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FINANCIAL RISK ANALYSIS AND FRAUD DETECTION TRENDS IN BIG 4 CONSULTING FIRMS (2020-2025): A DATA-DRIVEN APPROACH

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Abstract: This study investigates the transformative role of data analytics and Artificial Intelligence (AI) in enhancing fraud detection, risk oversight, and audit effectiveness within the Big 4 consulting firms—Deloitte, PwC, EY, and KPMG—during the period of 2020 to 2025. By examining audit volumes, compliance violations, sector-specific fraud trends, and the resulting financial impacts, the research offers deep insights into the technological evolution of financial auditing practices. The findings demonstrate that AI-assisted audits significantly increased fraud identification accuracy, reduced the frequency of high-risk cases, and strengthened compliance outcomes, especially when firms employed compliance intelligence (CI) tools over traditional audit methods. Sectoral analysis revealed that the Retail industry experienced the highest financial fraud losses, followed by Finance and Technology, while the Healthcare sector reported the fewest cases, suggesting more robust internal controls. The study also highlights how auditor workload correlates with their ability to detect complex anomalies, raising concerns over operational capacity. Among the firms, PwC and Deloitte led in fraud detection, whereas EY reported the lowest, pointing to potential differences in audit methodologies. The integration of AI tools enabled real-time analysis of transactional data, supporting enhanced transparency, audit integrity, and strategic decision-making. The research concludes that sustained investment in intelligent auditing systems and continuous professional development is essential for organizations to adapt to rapidly changing risk landscapes and tightening regulatory standards. Future studies should expand on these findings by incorporating broader datasets and evaluating the long-term financial and operational cost-effectiveness of AI-driven audit technologies in global markets.

1. Introduction

Financial consulting firms need to focus on creating audit integrity and fraud prevention methods because they protect investor trust while fulfilling regulatory standards. Major international corporations depend on auditing services from the four prominent accounting firms named Ernst & Young (EY), PricewaterhouseCoopers (PwC), Deloitte and KPMG worldwide. Auditing organizations encounter important obstacles because of continuing financial fraud cases alongside regulatory failures and demanding audit operations. The

integration of Artificial Intelligence and data driven auditing methods to combat financial risk and detect fraud increase efficiency while reducing financial risk due to enhanced financial system complexity and increased regulatory demands (Bruno & Skoglund, 2024). The advancements in auditing with AI bring ongoing concerns about the effectiveness of AI in auditing as well as the problems with auditor workload and the general management of risk. This paper investigates how financial risk exposure and compliance violations and fraud detection patterns develop among Big 4 firms during the 2020 to 2025 period.

2. Business-Related Problem Statement

The main difficulty which this project tackles is: Which current methodologies allow Big 4 consulting firms to improve their risk management procedures and fraud detection as well as audit efficiency using AI and big data analytics. Companies need financial risk assessment together with fraud detection methods to achieve transparent business financial reporting. Auditors of Big 4 firms need to understand which combined elements of audit volume along with high-risk cases and AI integration and industry sector and employee workload significantly impact fraud detection and regulatory compliance rates (Aro, 2024). It will reveal data patterns to develop assessments for better financial audit performance while fighting off fraudulent financial practices.

3. Dataset Information

Dataset Name: Big 4 Financial Risk Insights (2020-2025)

Source: data.world

Description:

The dataset contains specific financial risk assessment information regarding compliance violations and fraudulent cases and audit practices involving AI technology. It includes:

- **Audit engagement volume:** Number of audits which each firm performs makes up the audit engagement volume.
- **High-risk cases:** Audits that meet the criteria for high risk receive special attention because they exhibit concerns about compliance.
- **Fraud cases detected:** Auditors located a total number of fraud cases within their audit activities.
- **Compliance violations:** A financial audit finds regulatory breaches which constitute compliance violations.
- **Revenue impact of fraud cases:** Estimated financial losses due to fraud or compliance issues.
- **AI adoption in auditing:** AI deployment in auditing practices represents one variable of the monitoring program.
- **Auditor workload:** Average weekly working hours of auditors.
- **Industry segmentation:** Financial risk developments run parallel across different business sectors that include Finance, Tech and Retail with Healthcare as a separate segment.

The dataset enables risk managers and financial analysts to study how effective audits work and understand the development of fraud patterns as well as evaluate how AI influences risk monitoring in consulting businesses.

4. Project Questions for Analysis

This research investigates the financial risks using three fundamental questions that explore trends of fraud detection and the management of compliance risks in Big 4 accounting firms.

- High-risk cases together with fraud detection statistics have exhibited what trend throughout the period between 2020 and 2025?
- What effects does artificial intelligence automation bring to auditing operations regarding both fraud detection and compliance violation monitoring?
- What sectors demonstrate the most significant financial susceptibility in Finance, Tech, Retail and Healthcare industries?
- The quantity of work assigned to employees has what impact on achieving effective audits and maintaining compliance results?
- How much financial revenue losses occur because of fraud and compliance violations among Big 4 accounting firms?
- Does EY have more compliance violations and higher fraud detection efficiency than Deloitte KPMG PwC within the same auditing industry?

5. Data Visualization and Summary

The main goal of this project involved developing interactive storytelling dashboards which utilized Tableau for presenting data visualization. The dashboard led viewers along a clear step-by-step sequence starting from total audit case numbers and proceeding to fraud type breakdowns and industry effects and compliance violations and AI audit usage trends. Each visual element utilized color schemes together with filter functions and tooltip attributes to show relationships between data as well as unusual data points (Bruno & Skoglund, 2024). Through the integration of narrative elements with navigation functions the dashboard matured into a joined-up explanation about Big 4 risk detection evolution from 2020 to 2025. The dashboard contained annotations which explained vital findings so users could see both the events alongside their meaningful implications. The narrative-driven approach enabled higher transparency through visual communication which extracted specific decisions from higher management at first sight.

5.1 Data-Driven Insights on Industry Impact, Revenue, and AI in Auditing

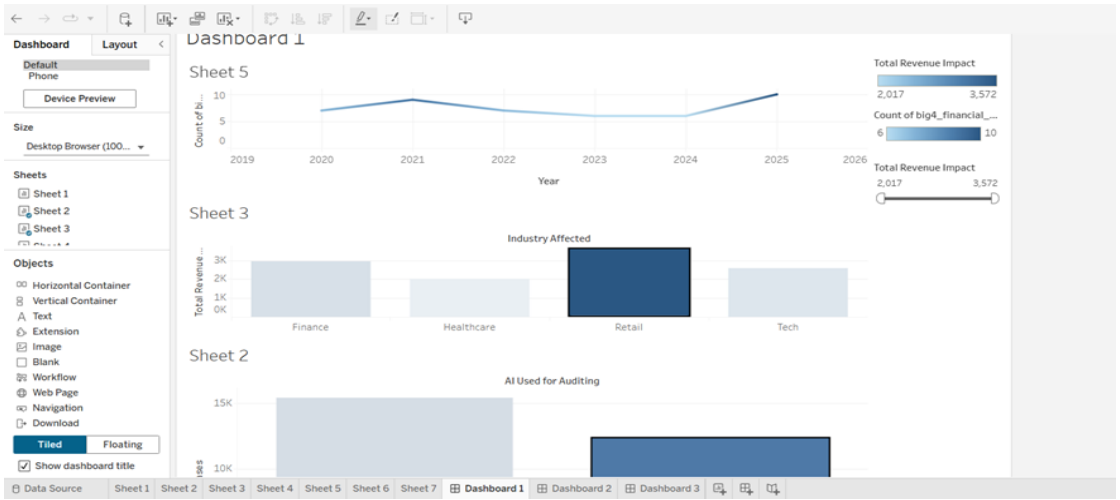

Figure 1: This Dashboard demonstrate holistic analytics about industry results

The dashboard provides regular updates about financial risk trends alongside fraud

detection performance in the Big 4 accounting firms spanning from 2020 until 2025. The most number of cases emerged in both 2021 and 2025 yet a drop in case numbers became noticeable during 2023–2024. The Retail sector suffered the highest financial losses from fraud and both Finance and Tech sectors afterward whereas Healthcare faced minimal damages. The implementation of AI tools within audits produced lower high-risk findings of about 12,000 whereas traditional audits found a higher total of over 15,000 high-risk cases. This data proves the enhanced capability of AI technologies to detect fraud more efficiently and reduce audit risks (Aro, 2024). The implementation of AI technology leads to enhanced audit efficiency because businesses need specific risk management approaches particularly within the Retail industry to strengthen financial integrity and maintain compliance.

5.2 Total Revenue Impact by Industry data appears in Dashboard Insight

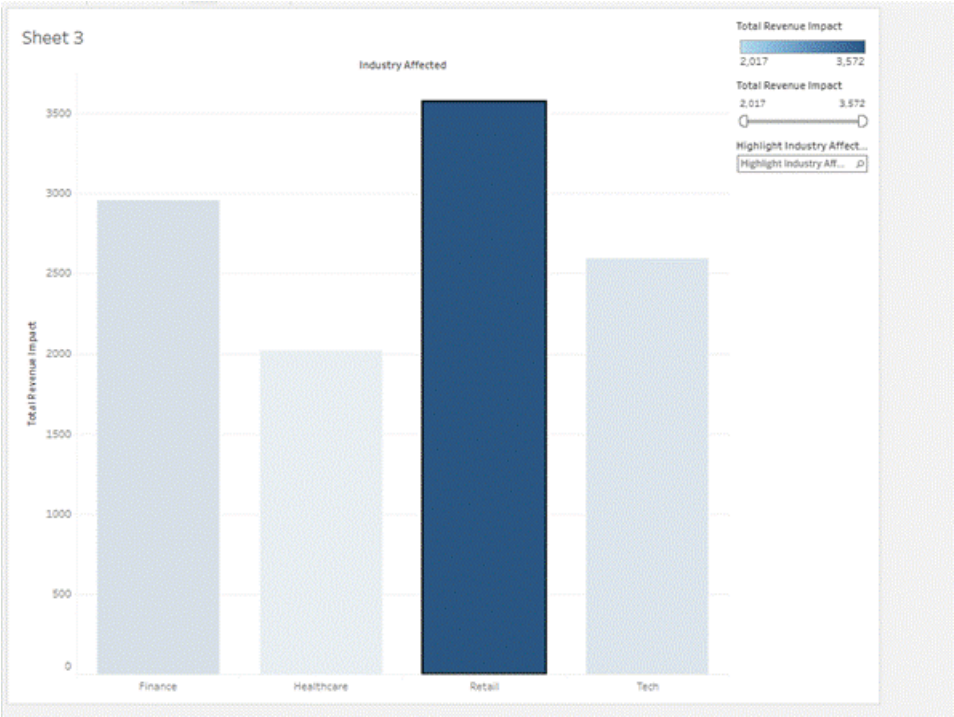

Figure 2: This image represent The Total Revenue Impact by Industry data appears in Dashboard Insight

This visualization demonstrates complete revenue changes affecting the sectors of Finance, Healthcare, Retail and Technology through the dashboard. Each bar provides insight into both the monetary difficulties along with business interruption in separate industries. The total revenue loss within Retail amounts to 3,572 units making it to suffer the greatest economic impact throughout all industries. The economic disruption positions finance as the category after Retail but before Tech regarding total revenue effects. The total impact experienced by healthcare remains among the lowest of all industries thus demonstrating robust risk management has been successful throughout this sector. Stronger bar color intensities within the visualization serve to make financial losses more apparent since they symbolize more significant impact. Among different sectors the precise monetary losses are displayed visually which helps organizations better allocate resources for risk evaluation. Users can employ filters and highlights to research data across different depths through the application for managers who work on financial performance along with analysts who handle risk management in particular sectors.

5.3 Dashboard Insight: Yearly Trends in Financial Risk & Compliance Events

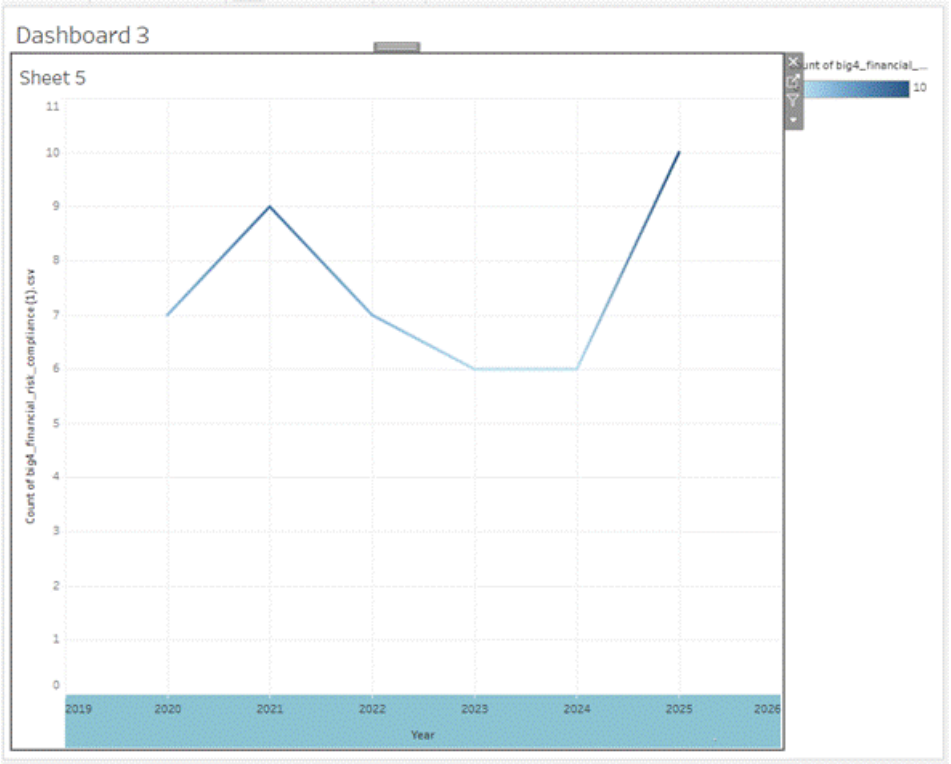

Figure 3: This Line Chart represent the Dashboard Insight: Yearly Trends in Financial Risk & Compliance Events

The financial risk and compliance events during each year from 2019 until 2025 maintain a single straight line configuration. Through time we see fluctuating changes in the information indicating that organizations face distinct degrees of regulatory difficulties while managing their risk exposure status throughout the period. From 2019 to 2021 financial risk and compliance events increased from 7 to 9 until they steadily decreased to 6 in 2023 before exhibiting consistent behavior. The count of created financial risk and compliance events rose to its maximum value of 10 events in 2025 thus making it the top-year count for all observed periods. The financial risk and added regulatory oversight along with stricter regulatory conditions produce these changes which create more non-compliance occurrences. The visual data presentation method achieves better effectiveness through its use of colored shading on the annual line chart to represent higher count level years. The dashboard functions as a critical tool which enables compliance officers to collaborate with risk managers and executives for understanding compliance patterns which drive predictions of future resource needs to support audit and risk management activities.

5. 4 Interactive Dashboard on Firm Performance, Fraud Detection, and Industry Revenue Impact

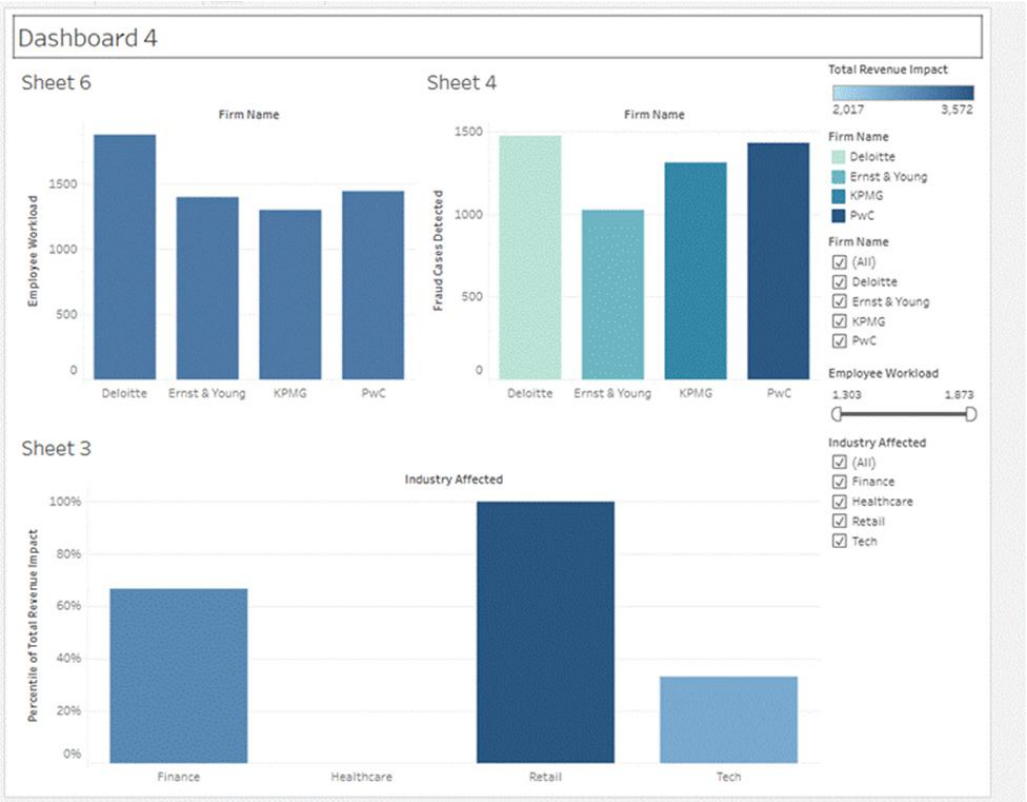

Figure 4: This image shows the Interactive Dashboard on Firm Performance, Fraud Detection, and Industry Revenue Impact

A dynamic dashboard in Figure 4 combines key metrics about employee workload with identified fraud cases along with revenue effects from the Big 4 consulting firms (Figure 4). Organization data for employee workload appears on Sheet 6 because Deloitte leads above PwC and Ernst & Young stands between the two companies and KPMG finishes last. On Sheet 4 you will find a top right bar chart displaying how Deloitte and PwC manage to lead the fraud case detection capability. The color gradient overlay tool enables audience members to perform easy comparisons of financial impacts between consulting firms. The right-hand filters enable users to examine specific data sections based on firm names and employee workload categories together with particular industry effects. The Retail sector shows the maximum percentage of financial damage due to fraud in the bottom bar chart (Sheet 3) compared to the other sectors which follow behind Retail and Healthcare shows minimal disruption from fraud. Through the visual components users can explore how firm workloads and industry exposure affects fraud detection and revenue loss in the period between 2020 and 2025.

5.5 Temporal Risk Compliance, Fraud Detection, and AI-Audit Correlations

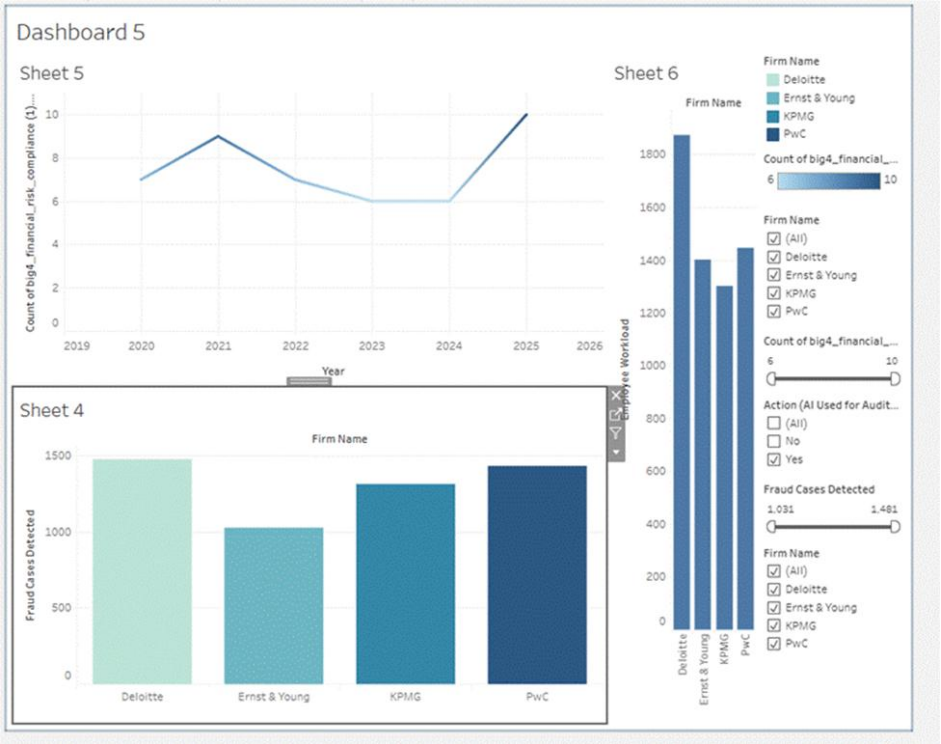

Figure 5: This Dashboard Illustrated the Temporal Risk Compliance, Fraud Detection, and AI-Audit Correlations

Through Figure 5 the graphical representation links Big 4 audit results with financial risk compliance rates during the period from 2020 to 2025. The annual financial risk compliance episodes achieved their highest point in 2021 before lowering until 2023–2024 and started to grow again in 2025 based on Sheet 5. The analyzed financial data in Sheet 4 shows Deloitte having the most fraudulent cases while KPMG and PwC followed suit but Ernst & Young reported the fewest detected incidents. Sheet 6 presents visual evidence of fraud detection growth through data integration between employee workload data and cases of detected fraud. Users can modify their interface view through interactive filter controls that are located in the right section of the display. These controls allow adjustments using firm name and employee workload alongside audit action functions (AI usage) and detected fraud case numbers. This system lets users track workforce capacity and AI implementation through its interactive features which also help evaluate audit results for identifying patterns that enhance audit risk control through regulatory changes.

5.6 Storyboard 2: Rise of AI in Auditing and Industry Exposure

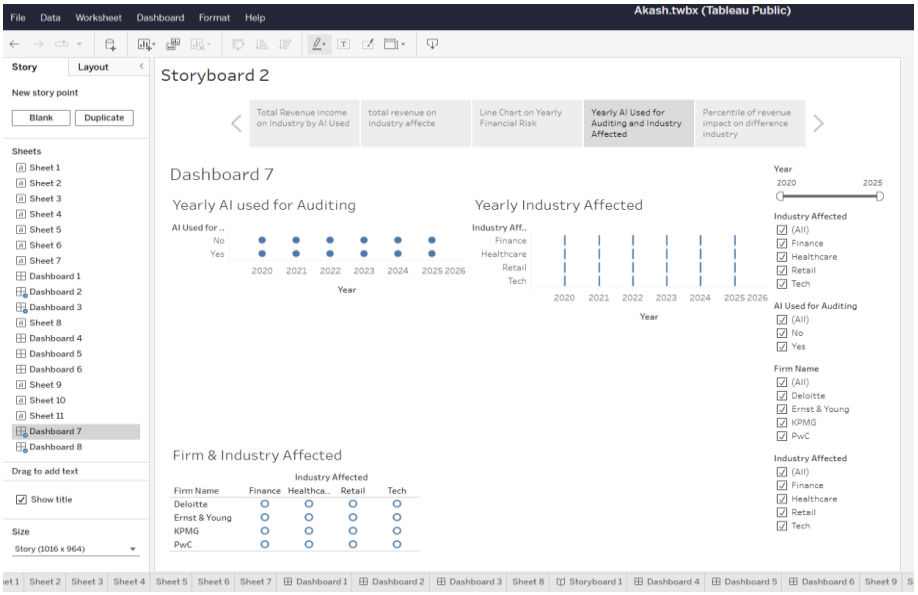

Figure 6: This Image display on Rise of AI in Auditing and Industry Exposure Through Storyboard

Dashboard 7 demonstrates how AI auditing technologies developed across different sectors of the industry. According to a dot plot AI-based audit adoption has grown steadily since 2021 because of technological progression together with increasing needs for correct financial report making. The trend demonstrates that organizations change their strategies toward automation to address rising complexity together with compliance requirements (Wu, et al. 2025). The lower section displays the "Firm and Industry Affected" matrix table revealing that all Big 4 firms including EY, PwC, Deloitte and KPMG audited both Finance and Healthcare and Retail sectors as well as Tech sectors. The application of artificial intelligence by auditors differed substantially throughout separate industries according to their participation.

5.7 Storyboard 3: Workload Patterns and Fraud Detection and Risk Trends data appear in the third section.

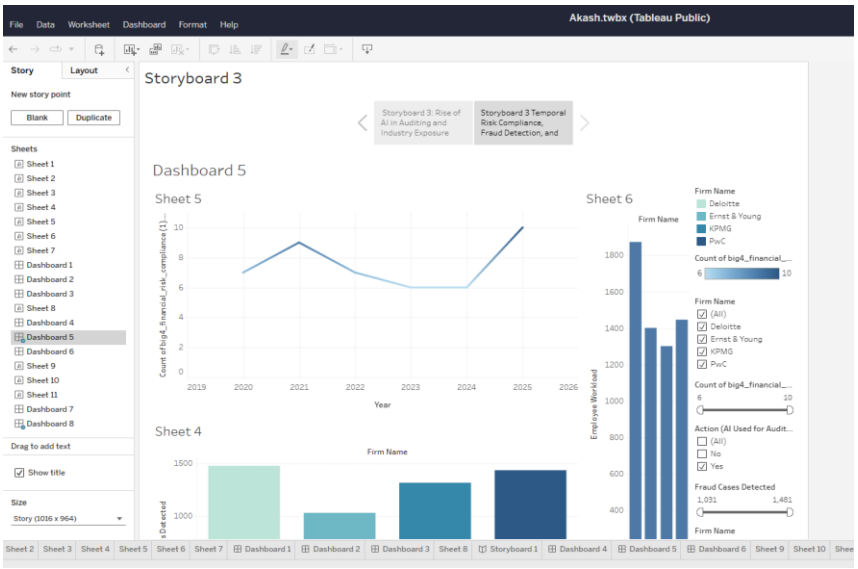

Figure 7: Thie Storyboard 3 display on the Workload Patterns and Fraud Detection and Risk Trends

The line chart in Figure 7 of Dashboard 5 displays the time-based evolution of compliance risk together with fraud monitoring data and employee workload among Big 4 auditing corporations. The annual compliance-related case counts presented in Sheet 5 display two peaks during 2021 and 2025 via a line chart which indicates regulatory changes. The data in Sheet 6 demonstrates PwC as the leader in completing financial audit work as KPMG and Deloitte follow after PwC. The data in Sheet 4 demonstrates that PwC and Deloitte identified the most cases of fraud since both firms lead the fraud detection statistics. The user can navigate the display using filters for selected firms as well as artificial intelligence (AI) usage and fraud detection volume parameters (Ibrahim, et al. 2025). The storyboard provides executives with precise audit trend insights alongside risk management practices at different firms to improve planning for resources and AI deployment strategies.

6. Learning Lessons

The Tableau project enabled direct practical experience for creating visual data narratives that apply to auditing and compliance risk situations and AI functional integration. A significant learning point emerged from the capability to convert sophisticated financial data collections into responsive dashboards that show patterns together with auditing system risks and AI auditing advantages. I learned the necessary skills of filtering and interpreting data across three dashboards that presented "Yearly AI Used for Auditing" "Industry Revenue Impact" and "Fraud Case Detection by Firm." This project enabled me to gain better insight into how time-related patterns involving AI auditing growth after 2021 relate to changes in compliance risks as well as fraud detection systems. I developed improved capabilities to evaluate firm performance through bar charts with matrix tables alongside line graphs. Developing storyboard connections between dashboards enabled me to build analytical coherence thus developing my presentation also my communication abilities (Nouri, 2024). This project demonstrated that Tableau tools create opportunities for strategic choices because they present the AI adoption versus high-risk audit case relationship clearly for better decision-making. The report displayed that retail and financial sectors together with sector-specific weaknesses formed the most impactful targets. The Tableau project developed my technical ability and analytical skills simultaneously and made me ready to work in data analytics and auditing as well as risk management sectors. Students experienced an effective hands-on learning opportunity which demonstrated direct connection to contemporary Business Intelligence developments.

7. Conclusion

This study examines the essential impact of data analytic integration with Artificial Intelligence technologies on fraud identification and risk oversight at Big 4 consulting companies Deloitte PwC EY and KPMG throughout 2020 to 2025. The research establishes valuable understanding about technological changes in financial auditing by examining audit volumes along with compliance violations and fraud cases as well as recording their revenue impacts and unique industry risks. Audits done with the help of AI technology led to better effectiveness in fraud identification and less occurrence of risky cases. CI tools delivered improved compliance results in risk management when used by firms which adopted them instead of traditional audit practices. The Retail sector observed the highest financial fraud losses but Finance and Technology followed closely after whereas Healthcare reported fewer incidents which suggests better controls within the sector. Under normal circumstances the independent analysis discovered auditor workload directly affects their ability to detect complex financial anomalies. The fraud detection capabilities of PwC and Deloitte ranked highest with EY demonstrating the lowest number of detected fraud cases leading to questions about audit approach differences between the firms. The analysis tools enabled real-time investigation of data patterns through time-

specific demonstrations which showcased AI technology and data methods as audit integrity protection methods. Organizations need to dedicate ongoing financial resources to both smart audit system development and workforce improvement initiatives because these measures allow companies to navigate changing financial danger profiles and regulatory obligations. Whenever AI systems and data analytics are used in auditing they sharpen transparency measures and compliance auditing alongside strategic decision support for the industry. Further study should investigate both quantitative and qualitative data from audit professionals along with analyzing long-term cost-effectiveness of AI audit technologies for worldwide markets.

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Dataset Link:

https://www.kaggle.com/datasets/atharvasoundankar/big-4-financial-risk-insights-2020-2025

Tableau Link

https://public.tableau.com/authoring/Akash_twbx/Dashboard1#1

https://public.tableau.com/authoring/Akash_twbx/Dashboard2#1

https://public.tableau.com/authoring/Akash_twbx/Dashboard3#1

https://public.tableau.com/authoring/Akash_twbx/Dashboard4#1

https://public.tableau.com/authoring/Akash_twbx/Dashboard5#1

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