectives. Using the computer, they sorted the information into chronological order, identifying the logical flow of correspondence related to specific topics, by subject. They also identified all correspondence to or from specific individuals, as well as all correspondence between any two individuals. Further, they identified all correspondence that referenced specific keywords, for example:

Correspondence Sent by “Jones”

Originator	Recipient	Date	Description
Jones	Black	03/01/2004	Polaris Expenditures
Jones	Smith	03/02/2004	Reply to Stroby Incident
Jones	Smith	04/13/2004	Reply to Stroby Incident

Correspondence Related to “Polaris”

Originator	Recipient	Date	Description
Coderre	Black	04/17/2004	Polaris Exp and Time Table
Black	Williams	03/03/2004	Polaris Expenditures
Black	Jones	03/03/2004	Polaris Expenditures
Jones	Black	03/12/2004	Polaris Expenditures
Williams	Black	04/21/2004	Polaris Expenditures
Black	Coderre	04/16/2004	Time Table—Polaris

The ability to search and sort volumes of data on multiple values (date, subject, to, from, etc.) was greatly enhanced through the use of the computer. Now, questions could be answered quickly and with assurance that all relevant files had been considered. Answers to a wide variety of questions could easily be determined without having to manually search through all the files over and over again. Detailed information related to a specific question was easily extracted from the manual file when required, using the file number as a reference. The days spent performing the data capture were more than recouped through the enhanced ability to analyze the information electronically.

CAATTs can be used to perform routine functions or activities that are better suited to computers, allowing the auditors to exercise audit judgment.

The use of automated tools and techniques in audit can result in many benefits:

- Increased audit quality
- Identification of materiality, risk, and significance
- Increased efficiency and effectiveness throughout the audit process
- Better audit planning and management of audit resources

The credibility of the audit function can be enhanced through improvements in the ability to access, analyze, and use data effectively. The integrity of audit results can also be made more reliable by using computers to assess the full impact and significance of findings. Finally, the ability of the auditors to conduct audits in today's electronic environment will improve dramatically. As a result, the audit division will be made more appealing, making it easier to attract and retain qualified audit staff.

Recognizing Opportunities

The following outlines the basic steps that should be followed in determining how automated techniques can be applied to an audit. Naturally, these steps only present a starting point for a critical examination of the information. A similar approach can be used to identify opportunities for improvements in the exercise and administration of the audit function.

1. *Identify the goals and objectives of the audit.* This step is no different than what would be done for any audit, whether the computer is used or not. The main difference is to avoid being constrained by old modes of thinking. Identify what needs to be accomplished, not how this will be done. The how can be determined at a later stage.
2. *Identify what information will be required to address the objectives and determine the possible sources of the information.* Try to find automated sources of information. Start by assuming that the information exists in electronic format, and where possible:
 - Identify the owner of the information
 - Determine the possible sources and who is responsible for them
 - Obtain all necessary documentation
3. *Obtain access to the information, in electronic format.* This can be done in several ways, such as:
 - Obtain physical and logical access to the client system and sign-on as a user

- Obtain access to the actual application files and extract and prepare the data for use with the audit software
 - Obtain copies of reports—where there is a printed report, there is likely an electronic system that generates the report. If possible, obtain electronic copies of these reports.
 - Electronically capture screen images and use the information with your audit software
4. *Verify and develop a good understanding of the data.* This requires that the auditor:
- Develop an understanding of the key data fields and data elements
 - Ascertain the timeliness of the data—determine if the information is current and how often it is updated
 - Determine if the information is complete and accurate
 - Verify the integrity of the data by performing various tests such as reasonability, edit checks, comparison with other sources, previous audit reports, etc.
 - Check control totals (number of records, totals of key fields) and dates
 - Obtain management agreement that this data can be used to address the audit objectives
5. *Develop an understanding of an application.* Whether you are auditing an application or simply using the data from the application as part of an audit of an operational area, you must develop a certain level of understanding of the application and the business it supports. This may be time-consuming, but if the application is going to be used to support other audits, the benefits are well worth the effort. A basic understanding can be obtained from the existing documentation by:
- Reviewing general system description documentation such as user and programmer manuals, system flowcharts, copies of input documents, sample output reports, and descriptions of the controls
 - Interviewing system users and programmers
 - Reviewing standard reports and exception reports
- At times, a more in-depth knowledge of the system is required to support an audit's objectives. This can be accomplished by:
- Analyzing detailed system flowcharts and/or a narrative of the data flows
 - Examining copies of all input and output documents
 - Studying record layouts for all data files with detailed field descriptions and explanations of possible values for each field
 - Performing transaction counts and exception and summary reports

6. *Develop an analysis plan.* This analysis plan will outline the:
- Reason for conducting the analysis including a statement of anticipated results (Why?)
 - Specific audit objective to be addressed by the analysis (What?)
 - Sources of the data to be used for the analysis (Where?)
 - Types of analysis that will be performed by the audit team (How?)

The analysis plan should be reviewed and agreed to by the team leader and approved by the audit manager. All potential problems, such as access to data, should be identified and potential solutions evaluated. The analysis plan serves as a guide and provides a framework for the audit team. It is not meant to constrain audit judgment. As the analysis progresses, the audit team may take unforeseen avenues. Therefore, the analysis plan should be considered as a living plan that is adjusted when appropriate to audit opportunities in general and the use of CAATs in particular.

Transfer of Audit Technology

Once the audit organization has embraced the use of automated tools and techniques, it will be better positioned to have a major impact on the operations of the organization. This can include the provision of tools and techniques to the clients.

Traditionally, whether to ensure independence or for other reasons, many audit organizations have attempted to maintain their distance from the client. More recently, audit sees the client as more of a potential beneficiary of audit's services. Audit reports are becoming much less compliance oriented and are focusing on ways to help the clients improve the overall operations. In some cases, this has meant reducing unnecessary controls. Auditors are trying to keep pace with the organization as a whole and are interested in assisting clients in improving their efficiency and effectiveness. This can take many forms, from the development of self-assessment tools to the transfer of knowledge and audit-developed tools and techniques.

With more internal audit groups using the computer as an audit tool, the opportunities to transfer the knowledge gained by the audit teams to the client have increased. Often, due to operational constraints or other factors, the client does not have the time or resources required to develop new or improved management systems. Also, the unique role played by internal audit allows it to cut across traditional boundaries or organizational lines, obtaining different perspectives on issues. In some cases, the audit team may have a more pressing requirement for specific data than

the client, forcing the team to gather or develop new sources of information. Regardless of the reasons, the audit team may obtain information that is not only useful for the audit, but also relevant to the client's ongoing operations.

In addition to the audit report, the transfer of the knowledge and data to the client should be considered as an audit product. For example, one audit team performing an audit of a computer application built a test deck to test various edit functions of the system. The test deck successfully identified several flaws in one of the main program modules of the client application and led to the identification of weaknesses in several controls over the completeness of the data. After the audit, the auditor's test deck was provided to the client and is still being run to test all modifications to the application. In another case, a new tracking system had just been developed for a high-profile project. Because the auditors required data from previous years, they collected information from a variety of manual sources, creating three years worth of historical data. At the end of the audit, the historical data was provided to the client, who used it as part of a regression analysis to project future costs. In still another example, the auditor's combination of three separate databases provided management with a unique view of the operations and was considered so important by the client that a new relational database structure was developed to capture similar information on an ongoing basis.

In each of these examples, the auditors used the automated tools and techniques primarily to address their own objectives. However, the information they collected or the analyses they built were also provided to the client at the completion of the audit. The transfer of this type of information is often of immediate value to the client. Future audits can benefit from these new systems or reports by reducing the audit time in the years to come.

Audit organizations that have embraced the use of CAATTs should ensure that they have installed processes to transfer the knowledge gained during the audit to the client. The transfer of the audit developed tools and techniques should be seen as one of the products of the audit. In some audit organizations, the process of audit technology transfer has been formalized and is incorporated as one of the steps in the audit process, requiring audit teams to plan for and track instances of technology transfer.

Summary and Conclusions

The productivity improvements that can be realized through the development and use of CAATTs will only succeed if the required management and auditor commitment exists. This will likely require a different mindset in order to break old paradigms and modes of thinking. Further, a mixture of

IS and audit expertise is highly desirable in establishing effective CAATTs and creatively determining how the computer can be used to accomplish audit objectives. Also, as is the case whenever something new is being introduced, communication will be a key to success. Communication between the auditors and the IS support section and between management and the support section are particularly important.

Auditors cannot be expected to obtain maximum benefits from CAATTs unless they have received sufficient IS training. Auditors must be comfortable with the technology. Finally, even if several persons are devoted to the task of implementing the automated tools and techniques, the process is still fairly time- and effort-intensive. Gaining an understanding of what is required, how to deliver it, and bringing everyone up to speed will not be accomplished overnight.

For many audit organizations currently using CAATTs, there is still more work to be done. The integration of computers into the audit process, from project initiation to the final reporting stage, is an evolutionary process—not merely a single step of purchasing hardware and software. There will be a requirement to change the way audits are conducted and even the types of audits performed. However, the adoption of automation will enable audit organizations to make more efficient use of all available sources of data, allowing them to plan, conduct, report, and monitor audits more effectively. After all, economy, efficiency, and effectiveness (the three Es) apply to audit organizations as well as to their clients.