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Chapter 7: Driving audit efficiency through real-time data collection and artificial intelligence-powered insights

7.1. Introduction

Conducting an external audit can be a long, uncertain, and costly process for an organization of any size. Traditional audit methods are slow to contend with a key factor in the process—the pace of business, and are hampered by limitations in the availability of data. Both the timing and type of data used in the audits define the potential findings impacting the financial statements. For example, relying solely on sampling methodologies for the presence or absence of account anomalies can result in material misstatement that goes undetected in the final report. Technology-enabled solutions for real-time data transfer to the audit team combined with Analytical Procedures using Artificial Intelligence extend the capabilities of external audit, allow maximum coverage for anomaly detection, and provide timely recommendations for proactive corrections while the year, quarter, or month is still open. The advantages of such digitally-enabled real-time audit are a quicker and less disruptive process with a longer window of opportunity to drive better management decision-making, resulting in further efficiencies for stakeholder report, disclosure, and assurance processes (Arens et al., 2020; Bagchi, 2021; Moeller, 2022).

The additional costs incurred in deploying digitally-enhanced audits also allow for lower long-term audit costs with the potential for revenue growth for audit firms in parallel as stakeholders rely more on assurance processes and audit recommendations not just for assurance but for decision-making purposes. The difficulty for many audit firms lies in navigating the initial cost and thought process impediments to shifting from traditional methods and mindset to more modern ideas and tools. Integrating new natural-language processing, machine-learning-powered procedures, and advanced analytics into existing models will reduce or completely eliminate dependence on wasted time-consuming hours, increase productivity with timely issuing of working paper documents in words,

figures, tables, and charts in no time at all, and allow for opportunity consideration of the many levels of further business-enhancing potential from deployed tech.

This automation of certain aspects of the traditional review of accountancy books using heuristic processes adds the possibility of greater accuracy through the use of reason, prediction, recursion, and planning and allows external auditors to perform more complex reviews at the same time and with greater efficiency. However, imperfect human judgment is likely to always be needed to serve as a quality control check for the conclusions reached by this automated process, in much the same way as machines in the manufacturing sector could manage high levels of production with very few defects if error promoters were intelligently designed out by humans (Soliman, 2018; Satoglu & Durmuşoğlu, 2020).

Fig 7.1: Driving Audit Efficiency Through Real-Time Data Collection

7.2. The Importance of Audit Efficiency

Audits are an essential service for all governments and organizations that receive public funds. They help ensure that public funds are spent properly and that taxpayer money is not wasted or misused. Stakeholders require transparency and accountability, which is enabled through the availability of reliable and useful financial information, freeing them of information asymmetry and adverse selection problems. However, this need for transparency and accountability creates upward pressure for audit effort and the consequent audit cost – something that has been of increasing concern to public auditors as well.

Any government body conducting audits continually seeks to increase its audit efficiency, providing the highest level of forensic scrutiny and assurance for its stakeholders at the lowest possible cost. This required increased efficiency and productivity pressures on the external audit function result in an increasingly informed and technology-driven stakeholder who expects added value from audit services at relatively low cost. Shortened cycles and increased costs have concluded that the main external factors determining audit efficiency are the devolution of powers to lower levels of government, changes in the public accounting environment, improvements in information technology, stronger demand for accountability, more rigorous legal requirements, and audit risk factors.

Technological advances in data collection processes have helped with cost containment in the pre-audit transaction validation stages. However, the actual audit examination stages of the process have remained relatively low technology in their manual review orientation. In recent years, audit automation, specifically the application of artificial intelligence, has become a more attractive solution compared to internally developed automated procedures.

7.3. Real-Time Data Collection

Overview of Data Collection Techniques Information is the foundation of all audits, risk assessments, and diagnostic activities. Yet, how the financial, operational, information technology (IT), and compliance audit function approaches the data collection process can make a noticeable difference to both the efficiency and efficacy of the entire audit engagement. Unlike many tools in an auditor's toolbox that are most effective when used in traditional ways, we believe that data collection tools and techniques, when effectively used, offer tremendous opportunity to shorten audit timelines while improving quality and overall success. Increasingly, auditors are moving from traditional manual data collection methods that take extensive effort and time to real-time, low-effort, high-payoff methods that not only reduce costs but also enhance audit quality. Manual

information requests and collection are increasingly being replaced with real-time data streams from automated transaction monitoring systems, transactional data warehouses, and secure cloud file storage and sharing. This paper focuses on the growing trend toward real-time data collection for audits and risk assessments and discusses the benefits derived, various methods, and challenges faced.

Fig 7.2: Real-Time Data Collection

Challenges in Traditional Data Collection With recent advancements in information technology and the advent of interconnected cloud systems, the traditional auditor data collection process has been transformed — from one that is often painful and time-consuming — often begging and pleading for data from organizations — to one that could be "plugged in" or automated using active monitoring systems and/or easy-to-use cloud data storage. Many decisions can be based on inaccurate or even fraudulent data. The audit and risk assessment function is responsible for helping stakeholders make important decisions by evaluating whether the information that stakeholders are using is reliable. To determine whether the information is reliable, auditors and risk assessment professionals use their expertise and experience on the business, industry, regulatory and other risks that may impact the organization to select specific sample inputs from the information that the stakeholders are using, and test whether those inputs are valid based on independent verification or other agreed-upon procedures.

However, this traditional approach of sampling from historical data is not without challenges. The historical sampling process is slow, cumbersome, and manual. The manual data requests can be lengthy, time-consuming, and disruptive, resulting in cooperating with the auditors almost a full-time being for somebody in the organization. In some instances, the cooperation is acknowledged to take more than the entirety of the audit. This paper presents an approach that can significantly reduce these issues through the use of real-time or "plugged-in" data collection approaches that reduce redundancy and repetitive requests using emerging technologies. Such approaches can not only reduce the time taken for data collection but also reduce associated costs and improve the quality of outputs.

7.3.1. Overview of Data Collection Techniques

Real-time data collection has future implications and applications for all audit functions, including risk assessment, analytical review, performance consideration, substantive testing, and audit quality review. In this section, we will highlight prior audit and non-audit research on data collection techniques supporting standard audit functions. By categorizing these techniques based on how and when data collection occurs, we will help frame a research agenda for auditing while illustrating how data may be used for other business functions, including monitoring and fraud detection.

Data collection in audits is commonly performed using traditional techniques, such as inquiries, walkthroughs, direct observation, inspection, and reformance. Data is gathered using these techniques at a particular point in time in the business cycle, typically during fieldwork or sometimes before or after fieldwork via interviews and observation. Although traditional data collection techniques can certify the content validity of a measure by confirming the appropriateness of that measure based on knowledge and experience, they are time-consuming and prone to human error. Audit research has increasingly focused on automating traditional data collection, including the use of email to expedite and capture written inquiries, using cameras to peer into environmental settings, developing motion and nocturnal animal detection algorithms using imaging technology, and employing robots in lieu of auditors to inspect buildings. Such automations also lower the costs related to traditional data collection techniques. By analyzing an entire set of transactions in lieu of random sampling, auditors can improve the assurance of conclusive and accurate results in fraud detection or risk assessment. This also reduces detection time and the time to perform tests of controls.

7.3.2. Challenges in Traditional Data Collection

Data collection is a cornerstone of practically all research endeavors. Traditionally, data was manually collected from appropriate sources, possibly with considerable effort. More recently, and given the speed at which the world is moving today, even more importance is being placed on real-time access to data. We need to know yesterday what happened today, for both factors to make informed and appropriate decisions. In the audit field, however, perhaps in consideration of the origins of the profession, auditing remains partially resistant to technological disruptions. Traditional data collection methods are still being used within audit firms. Focused interviews, focused workshops, and document reviews to consider entity policies and procedures are performed. Data collection memos are prepared by audit seniors, and time is spent waiting for the responses to arrive. Ready-made templates are used repetitively, possibly in consideration of the fact that the audience perceives them to be as comprehensive as possible. The consideration here is whether this traditional process with its inherent delays and weaknesses should be replaced completely or at least supported with alternative approaches. Additionally, while research has shown that audit quality could substantially benefit from the inclusion of technology in collecting financial audit decision-making, reverence for tradition appears difficult to shake off. It is our contention that there is now plenty of enabling technology available for this type of activity. Furthermore, the tools are both affordable and easy to implement. Technologies that support near real-time data collection such as software robots are available for almost any type of organization, and available at a lower price point than what would have seemed possible a few short years ago.

7.3.3. Benefits of Real-Time Data

Real-time data collection offers a range of tangible benefits when compared to traditional data collection techniques. First and foremost, the fundamental purpose of the data is to assist auditors in decision-making, not only to comply with the auditing standards. A decision model that uses real-time data will consider both model estimation and evaluation in the decision-making process so that a more accurate analysis can be carried out. For a cost predictive model, decision-making may focus on small samples in areas of high cost. Using real-time data helps to keep the model current. In forensic auditing, where abnormal patterns indicative of fraud are detected, it is also advantageous to model on the most recent data. Keeping the model updated ensures that predictors of the modeling are indeed the best estimates.

Unlike traditional data collection approaches, not all real-time data is kept or stored for analysis. There is little or no manual input required in real-time data sources. In a typical data warehouse environment, historical data is kept for some period of time in a

relational database that utilizes rigorous mechanisms to secure it against external manipulation. Data warehouses typically also have quality controls in place to check the accuracy, consistency, and completeness of the data. A second statement of assessment in this area may occur at the archival stage, upon excess data being migrated out to cloud storage or Long Term Archival Storage. For real-time data, audits may be done informally but they are built into the data collection tools. There are numerous advantages and disadvantages to real-time data. Speed and ease of collection, particularly from novel sources, allow decision making, but the results, compared to traditional sources, are often subject to extensive post-processing. The data may be incomplete or skinny in nature, missing significant features, as the contribution of some data elements is still unknown and have not yet been programmed into the data generating system.

7.4. AI-Powered Insights

Like all advancements, the implementation of AI tools also opens up avenues for misuse or misinformation. Therefore, education on the concept of AI will be integral in understanding how it could be applied to help solve specific problems in auditing. Artificial intelligence is an evolving combination of technologies that allows computers to automatically respond to complex scenarios in ways that were historically thought to require human intelligence. AI technologies include computer vision, expert systems, natural language understanding, natural language generation, machine learning, machine reasoning, and context-aware computing.

Machine learning is a subtype of AI that builds algorithms in computers that can do a task without being taught to perform the specific task. Such algorithms learn from historical data. The effectiveness of a machine learning model for tasks such as classifying data or predicting outcomes hinges on two factors: the quality of our historical data and the appropriateness of the algorithm used. Machine learning is sometimes colloquially told to involve "pattern finding." Various machine learning algorithms are often used to help automate such processes as identifying high-risk audit areas, predicting material asset values, and linking unstructured textual disclosures to financial statement assertions.

Predictive analytics is the use of a wide variety of data sources to predict the likelihood of certain risks, events, or behaviors. Auditors use internal historical client data, as well as industry and economic data, as predictors in assessing risk. Predictive analytics are often used by auditors in tasks such as planning the audit, predicting certain risks, estimating allowances on loss contingencies, estimating fair values for certain categories of assets and liabilities, and making predictions based on risk assessments.

7.4.1. Understanding AI in Auditing

Audit is a process of examination. Therefore, by its very essence, audit has the potential to be aligned with AI technologies that augment human examination abilities, accelerate the rate of data examination, and identify issues that require immediate action on behalf of a client. AI refers to any number of tasks that would require human cognition, such as reasoning, acquiring information, making decisions, learning, creating value, and making predictions. An AI system is constrained by the level of skill incorporated into it. The capability of an AI system is limited by how closely it can model the function that it is attempting to approximate. For example, human-expert-level capability in a narrow domain, such as beating the world's best chess player requires encyclopedic knowledge of chess and advanced reasoning skills that enable creating complex strategies over many moves. Artificial intelligence is being used in a variety of applications within different industries. Within the auditing domain, AI is being deployed in applications ranging from risk assessment, data extraction and sorting, analytics of historical data, and predictions of future events or trends. AI technology in itself does not change audit and assurance. The nature of assurance practice is based on the competency of the auditor to perform appropriate procedures to gain the objective evidence that is sufficient and appropriate to base an opinion. AI is another technology that can increase the efficiency and efficacy of audit services. The argument against auditors simply relying on AI is the same as that of auditors relying on other technologies such as data extraction software that may be used during an audit but cannot replace the skill of the auditor.

7.4.2. Machine Learning Applications

The term machine learning refers more specifically to the algorithms that allow computers to perform certain tasks without being specifically programmed to do so. It is a subfield of artificial intelligence that promotes the building of systems that can learn from and make decisions based on data. Some machine learning algorithms are analogues of the human brain and use connections similar to our neuronal synapses to perform pattern recognition. Other techniques identify and exploit patterns in data to provide insights, such as decision trees, clustering algorithms, and probabilistic graphical models. Use of these techniques may be less advanced than the brain's, but they do possess the potential to be much faster and often more accurate than humans in performing certain tasks, such as facial recognition or playing board games. Success has been reported in virtually every field of human activity and observation, where a computer is exposed to sufficient relevant data. Examples of reports relate to computers operating at or near human levels in the fields of face and character recognition, object detection and classification, machine translation, board games, and speech recognition.

This success is, however, limited to narrow domains. In practice, machine learning is applied primarily in commercial areas; in particular, recommendation systems, image processing, finance, and healthcare.

AI and machine learning are being increasingly integrated within information systems or applications in a functionally embedded manner to provide enhanced specific data analytics services and to enable users with or without data science skills to implement machine learning capabilities. For example, most traditional commercial statistical software packages and a growing number of commercial general-purpose websites or cloud development platforms now include AI machine learning functions or libraries.

7.4.3. Predictive Analytics in Audit Processes

Differentiate Reported and Predicted Results. Predictive analytics provide a wide range of data-related assistance during the audit process. It helps the auditors in visualizing various possibilities around a specific event so that they can take the right course of action according to anticipated outcomes. Predictive analytics can make a great contribution to the preliminary phase of an audit. It can advise on any outside events likely to affect the client's performance. It can reveal the strength and weakness of a client by calculating performance growth trends. The insights provided by predictive analytics can prompt the auditors to carry due diligence as well as follow professional skepticism. It can suggest when to deploy more resources during the assessment stage of the audit. Responding to the data-driven insights provided by predictive analytics can enhance the audit quality by reducing the chances of incompetent teams assessing the high-risk areas of the audit. Predictive analytics can also be useful in planning a walk-through test, by disclosing circuitous or unusual transaction flows based on the auditor's knowledge of the client.

Audit risks can be divided into two motives: the manager's intent and the client's situation. Information about these two facets can play an influential role in the auditor's understanding of the audit client. Predictive modelers can predict the likelihood of a company being involved in an illegal act and these probabilities can reveal information such as earnings manipulation by managers. Analysts can also predict outliers in the financial reports and the audit firm can make decisions focused on those firms. Predictive modeling can inform the auditors about the management style of the audit client which in turn would negotiate the lengths and levels of scrutiny of testing involved in the audit.

7.5. Integrating Technology into Audit Practices

Audit technologies discussed will only deliver value for audits and ease of use for auditors if they are properly integrated into audit practice, especially the implementation of audit methodology and guidance. But what does it mean to integrate a technology into a business function? And how can audit firms prepare for what successful technology integration looks like? To provide some guidance, we first propose a framework for thinking about technology integration along four dimensions.

Technology integration is the seamless embedding of technology into a practice such that the technical and human elements function effortlessly together to deliver value to the goal of that practice. Technology integration will be successful and least intrusive into the lives of practitioners when consistency is provided across three areas: the physical integration of tools into the workflow, the mental perspective on the tools offered by the practice's leadership, and the intuitive ease of use of the tools. Audit leaders must support these three internal areas for technology integration alongside behind-the-scenes development support. And it is these team leaders who will shape the way audit techniques look and feel. As in most endeavors, but especially creative ones, the attitude and leadership of the team captain shapes the final result. Audit partners and managing directors are key to not only shape the external areas comprising tools embedded in workflows and behind-the-scenes technical development, but also shape the enthusiasm and eagerness of the practitioner, especially junior auditors. They have the most direct influence on the audit engagement team's embrace of the technology solutions.

7.5.1. Framework for Integration

This chapter proposes a framework for integrating real-time data collection technologies, leveraging data analytics, predicting events and outcomes, and generating insights to a higher level of audit practice, to meet the increasing capability for predictive analysis and real-time evaluation of internal controls. In order to accomplish this goal, we first outline the methods by which internal audits deploy these tools, and then suggest answers to three questions. Why now? Why this way? and Why do it? The audit function plays two roles in assuring the corporate governance process: underpinning the control process and exercising oversight over the process. Our focus here is on the internal audit function within the enterprise, as distinct from the external audit function and regulatory authorities.

Real-time systems reduce the time lag between the occurrence of important corporate events and the analysis and reporting on those events, improving the effectiveness of internal audit as an early warning system for corporate governance failures. The

revolution in the technology and cost structure of capturing segments of the corporate data universe brings with it an unprecedented capacity for driving audit and risk management efficiency and effectiveness through the accumulation, proactive analysis, and application of internal risk and compliance data. Internal audit can fill the information gap created by this increasingly decentralized, data driven, and technologically enabled business environment. It is, however, our belief that internal audit must seize this opportunity and integrate into audit, control, and risk management processes these new technologies for data creation, aggregation, analysis, and prediction in order to add higher levels of value added services to stakeholders and clients.

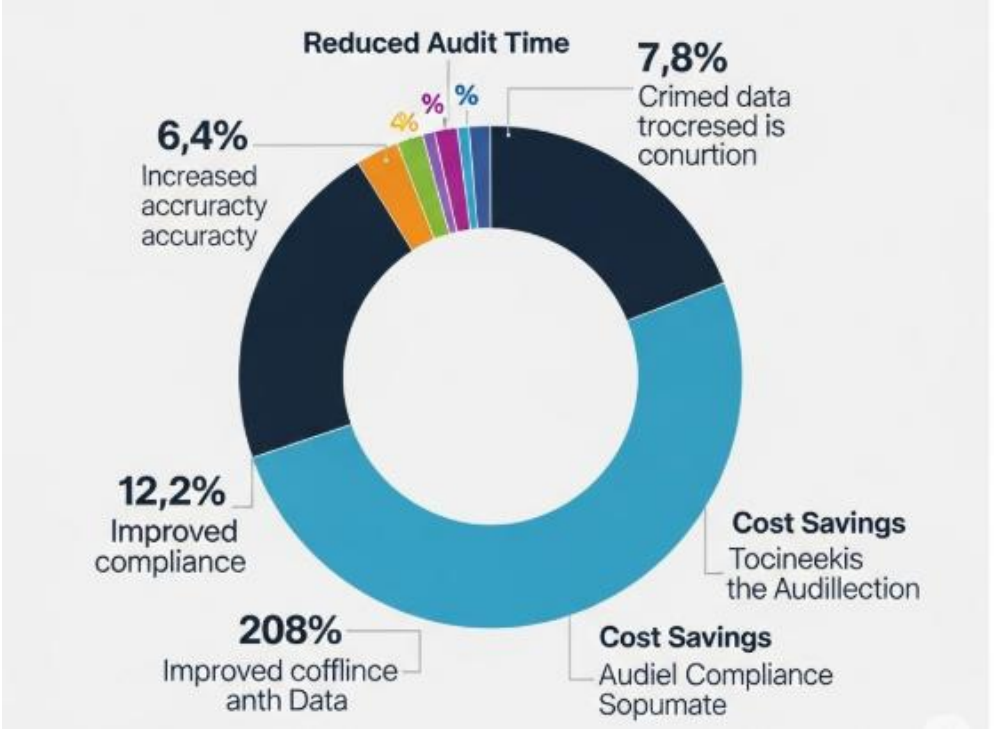

Fig 7.3: Efficiency Through Real-Time Data Collection and AI-Powered Insights

7.5.2. Case Studies of Successful Implementations

Over the last couple of decades, several studies have discussed issues about using data analytics in audit practice; these studies have also examined the reasons for not adopting audit data analytics among audit practitioners, issues mainly related to cost, a low level of assurance, and regulatory demands. Much of the research in the area has been more theoretical than practical. However, some audit firms have integrated data analytics into their auditing practices, and some have developed very detailed integrated methodologies, focusing on particular areas or cycles. Accordingly, in this paper we

discuss the successes of some of these firms, and present how they engineered this integration. In the first instance, the case studies are anecdotal and qualitative in nature, and we provide examples from leading firms regarding the integration of data analytics by the major elements of audit methodology. These examples illustrate how the firms are coordinating the separate components of audit methodology, such as audit risk assessment, decision support systems, detailed testing, and audit planning, using data analytics, ideally to the benefit of audit quality and audit efficiency.

While many specialized audit analytic tools exist, some of the Big Four firms and their divisions have developed in-house solutions. These tools try to combine and enhance the different functionalities of the specialized tools, offering a more comprehensive solution for audit analytics. Additionally, these dedicated audit tools are not suited for other business functions. For example, a proprietary analytics solution was integrated with its ERP system. However, an external company must develop both private and semi-public external analytics solutions, because not every audit firm has the capabilities to develop in-house proprietary analytics solutions.

7.6. Data Security and Compliance

To drive audit engagement efficiencies, it is critical to collect engagement data without impacting the client's business. In addition, this data must be secured and compliant with various security, privacy, and regulatory guidelines. From security review questionnaires to documentation on compliance for various reporting standards, these issues often lead to considerable delayed response times. Working through security compliance steps and lengthy approval processes consumes significant time and effort. It blunts the benefit of improving audit engagement efficiency with real-time data access. In addition, many companies are concerned that too much data sharing and integration could lead to data leaks or unintentional requirement violations.

Security compliance is no longer an option that only large companies with public interests have to deal with. Other than the popular policies, there are various acts and guidelines at the country and regional level. In addition, multi-national company policies require all the vendors and third parties to control sharing sensitive information to protect their corporate assets. Commercial companies and public agencies are constantly reviewing and upgrading their security compliance models due to privacy concerns. Great technology like paperless accounting may not be best for companies that have strict guidance requirements. Auditors are left holding the bag as it is often difficult to balance the optimal engagement timing with security compliance demands.

7.6.1. Understanding Data Privacy Regulations

Privacy laws and regulations apply to various businesses and government agencies that collect data from individuals. For the most part, these laws require organizations to collect information only with the subject's knowledge and consent. They also limit what organizations can do with that data and provide individuals with some means of having their data corrected or removed. The various laws that apply to any organization are determined by factors including jurisdiction, industry, and the types of information collected. Though there are several laws and regulations that govern data privacy, there are some common principles or key concepts: 1. **Notice**: The organization should notify individuals about the collection and use of their data. This can be done using a privacy notice. 2. **Choice**: The individual should be able to choose whether or not their data is disclosed or used for a secondary purpose. 3. **Access**: Individuals should have reasonable access to the data they have provided, to review and approve it if necessary. 4. **Security**: The organization should take reasonable measures to protect all collected data. 5. **Enforcement**: The organization must establish policies and practices for enforcing these basic principles. State governments often recognize the importance of these principles when establishing data privacy laws. However, because they have limited resources, state laws are usually far less comprehensive than their federal counterparts.

7.6.2. Best Practices for Data Security

Every key step of the audit management lifecycle, from data capturing to storage to workflows and reporting, must be thoroughly assessed from a data security perspective. Fortunately, there are specific best practices that can help in developing a roadmap for data security in audit software.

Remote Role-based Security: The software must provide remote, role-based security features that allow your company's audit department to set permissions to control access to audit projects, programs, and objectives, as well as the ability to create, view, edit, delete, or export findings and work papers. The software should include robust user groups and user roles that allow granular control of user access to each of these areas for every user role needed in your organization. Invalid users should be explicitly denied access to secure applications, files, and resources. Authentication helps establish a person's identity, but an identity can be verified and authenticated in other ways.

Access Management Approvals: The software should provide built-in lists to give audit managers a quick way to assign ratings to different users. Access control should allow for different approval paths and workflows for the different actions being requested. The software must help prevent users from improperly approving a transaction they initiated.

Alert forms should allow developers to create new alerts as needed, guiding the auditor through the setup process.

No Built-in Administrator Passwords: To keep the system secure, the best practice is that default passwords are not built into the application, although a default process may be permitted that forces users to change the password when they first log in. Passwords should not be hard-coded; any shared key should be stored securely, using industry best practices. The administrator passphrase should not be stored in the database.

7.7. Conclusion

While real-time data collection, automation, and AI-powered insights are a potent combination to drive audit efficiency, companies should not implement it in isolation. For example, performing a walkthrough inspection, inventory count or testing opening balances at year-end is done in one go. It is unlikely to see a solution in the market performing these tasks better than a human being. What usually happens is that sample-based data collection happens at discrete intervals through an audit period. Usually, companies conduct audits at a quarterly, semi-annual or annual interval, signing off on the respective reporting periods. Sample bias is natural at these points. Conversely, internal controls are active mechanisms throughout the audit period. They operate continuously, checking and authorizing transactions that occur during the period, regardless of the sign-off periods. When the same controls affect a large number of transactions, say upwards of 70%-80% for any given audit period, the final sample space tends to be huge at the end of the period. The high sample size provides comfort to auditors at year-end although sample bias can always affect the result.

Real-time data collection, insights based on AI/ML, and automation of low-level tasks enable auditors to increase their sample sizes as often as required over any given audit period, potentially approaching 100% sampling. This is a huge advantage of real-time systems and one that can lead to dramatic shifts in testing protocols. Conventional wisdom dictates that obtained annual evidence is appropriate for year-end tests of a company's internal controls. But if a company's IT remains active over the complete audit period for specific tests, can auditors get more comfort over the final balance at year-end from testing automated IT than from testing the year-end balance of manual IT?

7.7.1. Future Trends

The space for further real-time, AI-driven advancements in the audit world is vast. Departmental and financial segmentation of companies, whether by geographic, vertical,

or other divisions, is a quickly implementable best practice, while segmentation by global intercompany transfer pricing models is dependent on more resources being available to audit firms. Certainly real-time cash transaction oversight, implementations of more efficient data file types and new capabilities that more accurately classify entities and transactions for better data-driven analysis will open the door for more appeals-based analytics and more efficient, interactive audits. The ability to phase transactions into singular dates should help more audits move towards cash basis implementations, while expanding client access and usability give-prepared or direct feeds to the auditors for their real-time monitoring of sensitive data, better adjusts materiality to a client's risk propensity.

Client advisory services are more becoming the pro forma industry standard, which puts the stage for artificial intelligence to continually mine for non-compliance forecasting on other client engagements as well. Having the opportunity to provide near real time oversight on the client's compliance for other deliverables should not only reduce aberrational transaction potential but also proactively match up against concurrent activity from other client engagements to limit misclassification and to monitor client related risk. Global interdependence of the economy places the accounting companies in a critical position as early warning devices for other outside parties, whether boards of directors, taxing authorities or other general stakeholders.

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