Big Data Analytics: Challenges and Opportunities for Auditing in a Digital World

Auditors are now facing exponentially exploding big data landscape. The most important question is how can the audit processes be redesigned to audit more effectively, efficiently and economically using the cutting edge technological solutions in a "blue sky" scenario? To understand this concern, it is essential to appreciate the phenomenon of ever expanding big data mines, and what is called big data analytics; and how the new technological solutions can be applied in better audit outcome. Read on to know more…

What's Big Data?

Big Data is massive data fields containing structured, unstructured, semi-structured, stored, real time, internal and external datasets which cannot be analysed by traditional data processing applications. Data comes from sources from Internet search, Internet of Things (IoT), landline and mobile telephony, remote sensing, software logs, cameras, microphones, radio-frequency identification (RFID) readers and wireless sensor networks and other forms. Big data "size" is a constantly expanding moving target ranging to many many petabytes of data. It is estimated that 2.5 quintillions bytes of data are created every day and 90% of the data in the world was created in the last two years. Computer Sciences Corporation (CSC), estimates 4,300 percent annual increase in data generation by 2020.

In 2001, Gartner analyst, Doug Laney identified 3Vs to relating to big data characteristics: volume,

K. P. Shashidharan
(The author is a Former Director General of the Comptroller & Auditor General of India. He can be reached at kps.ps2013@gmail.com.)

The views expressed by the author are his personal views and may not represent the views of the Comptroller & Auditor General of India.

velocity, and variety. Big data is voluminous, and complex, high velocity data, often captured in real-time and integrated to historically stored in-house and other sourced data. Variety is big data's another distinguishing feature as structured, unstructured and semi-structured data is collected from multiple sources of the web and Internet, Internet of Things (IoT) including sensors attached to devices and machines, and cloud, gathered on line as text, images, audio, and video.

Big Data has other 2 additional Vs too as distinguishing features: While the 4th V, Veracity indicates the relevance of the data generated or processed, the fifth V, Value, determines how the data can bring value to the entity.

Applications of Big Data

Big Data Analytics has application in various businesses and industry sectors. Vast amount of sensory data in addition to historical data construct the big data in manufacturing. For instance, Oil and Gas industry companies have massive data fields relating to different phases covering survey, exploration, drilling, production gathered in real time data and stored internal and external sources. Big Data analytics can be done applying technological solutions like Hadoop, Microsoft MURA platform, IBM InfoSphere, Oracle 11+ etc. for performance excellence in operations, productivity, reduction in costs and enhanced bottom line.

Big data analytics has helped healthcare by providing personalised medicine and prescriptive analytics, clinical risk intervention and predictive analytics, automated external and internal reporting of patient data. The use of big data in an enterprise is called IT Operations Analytics (ITOA) to business solutions before the problems. In Formula One races, sensors can collect data on tyre pressure, fuel burn efficiency in order to win a race and to predict the time by simulations.

New tools like NoSQL and the open source software Hadoop have been developed. In-house data collected from point-of-sale terminals and loyalty cards by industry provide valuable information for marketing, but when the internal data is combined with relevant useful database sourced externally, big data analytics can be undertaken for trend analysis, customer preference, development of innovative products and processes. In certain situations, speed of data processing is important in analytics even in real time analysis of data 'in motion', while data is generated or 'at rest' in data mines.

AART is an Automated Audit, Reporting, and Tracking system applied to leverage the availability of information on a 24/7 basis. AART was initially configured and customised for Maximum Likelihood Estimation. It helps in understanding the client's business, conducting audit review by seeing trends, anomalies, and patterns.

In 2014, Gartner developed HTAP-Hybrid Transaction/Analytic Processing to analyse in memory database. Many businesses follow HTAP for doing better business like trending items for identifying best sellers and sensing customer preferences. The big data refinery is a new system capable of storing, aggregating and transforming a wide range of multi-structured raw data sources into usable formats for analysis to red flag certain types of events to respond.

Automated Audit Reporting and Tracking System (AART)

AART is an Automated Audit, Reporting, and Tracking system applied to leverage the availability of information on a 24/7 basis. AART was initially configured and customised for Maximum Likelihood Estimation. It helps in understanding the client's business, conducting audit review by seeing trends, anomalies, and patterns. AART can be customised with audit status indicators flashing green, red and yellow and pink warning icons pointing to a key control parameter in a centralised SAP system. Unusual transactions and operations can be identified by clicking on red button to red flag for audit review.

Daily Transaction Testing Report on random testing, the audit team can satisfy that the evidence and explanations provided were appropriate and sufficient. Unresolved issues can be reviewed by using statistical techniques, and obtaining reports, charts, and graphs produced by AART to arrive at an audit opinion whether the financial statements of the entity are free from material misstatements, reflect true and fair state of affairs and accordingly issue the appropriate audit certification.

AART has radically changed the audit dynamics. The audit can be conducted with a few highly experienced, technically competent specialists. The

audit and reporting models need to incorporate the changing dynamics in auditing process using right technological applications.

Internet and advances in technology help today's auditors to audit in a globally wired world of computing and communications devices. Smartphones, tablets, and computing and communications devices enable auditors to work from home or any place connecting to the teams seamlessly as if working in the same place.

Many of the audit procedures can be deconstructed into tasks to be performed wherever it can be done in a more effective manner: evaluating internal controls, meetings with the executives, outsourcing certain tasks like bank confirmations to third party specialist organisations who perform such tasks at the highest standards of reliability and security. Analytical procedures or journal entry testing for audits in an office located anywhere in the world can be performed by a specialist team stationed geographically anywhere. This Internet-enabled deconstruction of tasks into separate processes is possible with the aid of innovative technology.

More Effective Audit Data Analytics (ADA)

Data science technologies incorporate theories, techniques, software applications for data analytics, business intelligence, using mathematics, probability, statistics for pattern recognition, data visualisation, gamification, big data analytics, and text and process mining to conduct effective audits in a wired digital world. Challenge before the Chartered Accountants is to learn appropriate skills in applying technological solutions to audit more effectively and efficiently and economically.

Audit Data Analytics (ADA) helps identifying and analysing patterns, anomalies, and extracting relevant audit evidence and facts from unstructured vast data mines. ADA helps the auditor in audit analysis, modeling, visualisation, identifying anomalous patterns and outliers by drilling and analysing big data mines indicating financial performance, operations of units, systems, processes, products.

Using statistical methods like regression models provide insights. Preliminary and substantive analytical procedures assist the auditor to form an overall conclusion on financial statements of the entity.

ADA helps auditors in audit planning, identifying risks, fraud indicators and assessing the risks of material misstatement providing assurance about whether management's assertions are materially correct and the financial statements are free from material misstatement. The visual exploratory techniques show patterns, trends, and outliers that are otherwise hidden with linkages. Exploratory data analytics is detective in nature and confirmatory data analysis is judicial or quasi-judicial while auditing financial statements in line with GAAS.

Big Data Analytics empower the auditor in:

- Risk assessment like the risks of bankruptcy or management fraud;
- Assessing material misstatement;
- Test internal controls; and
- Operating effectiveness by adopting preliminary analytical procedures; and
- By applying substantive analytical procedures, identifying material misstatement,
- fraud; and
- to form an overall audit opinion on the true and fair state of the entity's financial statements.

Why Sampling When Full Population Can Be Audited?

Reasonably high, though not defined, means no less than 95 percent confidence. Technology can be used to provide a higher level of assurance by subjecting to the entire relevant data fields for analytics and audit analysis using statistical techniques like correlation, and regression instead of taking a few samples. Audit software can be used to perform tests on 100 % population and simultaneously analyse and visualise unexpected patterns and outliers requiring investigation. In case of third-party confirmation of assets, or the analysis of complex contracts it is possible to increase audit assurance by analysing the entire population.

Technology helps in recording, measuring and capturing any activity into data. This process is termed as "datafication," tracking many events in real time capturing numbers, text, images, sound, and video requiring petabytes of storage capacity.

AART has radically changed the audit dynamics. The audit can be conducted with a few highly experienced, technically competent specialists. The audit and reporting models need to incorporate the changing dynamics in auditing process using right technological applications.

Big Data and Predictive Analytics are powerful to transform the world of accounting and auditing by using predictive analytics, predictive accounting, and predictive auditing; understanding the emerging auditing panorama; changing the historical Financial Reporting by Continuous Auditing and Monitoring, and Predictive Audit Metrics impacting the profession and job skills for the future audit assignments in the wired world.

Big Data Analytics has become indispensable for effective auditing.

The technique has been widely used in marketing, political campaigns, demographics, sports, medicine, research, law enforcement and securities regulation. It helps auditor to gain deeper insights by enabling drilling and analysing large relevant data fields in the entity's ERP and data warehouse systems.

If an auditor has to determine journal entries that are risky or fraudulent, she can analyse the entire journal entries and identify unusual patterns accounting fraud, bankruptcy, or going concern issues using correlation and indicators from large data mines.

Continuous Auditing, and Continuous Assurance can be possible with cutting edge technology by auditing an entity's transactions at frequent intervals, assessing effectiveness of automated internal controls, detect potential risks as they occur. Continuous monitoring and auditing can be done in today's wired digital age that remotely pinpoint transactions of audit interest. Web-based technologies can provide results instantly online with interactive data reporting standards such as XBRL.

Transformative Audit Data Process and Analysis

Big Data and Predictive Analytics are powerful to transform the world of accounting and auditing by using predictive analytics, predictive accounting, and predictive auditing; understanding the emerging auditing panorama; changing the historical Financial Reporting by Continuous Auditing and Monitoring, and Predictive Audit Metrics impacting the profession and job skills for the future audit assignments in the wired world.

Audit Data Analytics provides methodologies for identifying and analysing anomalous patterns and outliers in data, mapping and visualising financial performance across operating units, systems, products, focusing on audit risks, building business models using statistics identify significant deviations.

ADA helps identifying and assessing the risks of material misstatement by performing preliminary analytical procedures, evaluating internal controls and performing substantive analytical procedures to ascertain the risks of material misstatement, fraud, and to form an overall audit conclusion.

Forensic Data Analytics (FDA)

Forensic data analytics has big potential. Building expertise with right technological tools for analysing large volumes of big data can enhance the risk assessment process and fraud detection and radically transform audit, improving quality and greater insight to management, audit committees, Board of Directors, regulators and investors.

Technological companies like Google, Amazon can apply their data analysis techniques for investors looking at predictive data than historical audit data to aid decision-making.

There is a growing need for organisations to move ahead from traditional audit approaches to a fully integrated auditing methodology and techniques backed by big data analytics in a seamless manner.

Challenges to Big Data Analytics

There are various issues and challenges. Barriers to integration of big data and analytics into the audit process are complexity involved in relevant big data capture, data protection and security concerns. Multiple accounting systems within the entity containing different sets and types of data, and the complexity of data extraction, volume, velocity, veracity, variety and value and relevance and multiplicity of data sourcing for analytics for informed analysis and decision making.

Big data analytics helps gathering audit evidence and better business risks assessment and auditor judgment based on data analytics and analysis. Auditors as well as those involved in risk management and compliance have their respective roles to play in addressing the risks of big data mostly from a variety of sourced databases and analysis of the big data to derive new insights into risks, identify fraud, error, abuse, waste and other internal control and compliance failures better audit outcomes and transforming audit process, risk

management, maintaining operational excellence, internal controls, better financial reporting.

Transforming Internal Audit Process

The Institute of Internal Auditors refers to the *Three Lines of Defense model* referring to corresponding responsibilities of auditors, controls and compliance professionals, and management. Internal auditors act as strategic advisors by analysing data to produce actionable information.

The value of integrating big data and analytics into the audit will only be realised when used by auditors to influence the scope, nature and extent of the audit. This will require auditors to develop new skills on knowing what questions to ask of the data, and the ability to use analytics output to produce audit evidence, draw audit conclusions and business insights. Auditors encounter hundreds of different accounting systems within the same company. Data extraction has not historically been a core competency within audit.

Integrating analytics into audits has to face many challenges: access to audit relevant data can be limited; availability of qualified personnel, resources, and timely integration of analytics into the audit are key issues.

The Board's Role

Most companies analyse just fragments of their data, though big data has huge potential for productivity, improving quality services, create value and enabling critical decision making. Necessary skills, infrastructure, data ecosystems and parameters for sharing data ensuring privacy and security must form part of corporate strategy. 'Data analytics' skills with adequate technical competence, analytical prowess and business know-how, and the industry knowledge and their linkage must be developed for better customer experience and productivity.

Meaningful operational change can come from the Board members. The board members need to understand how the company can leverage using big data and analytics for compliance, risk-monitoring and strategic areas of value creation, optimising cost structures, insights into consumer preferences and new revenue channels, better financial reporting, supply chain and human resources management. Boards and audit committees can discuss with external auditors regarding use of data analytics in risk assessment, auditing, compliance, internal control and enterprise risk strategy and how big data and analytics can achieve strategic business objectives and maximise ROI.

Optimal use of technology can improve audit of financial statements. Audit needs to be conducted associating with other specialists in tax, information technology, valuations, statistics, and actuarial science. There are opportunities for the audit firms for expanding the assurance services in the areas of data quality, security, compliance, fraud prevention and detection, and internal controls.

Audit Process Re-Engineering

Audit profession can improve tremendously by adoption of right technological aids. There must be more audit research in universities, firms, professional bodies, technology providers, and specialists in related fields like Artificial Intelligence, machine learning, statistics, and big data analytics to improve audit profession.

Optimal use of technology can improve audit of financial statements. Audit needs to be conducted associating with other specialists in tax, information technology, valuations, statistics, and actuarial science. There are opportunities for the audit firms for expanding the assurance services in the areas of data quality, security, compliance, fraud prevention and detection, and internal controls. Audit procedures can be continuous by conducting tests throughout the year.

Cloud computing creates opportunities for more automated corporate and audit systems. Multiple audit opinions can also be provided for the needs of different stakeholders. A "pink" indicator in the automated system can be programmed for taking immediate corrective action.

Auditing guidance and standards must encourage application of big data analytics, innovative methodologies, techniques and technologies to auditing. Auditing standards at present deal with audit sampling, but using big data analytics, auditor can examine 100 % population, increasing audit effectiveness. Audit guidelines and standards need suitable amendments for incorporating current dynamics. Auditors must be encouraged to adopt technological solutions for providing better level of assurance and they must be encouraged to use latest auditing tools, techniques and competencies to do value added auditing applying big data analytics. ■