E-Commerce White Paper

Auditing E-Business: Challenges and Opportunities

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Summary

E-Business brings new challenges to the auditing community. Some challenges can be met through traditional audit techniques, while other challenges require a completely fresh approach that relies on using electronic data analysis techniques.

This paper highlights some important differences between E-Business and traditional business, and describes the objectives, procedures, and findings of a typical E-Business audit. It also identifies critical success factors for implementing data analysis audit techniques in E-Business environments.

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This paper also examines how data analysis audit techniques have been successfully applied in E-Business environments, and identifies the critical elements of a successful implementation.

The Auditor's Changing Role

Traditionally, the auditor's role has been to establish the integrity of an organization's financial records, and to ensure that proper internal controls exist and are being followed. Today, auditors are also expected to add value by evaluating the efficiency, effectiveness, and economy of an organization's business processes.

Like basic business principles, basic audit principles have changed little over the years. What has changed in both business and audit has been the manner in which these principles are followed. With the advent of E-Business, audit procedures are once again under pressure to adapt. Auditing E-Business environments forces auditors to reevaluate the effectiveness of traditional audit procedures, and to explore both the possibilities and the opportunities available to them using data analysis software.

Auditing in an E-Business environment is, in principle, no different from auditing in a traditional environment. The challenge is that the audit evidence is in electronic form, and that the volume of electronic data accumulated by an E-Business is enormous. E-Business auditors must be able to access a wide

variety of data types, then sift through large data sets to identify trends and irregularities. This is why auditors are increasingly relying on data analysis techniques for auditing E-Business.

E-Business vs. Traditional Business

Essentially, E-Business is like any other business, except that it conducts its business electronically.

> *E-business is a dynamic set of technologies, applications, and business processes that link enterprises, consumers, and communities through the electronic exchange of goods, services, transactions, and information.*
>
> — The Gartner Group

Because the exchange of goods and services is electronic, auditors become involved with electronic data in entirely new ways. Conventional, manual audit techniques are inadequate for the electronic environment.

To appreciate the differences between these two types of business, let us compare an online bookseller to a traditional bookstore. Both pursue the same objective: maximizing stakeholder interests. Both pursue that objective by delivering goods and services competitively. Both share the same critical success factors: knowing one's clients as well as one's competition, minimizing the exposure to risk, and managing resources effectively.

The main difference between the two businesses is *how* they pursue these goals and objectives:

- The traditional bookstore relies on an attractive and well-organized physical shop where books are displayed, and where transactions with customers are concluded on a face-to-face basis. Bookstores gain a competitive edge through personal customer service, and by having the right inventory on the shelves.
- The online bookseller relies on an attractive and well-organized Web site where books are advertised and orders are processed online. Online booksellers gain a competitive edge by promoting the visibility of the Web site on the Internet, and having an easy-to-use electronic infrastructure to process orders and ensure accurate delivery of books.

In addition to selling books, an online bookseller may sell subscriptions to members, provide them with research content, and sell advertising and Web links.

E-business Distinctives

While E-Businesses are similar to other businesses, they differ in several important ways: the way transactions are recorded, the nature of the risks faced by the business, and the nature of the data to be audited.

E-Businesses Record Transactions Electronically in Real Time

In a typical sales cycle, the traditional bookstore will sell a book over the counter, receive payment, then issue the customer a cash register receipt. Or it may receive a physical order, send the book to the client, and then invoice for payment. Either way, the bookstore typically captures the sale in its computerized accounting system after the fact.

The online bookseller's sale cycle will start with an online order from the customer via the Internet. Accompanying the online order will be the customer's credit card detail as payment. Electronic payment and updating of the accounting records will take place automatically when the book is shipped to the customer. The entire sales cycle is captured electronically in real time. There is no physical evidence of the transaction.

E-Businesses Face Different Business Risks

A traditional bookstore needs to physically safeguard the store against unauthorized entry, theft of merchandise, or destruction.

The online bookseller must protect its electronic infrastructure against unauthorized access and implement a disaster recovery plan to ensure uninterrupted availability of its Web site. Here are some additional risks faced by an E-Business:

- Incomplete or inaccurate data
- Confidentiality of systems and data
- Unauthorized access to systems and data
- Non-repudiation of transactions
- Denial of service
- Difficulty of segregating IT from the business itself

E-Business Audit Evidence is Electronic

The main challenge E-Business auditors face is the electronic nature of the audit evidence. In the case of the online bookseller, every step in the sales process is recorded without producing physical output.

Automatic processing of customer orders is one of the keys to the profitability of an E-Business. It would be unrealistic to expect such a business to produce a hard copy of all orders, invoices, payments, and bank statements only for audit purposes. Clearly an E-Business needs fewer administrative controls such as manual reconciliations, segregation of duties, and so on.

This means there are few manual controls available to the auditor. Most controls will have to be integrated into the electronic business applications, such as: electronic verification of credit card details, protection of access to web servers and to accounting records, and so on.

■ Auditing E-Business

The analytical software needed to effectively audit E-Business environments empowers auditors to go beyond traditional audit methods and objectives.

Perhaps the biggest difference between conventional audit techniques and techniques that utilize data analysis software is the ability to **access and analyze all of the data.** Instead of evaluating controls and relying on samples, auditors can investigate 100 percent of the data. The table below highlights the differences between a traditional audit and a data analysis approach to audit.

	Traditional Audit	Data Analysis Audit
Purchases	Select 20 random orders and verify compliance. Select 50 MUS orders and substantiate values.	Recalculate all amounts on order file, and investigate irregularities detected.
Access Controls	Select users and check segregation of duties.	Analyze access control lists and find duplicate user IDs, workstation IDs, etc.
Interest Charged	Evaluate control over interest charges, select a sample of interest charges and recalculate.	Recalculate 100% of interest events for comparison to actual.

Inside an E-Business Audit

Using the online bookseller as an example, let us consider what an E-Business audit might look like.

Audit Objectives

An audit of an online bookseller could include the following primary objectives:

- Verify that all online orders were received, captured, and invoiced accurately in the accounting records
- Evaluate access control to member-only domains

In addition, the audit may also include secondary value-added objectives, such as:

- Analyze trends in online orders
- Identify lost customers
- Substantiate amounts charged to advertisers on the bookseller's web site

- Analyze web server traffic to verify management claims regarding web site availability, stability, hits, etc.
- Evaluate efficiency of company's Help desk

Information vs. Data

To meet these objectives, auditors must consider the kinds of electronic information available, and how to access the data that contains it. The table below shows some of the data sources that can provide the information needed for an E-Business audit.

Information Needed	Data Source
Online request order forms	Web log
Online return order forms	Web log
Orders captured in the company's records	Orders file
Invoices captured in the company's records	Invoices file
Member login attempts	Web log

Data Access Issues

The next challenge facing E-Business auditors is finding the data and getting access to it. While the electronic data is plentiful, it often exists in different forms and on different data platforms. Data analysis software provides the key to successfully accessing and analyzing incompatible data types.

Auditors need to know which questions to ask in order to identify the data sources they need, how to access the required data sources, and which data analysis techniques will give them the answers they need.

Audit Procedures

Identifying the questions to be answered leads to selecting the data analysis procedures to be used. These procedures are associated with the features available in the data analysis software. Most data analysis software supports common operations such as data extraction, and the joining of two data files to produce an output file of matched or unmatched records. For a list of data analysis software operations, see the Appendix.

The table below identifies a straightforward set of procedures that can produce dramatic audit findings. Data analysis software commands are in bold type.

Procedure	Result
Extract from the Web log all order forms downloaded and all order forms posted.	Files that contain: All requested online orders (GET.fil) All orders submitted for processing (POST.fil)
Join the extracted files GET.fil and POST.fil, then extract all unmatched orders to another file, LOST.fil.	LOST.fil contains all orders requested, but never submitted, together with their IP addresses. These are potential lost customers. Confirm whether they were followed up.
Join the extracted file POST.fil with the master Orders file, then **Extract** unmatched orders to another file, NONORDER.fil.	NONORDER.fil contains all orders submitted online but never captured in the accounting records.
Join ORDERS.fil with the master Invoices file, then **Extract** unmatched invoices to NONINVOICE.fil.	NONINVOICE.fil contains all orders captured, but never invoiced.
Extract from the Web log all unsuccessful login attempts, then **Classify** (sort and summarize) the file on the IP address to a new file, BADLOGIN.fil.	BADLOGIN.fil contains all unsuccessful login attempts, showing the number of attempts per IP address. A high number of unsuccessful login attempts per IP address is a strong indicator of attempted password cracking.

Note that the result of analyzing the available data yields *all* of the exceptions, not just a sample.

Audit Findings

Based on such an analysis, an audit report would lead to the following findings and recommendations.

Objective	Recommendation
We have identified six IP addresses that requested online orders but never submitted them. WHOIS enquiries* revealed the potential customers as follows: 193.225.12.47 — ABC.com 193.45.187.5 — DEF.com 193.63.247.66 — GHI.com 193.73.60.22 — JKL.com 194.140.15.18 — MNO.com 194.170.139.1 — PQR.com	Management must implement procedures to identify non-submission of requested online orders. This information should formally be fed into the company's sales pipeline to ensure that account managers follow up these leads.

Objective	Recommendation
Our analysis of the company's web server log files revealed the following online orders that were submitted by customers but never captured into the accounting system: 193.225.12.47 — ABC.com 193.45.187.5 — DEF.com	The customers who submitted these orders must be contacted as a matter of urgency to determine if the order can still be met. Management must also implement regular reconciliations between online orders received via the web log and orders captured in the accounting records.
A comparison between the orders received database and the invoices issued database revealed the following online orders that were never invoiced: 193.225.12.47 — ABC.com 193.45.187.5 — DEF.com	These orders must be invoiced immediately. Management must also implement regular reconciliations between online orders captured and invoiced issued in the accounting records.
Analysis of unsuccessful login attempts to the members-only domain revealed three IP addresses with an unacceptable number of login attempts (WHOIS results in brackets): 62.208.1.128 — 16 attempts (ABC.com) 195.67.104.238 — 6 attempts (DEF.com) 194.170.139.1 — 4 attempts (GHI.com)	Unauthorized access to the company's subscription web content has financial implications and could lead to denial-of-service and changes to web pages. Management must urgently implement continuous monitoring procedures and develop a security incident response plan to ensure that attempted break-ins are promptly detected, prevented, and responded to.

* WHOIS inquiries will not identify customers whose IP addresses are dynamically assigned, but they will identify the IP address owner. Even when the audit cannot identify individual customers, it does successfully identify the facts.

Additional (Value-added) Audit Objectives

The power of data analysis technology coupled with access to the right data sources can lead to avenues of exploration that are unique to E-Business. Here are a few additional audit objectives, together with the data analysis procedures that might be used. Data analysis command names are in bold type.

Objective	Recommendation
Substantiate amounts charged to advertisers on the bookseller's web site. Determine whether support requests are acted upon and closed within expected time frames.	**Join** the web log with a list of the advertiser web sites. **Extract** all GET commands for web sites contained in the list of advertiser web sites. This produces a list of all chargeable advertisement events. Then **Classify** on advertisers and obtain the number of clicks that should be charged to each advertiser. Finally, calculate the number of clicks, multiply them by the advertisement rate, and compare the calculated amounts to actual charges.

Objective	Recommendation
Analyze web server traffic to verify management claims regarding web site availability, stability, hits, etc. Items to investigate: irregularities in blocks of data, days that the server was down, trends in web site access, etc.	Analyze the web logs in any or many of the following categories: ■ Page requests per day, week, etc. ■ Unique hosts per day, week, etc. ■ Average minutes connected per IP address ■ Orders, logins, subscriptions, per IP, day, week, etc. ■ Duplicate entries ■ Gaps in dates ■ Classify on web page requested to obtain indication of popular pages, etc.
Evaluate efficiency of the company's Help desk.	Obtain access to the support tracing system log file. **Join** this file to the web log and compare times of support request in web log with times entered in support system log files. Query support system log file and **Age** open support requests. Investigate outdated requests. Query support system log file and calculate time between log and closed.
Implement continuous monitoring of suspicious login attempts.	Create a custom batch application to monitor login attempts, and **Notify** the audit department when unsuccessful login attempts reach a predetermined level.

Opportunity and Challenge

Without full and unrestricted access to an E-Business's data, auditors are ill equipped to deal with the challenges posed by this engagement. Data analysis software tools give auditors independent access to a wide variety of electronic data sources.

In addition to verifying the accuracy of the company's accounting records and assessing the business's exposure to risk, E-Business auditors can offer significant value-added services. The electronic nature of the data forces them to use data analysis software tools and techniques. These tools and techniques allow them to go far beyond traditional audit objectives to offer considerable analytical expertise and value to the organizations they serve.

Data analysis techniques allow the auditor access to a myriad of other data sources typically found in an E-Business:

- Web server logs — web traffic
- Operating system — logs: user activity
- Databases logs — changes to data files

Data analysis software can access these logs to produce extremely valuable control and management information, and elevate value-added audit reporting to a new level. Some examples include:

- Identifying attempted break-in attempts
- Identifying lost online orders
- Identifying most popular web content
- Analyzing web traffic trends
- Developing continuous monitoring using the Notify feature (by e-mail)

■ Implementing a Data Analysis Approach to Audit

The integration of data analysis techniques into the overall audit methodology requires careful planning. It is not uncommon to find audit departments in which the implementation never reached its full potential.

Examining both successful and unsuccessful implementations can help E-Business audit managers avoid common pitfalls and plan for success. Issues that require particular attention are:

- Determining an effective way to integrate data analysis techniques into the audit process
- Identifying the available E-Business data
- Designing appropriate analytical methods
- Defining ways to feed the results of E-Business data analysis back into the audit process

If predictions for the growth of E-Business are accurate, IS auditors will increasingly be relied upon to integrate with business audit teams in the same way that IT specialists are being absorbed into the management of E-Business enterprises.

Obstacles to Successful Implementation

Implementing new software and data analysis methodology in a partial fashion leads to less than successful results. There is no single reason for unsuccessful implementations, but rather a combination of important factors that were neglected:

- New technology was implemented in the audit department only, and independently of the organization as a whole.
- Few auditors in the organization had access to the software.
- Advanced software features were not used because of insufficient training.
- Departments did not take advantage of vendor support.
- Lack of procedures for regular, formal access to important data files.

- User departments were not exposed to the new software or the new data analysis methodology.

Critical Success Factors

To ensure the success of the integration process, audit management has to accept and support the strategic importance of the process as a whole. Auditors must resist the typical audit tendency to approach changes in the audit department independently of the organization and to attempt to do it at the lowest cost possible. Audit management must realize that the implementation and integration of data analysis will have to support the audit department well into the future and will have a significant impact on the department's efficiency.

When viewed with such a strategic outlook, it is clear that a typical IT approach will be needed. When a company's IT department implements a strategic software application, it registers a formal project with upper management approval and support, follows proper project management, has project sponsors, dedicated project resources, and an independent budget.

A recent and spectacularly successful integration of data analysis software in the audit department of a large financial institution followed this exact approach.

A recent and spectacularly successful integration of data analysis software in the audit department of a large financial institution followed this exact approach. During the evaluation period, various business unit managers became impressed with the level of detail in reports obtained from available data files. Under the leadership of the audit department, a number of these business units joined forces with internal audit to register a formal project to implement the software within the company.

The software was launched in all of the relevant business units, and a formal training program was implemented. Each business unit, including the internal audit department, went through a number of business process re-engineering workshops to integrate the data analysis software into their formal processes. From an audit point of view, the major benefits achieved through this approach were:

- A formal project and budget was approved and registered and costs were shared with other business units.
- Audit staff were dedicated to the project to effectively integrate data analysis into the audit methodology.
- A formal, certified training program was implemented and linked to the audit personnel career path. Auditors have been trained to use even the most advanced functions of the data analysis software.
- The audit department spent valuable time in workshops analyzing and questioning their old audit methodology and adopted a new, E-Business-ready audit methodology.
- Since the data analysis software was a part of the +company's official software architecture, the IT department also invested in it and now officially supports the software.

- With top-level sponsorship of the project, it was possible to implement a formal process through which auditors requested data files. Furthermore, a "cold storage" environment is being implemented to store native data files for audit purposes. This will allow auditors to share input file definitions among themselves and among business units, significantly improving access to data originating from various platforms.
- The software vendor's technical support and consultants assisted during the entire process, allowing the company to learn from other implementations in other parts of the world.
- With the benefit of advanced training in the software, many of the business units are now using advanced features, such as automated batches and file relations, on a continuous basis.
- The audit department's task has been significantly enhanced since business units and IT now know how to assist auditors in obtaining access to data files.
- Finally, but not least, the audit department has been recognized as an invaluable part of the business, and the software vendor's specialists are regularly requested to assist in developing specialized applications.

Conclusion

Auditors planning to audit E-Business environments must recognize that data analysis will form part of their future. Not just because data analysis is the only viable way to effectively audit E-Business environments, but also because it presents enormous opportunities to increase audit efficiency and effectiveness.

To successfully integrate data analysis into the audit methodology, a strategic approach needs to be taken, and the process needs to be facilitated through a formal project. This project must address, at least: audit methodology re-engineering, training, and data access channels. The data analysis software should become part of the organization's software architecture, with additional benefits gained when the software is distributed to other business units as well.

APPENDIX

Data Analysis Software Operations

Data analysis software performs a number of operations in addition to extracts and joins. The table below shows some of the kinds of operations you can do with *ACL for Windows*.

	Software Operations
Ensuring Data Integrity	Count records Total the values of numeric fields Verify data in fields
Surveying Numeric and/or Date Data	Create graphs to visualize data Profile — compute minimum, maximum, total, and absolute values Statistics — compute a set of descriptive properties Generate digital analysis with the Benford command
Identifying Concentrations of Data	Stratify — summarize on numeric values Age — summarize on date values Classify — summarize on character values Summarize — summarize on character values, with additional options
Sequence Testing	Test for sequence errors Search for gaps Search for duplicates
Multiple File Operations	Joining two data files into one Relating data by creating multiple virtual joins Merging two data files into one Appending data to existing files
Isolating Data	Search for selected records Extract data into a new file Export data into other file formats
Reordering Data	Sort data by rearranging it in a new file Index the contents of a data file
Statistical Sampling	Determine Sample Size Extract samples from a population Evaluate the effect of data errors on a population

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