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A financial auditing approach using failure effect mode analysis

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Abstract: This paper proposes adopting Failure Effect Mode Analysis (FMEA) in audit procedures in order to improve the prediction of corporate failures and improve reliance on financial reports. It is well known that corporate failures adversely affect the accounting profession's reputation, public interest, social costs, capital markets, and the national financial and monetary economic system, causing wasted resources by companies and losses by shareholders. In this article, we incorporate various recommendations of Brydon (2019) by suggesting the use of FMEA to strengthen the auditing profession. We are focusing on fundamental financial measures of liquidity and profitability, intending to increase the reliability of going concern issues for the company being audited. This article proposes the FMEA model for a substantial audit reform. FMEA adoption can prevent corporate failures in the future through the proposed model. This research is helpful to standard setters, managers, auditors, and governmental agencies and, finally, can protect the public interest.

Keywords: corporate failures; failure mode analysis; going concern; liquidity; profitability.

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1 Introduction

This article proposes a model to prevent audit firms' failure to detect going concern that has been occurring in recent years in the UK and has resulted in forthcoming reforms outlined in the Sir Donald Brydon report (Brydon, 2019; Fabiianska, 2020; Financial Times, 2018; Smith, 2012). Auditors' report contributes to accounting information quality, and the audit expectation gap is of concern when reliance on audit reports is reduced (Jeppesen, 2019). Restoring public trust in accounting is critical (Rezaee, 2004). Government regulators and the participants in the financial markets question the audit profession whenever there is a corporate scandal. Dangre (2009) asserts that aggrieved investors should have the right to hold the profession responsible for negligence and non-compliance with professional conduct.

It is always a question of what the auditors would do in the event of a corporate failure that results in financial losses to investors (McLaughlin et al., 2021). In light of recent financial reporting failures and the feedback of regulatory organisations with inspections and research (Pickard, 2019), along with detailed reports like the 135-page Brydon report and 65 recommendations, efforts are being made to identify the cause and prevent such failures from occurring again in the future. However, it is essential to ask

how such failures can be avoided in the future (Singer, 2018). Indeed the necessary predictions should have been made during the development of the accounting and auditing standards or the compilation of the supervisory rules for auditors' work by competent authorities such as the Financial Reporting Council (FRC) (Holm and Zaman, 2012). It should have been possible to find solutions before such corporate failures (Qiu et al., 2020). As a result of the bad performance of the auditing profession, a new aspect of auditing practice is emerging in the direction of predicting the cause of such painful financial failures for the victims (Hyde, 2022).

To address any conflict of interest, authorities recommend that accounting firms be prohibited from providing audit services while they are providing financially lucrative consulting services to clients (Brydon, 2019; Evans, 2019). Recently, one of the Big Four Accounting firms has announced it is considering a split for a third time, putting pressure on the rival accounting firms (Reuters, 2022). According to the FRC, an auditor may not provide services other than audits to large UK companies unless such services are closely related to audits and are required by law. This work focuses on preserving the auditor's independence and protecting the public interest since restoring public trust in auditing is a significant challenge. The majority of those who use financial information complain that independent auditors lose their independence when they perform non-audit services in controlling the audit of financial statements. A progressive set of measures should be implemented to ensure that the future of auditing is based on a robust audit regime that provides a framework of governance that is respected by the public. After the fraud detection failures at Enron and Worldcom in the USA, the Sarbanes-Oxley Act of 2002 placed greater responsibility on accounting firms and corporate board members. This act was intended to combat fraud, improve the reliability of financial reporting, and restore investor confidence. It places more oversight and a greater emphasis on controls and balances between the work of management, the independent auditor, and the board's audit committee, with increased reporting costs. The costs and benefits of the Sarbanes-Oxley Act have been debated since it was implemented. The most burdensome element of the Act was Section 404, which says that it is management's responsibility to maintain a sound internal-control structure for financial reporting and to assess its own effectiveness and that it is the auditors' responsibility to attest to the soundness of management's assessment and report on the state of the overall financial control system. While the act was intended to benefit the investment community, smaller public companies, in particular, complained about the increased demands of its executives' time and costs running into the millions of dollars.

The debate of splitting the accounting firm's lucrative consulting work from their assurance business continues to be debated. The attempt with the split is to increase the reliability of financial reports with increased reliance on external audits. However, consulting is financially very lucrative for accounting firms. The dominant market position of the big four accounting firms has started the debate on whether to strengthen the smaller audit firms' power to increase competition. The consequence of audit firms becoming non-audit consulting service providers is limiting the number of audit clients they can serve. With the increased number of competitors, the auditors could be forced to improve the quality of their services and invest further in their processes. The result would be enhanced audit quality and increased reliability on financial reports. Additionally, new auditing standards in the UK will reduce fraud or deficiencies in the

audit process. A complimentary assurance system should be designed to provide deep and broad certainty to protect users of financial reports.

Brydon, the head of the London Stock Exchange, examined the quality of audit information and the auditing philosophy to explain the recent collapses of large companies such as Carillion Wirecard and Patisserie Valerie (Brydon, 2019). Interested groups have expressed concern over Brydon's recommendations because they believe they may confound other audit performance reviews. A criticism of Brydon's report is that it only interprets symptoms rather than uncovering the underlying causes and main reasons. Thus, the financial problem that increasingly affects countries' capital markets, notably the UK, remains unresolved.

This article initially aims to investigate corporate failures from various perspectives and angles. Alternative models have been developed to determine the accounting manipulations made by companies. While some models use textual analysis (Larcker and Zakolyukina, 2012; Purda and Skillicorn, 2014), other models utilise non-financial data using statistics or a machine learning process to predict the possibility of financial manipulations (Kirkos et al., 2007; Brazel et al., 2009; Cecchini et al., 2010; Dyck et al., 2010; Wang et al., 2010; Wang, 2013; Amiram et al., 2015, 2018; Bhardwaj and Gupta, 2016; Kim et al., 2016; Dutta et al., 2017). Beneish (1997) demonstrates that both lagged accruals and an index of the days' sales in receivables aid in identifying earnings manipulations among the models that use financial statement data. Other studies add to this research field and provide a link between fraud and financial statement variables (Summers and Sweeney, 1998; Lee et al., 1999). Beneish (1999) further developed an asset quality index which helped to manipulate predictions further. The revised model was shown to predict 76% of manipulators accurately and 17.5% inaccurately as non-manipulators using eight financial statement variables. Spathis (2002) created an alternative model where a low stock turnover ratio, low return on assets and low Altman Z-score increase the likelihood of financial statement fraud. Richardson et al. (2006) build on these prior studies by adding a comprehensive measure of accruals that incorporates both working capital accruals and accruals relating to non-current assets and liabilities. The final objective of this article is to improve corporate failure models with a robust analytical technique. This will help auditors better predict the client's financial performance and protect the financial markets by reducing financial fraud and preventing the profession from poor performance. Yet, this technique is not a unique solution that completely resolves the problem.

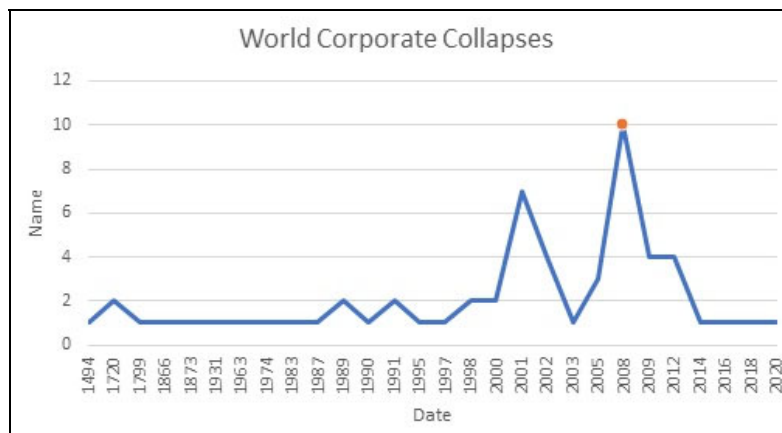
The following outlines the remainder of this paper – a background to the study, followed by critical factors in determining organisations' survival. The article introduces the stages of using FMEA and finishes with a conclusion. The paper is organised as follows: first, we discuss the main objective of the auditing function, which is to protect the public interest. Afterwards, we discuss the main audit scandals related to failing to warn users about corporate failures. Innovatively, we suggest auditors use reliability engineering methods by explaining how the system works.

2 Background

According to the agency theory, a violation of the public interest may occur when managers, investors, and the public's interests are not aligned. Auditing plays a significant role by conducting an independent examination to give credibility to financial

reports prepared by managers for the stockholders. The auditor acts as a professional expert to ensure the firm's financial statements and is an agent of the public interest. Failure of a corporation has several adverse effects, including the loss of public trust in the accounting profession and financial markets. Loss of confidence in financial markets leads to stock purchases and sales stagnation, ultimately harming the national economy. The government and relevant authorities usually develop stricter laws in response to such corporate failures. In the USA, the SOX law is perhaps the most prominent of these laws, affecting not only the USA but also other countries (such as CLERP 9 in Australia). In analysing the history of major corporate failures from 1494 to 2020, we find that the USA (21), UK (11), Germany (8), Australia (5) and Canada (5), along with other European countries, have had the highest number of corporate failures. In 2008 and 2001, there was the highest number of legal failures since 1494. Following the banking industry, the insurance industry has the highest collapses. The USA accounted for 60% of such failures in 2008 (see Figure 1)¹.

Figure 1 Number of corporate collapses from 1494 till 2020 (see online version for colours)



Approximately six years after SOX, most legal failures occurred in the USA. However, what is happening now in the UK is the reshaping of stricter rules on the work of professional accounting and auditing firms in the mimic of SOX. It seems we need to formulate new laws that are more precise and more thorough than SOX. Thus, a progressive set of measures should be adopted to ensure the future of auditing in the UK based on a solid audit regime that provides a framework of governance that is respected by the public. The UK needs to adopt a more robust and more appropriate version of SOX, with a stronger focus on checks and balances between management, the independent auditor, and the audit committee, ultimately benefiting long-term investors.

Auditor services are in demand because of the agency problem. Investors believe financial statements are reliable because auditors provide credibility to these statements through the independent audit process. Although auditors provide reasonable assurance, it has always been challenging to define their role in an acceptable way (Humphrey et al., 2021). Any loss in trust would cause a perception gap between auditors and users. Financial scandals involving large companies like BHS, Carillion, and Patisserie Valerie have exacerbated that perception gap in the UK financial market. Auditors and users perceive different performance levels in audit reports, called audit expectation gaps.

Based on Akther and Xu's (2020), stakeholder confidence is moderated by the active role of the financial reporting council. Among other things, the Brydon report discusses the gap between auditors' expectations and their reality. There have been three independent reviews conducted by the British government in the area of audit reform: an Independent review by Sir John Kingman of the Financial Reporting Council (FRC), the Competition and Market Authority's (CMA's) Statutory Audit Market Study, and Sir Donald Brydon's Independent Review of Audit Quality and Effectiveness.

The position of increased regulations proposed by traditional agencies and regulatory bodies creates a debate due to the increased costs of assurance services that come with increased audit requirements. The radical reforms will be criticised and removed if they cause a conflict of material financial interests with specific individuals or groups. In the final stage, the lowest level of reform will be implemented. While aspects of the audit environment have changed over the years, fraud and professional misconduct could not be prevented. Some examples include changes to several standards, increased supervision, more recommendations relating to auditor independence and competition, and changes in the auditor's professional education curriculum. In auditing, the primary objective is to provide users with quality information. It is necessary to develop and correct auditing standards to ensure companies' long-term survival in the digital economy era. After COVID-19 and leaving the European Union, companies in the UK assume to assure society they will act responsibly in employment, investment, payment of taxes, interest, and dividends, as well as business competition.

The auditor is required by law to verify the accounts according to a 'true and fair view', but they are required to do so based on an accounting system dominated by the management of the enterprise and accounting standards that allow the figures on the financial statements to be reported in a meaningful manner. In other words, an auditor's proper judgement of the quality of the company's accounts is primarily influenced by whether managers record transactions following accounting standards. The purpose of auditing is to ensure that management has not misused the company's financial resources and that the financial statements are a complete and accurate representation of the company's financial situation.

Corporate failures in the UK have not only tarnished the professional image of the Big 4 but have also resulted in substantial losses for them. For instance, a \$250 million lawsuit has been filed against KPMG for the case of Carillion (Financial Times, 2020). The auditor's report on the company's profitability leads to dividend payments. In contrast, the required liquidity, which was reported to be 7 billion pounds in January 2018, actually amounts to 29 million pounds in cash, raising the question of whether auditors are sufficiently concerned about raising red flags for struggling companies. As a result of the KPMG audit report, Carillion's board of directors considered the business to be 'profitable and sustainable'. Even though the earlier section provided some data on detecting financial manipulations, according to Qiu et al. (2020), further research is needed on the interaction between liquidity, profitability, productivity, leverage, and asset turnover.

In Carillion's case, auditors failed to gather sufficient evidence on three key accounts. First, net income was incorrectly measured and reported. Second, the actual amount of the company's debts, which is the basis for calculating interest and other legal costs, has been in the shadows. Third, the growth of liquidity and its sufficiency to pay dividends was overstated, which was affected by the incorrect measurement of net income. In previous studies, auditors' familiarity with the client was considered a risk to their

independence. When it comes to audit judgement, this issue results in not collecting sufficient audit evidence and applying professional scepticism (Svanberg and Öhman, 2015).

The audit report should focus on a company's financial health and continuity in the future, which depends on these two essential factors: the accuracy of the net income calculation and the adequacy of the liquidity level. In both cases, Carillion's auditor had committed gross fraud. Just four months after the audit report, the company's assets were reported to be 800 million pounds more than the actual amount. In his report, Brydon concluded that auditors should include more critical information in their reports to guide users after 80 years of traditional reporting. This article highlights the critical issues that should be included in the audit report.

3 Liquidity

Without sufficient liquidity, even the most profitable company will fail. Charitou et al. (2004) demonstrated that operating cash flows are essential in predicting failure. An analysis of 51 corporate failures of British public industrial companies was conducted during 1988–1997. Maintaining adequate liquidity and managing cash is one of the essential managerial skills. Cash is one of the main areas of focus in financial fraud. In the case of Wirecard, observers of the auditing profession in Germany believe the auditor failed to obtain sufficient audit evidence to support the professional judgement or fraud involved. Since 2009, the same accounting firm audited Wirecard but could not uncover fraudulent bank balances and transactions at the German payments company, which was worth €24 billion at its peak. The accounting firm failed to detect approximately €1.9 billion of fraud while auditing Wirecard for a decade (Financial Times, 2021). The audit firm claims that individuals conducted the audit procedures professionally, to the best of their knowledge, and in good faith. The accounting firm said that “third parties provided false documents with intent to deceive”. The lack of professional commitment eventually wastes time and money, which causes considerable losses to the public and harms the economy by providing false assurance to investors.

In January 2019, Patisserie Valerie filed for bankruptcy, resulting in the closure of 70 of its 200 coffee shops and the loss of 900 jobs. The company failed to provide adequate information to the users regarding liquidity and profitability, even with a clean report from its auditor. Claudia Mortimore, the FRC's deputy executive council, stated that “the audit of Patisserie Holdings plc's revenue and cash, in particular, involved missed red flags, a failure to obtain sufficient audit evidence and a failure to stand back and question information provided by management”². In the two years following the detrimental audits, the board approved almost £250 million in dividends and advisers' fees. The audit firm is likely to have violated accounting standards.

To maintain healthy growth, businesses should respond quickly to changing conditions and new opportunities that may arise. Having a healthy cash flow involves both a healthy cash inflow and a healthy cash outflow that, when monitored continuously, allows the company to optimise cash flow if new opportunities arise. Moreover, if the company encounters unexpected challenges, it can cope effectively. Take the necessary risks to achieve positive growth. Sustainable and healthy development should be completed by managing these issues. On Friday, 12 January 2018, the last day of trading

for Carillion, £6.4 million was paid to auditors, consultants, and law firms. A check for £2.5 million was issued to the audit firm, a cheque for £1.02 million was issued to wages for consultants, and a check for £276,000 was issued to a different big four accounting firm. Carillion made another payment of £551,000. The next day, Carillion asked the government for a £10 million grant to keep the company afloat. In an exciting development, Carillion requested £10 million in funding from the government the following day to remain solvent. To survive both short-term and long-term, Carillion did not establish a healthy and robust cash flow system, and the auditor failed to report the issue to investors.

3.1 Liquidity analytics

To prevent the recurrence of the liquidity problem, auditors need to perform liquidity analytics, which enables auditors to thoroughly analyse a company's liquidity condition to determine how healthy the cash inflows and outflows are. The most conservative measure of liquidity is the cash ratio, and the last one is the current ratio. The current ratio includes accounts receivable that may not be real or collectable. The optimal liquidity state, $f(Liq_{i \geq Min}^{\leq Max})$ of a company is an (either continuous or discrete) random variable that should be located between the minimum optimal liquidity level within the industry ($f(Min_{Liq})$) to less than optimal maximum industry level ($f(Max_{Liq})$). The auditor should calculate the $f(Liq_i)$ through current industry data. So, we have:

$$f(Min_{Liq}) < f(OptLiq_{i \geq Min}^{\leq Max}) < (f(Max_{Liq}))$$

It is recommended that the auditor measures five levels of numerical liquidity: the minimum level of liquidity of the industry, the minimum level of optimal liquidity, the average level of optimal liquidity, the maximum level of optimal liquidity of the industry, and the maximum level of liquidity of the industry. The audit report should raise a red flag when customer liquidity levels are below industry minimums.

The auditors usually have historical data related to the client but should also collect historical data related to the industry for analytical analysis to discover any irregularities. As a rule, this data will be in the form of panel data, which includes information regarding the year and items of current assets and liabilities, such as cash, accounts receivable and payable, inventory, charges, and interest owed. The data type will be used as a ratio or natural logarithm of monetary items. A trend analysis is recommended in auditing standards under analytical process techniques.

3.2 Liquidity issue in audit report

The auditor should report the liquidity health of a company by accurate measurement. The auditor is required to inform the user of the company's liquidity status at the end of the financial year, at the balance sheet date, and at the time of the audit report. Reporting the liquidity status on two dates allows the user to know the events between the two dates and the trend. The user can make a more informed decision by understanding the concept of minimum and maximum liquidity levels and the company's current liquidity situation compared to its main competitors.

4 Profitability

It is a sensitive matter for auditors, investors, government officials, managers, and lenders to assess profitability and performance accurately. The measurement of profit on an accrual basis can distort the accurate picture of profitability. The depreciation of intangible assets may result in an unrealistic increase or decrease in the value of total assets, while at the same time, profit measurements may not be accurate. As another example, the profits of subsidiaries of a group can be accumulated rather than paid to the parent company, thereby expanding the consolidated balance sheet. At the same time, the parent company can still prudently record its investment in subsidiaries at historical cost. This results in the parent's balance sheet being much more extensive than its consolidated balance sheet. Accordingly, while Carillion's consolidated net assets were £729 million in its last full financial year, the parent's balance sheet was £1.1 billion. In this manner, the parent company does not harm its investments in loss-making or indebted subsidiaries. Because the parent company is the only one that can pay dividends to its shareholders from its accumulated profits or distributable reserves, its balance sheet is essential. If such earnings are overstated, this will result in more debt and result in companies paying dividends and unearned bonuses to increase the value of their stock on the market.

In 2018, GSK³, for example, reported an accumulated profit of £18 billion on the balance sheet of its parent company, compared to a loss of £2.1 billion in the consolidated accounts. A £20 billion difference and GSK's decision to pay a dividend of £3.9 billion. It entails paying approximately twice the accumulated losses of the consolidated accounts. Thus, the value of subsidiaries is increased in a manner that misleads the user. Consider the case of Carillion, which collapsed within a few months of distributing £54 million to shareholders. The auditor focuses on companies with distributable reserves that are nearing completion since the quantity and quality of these reserves must be of great importance. According to the Brydon report, the new goal of auditing should be to prevent the misuse of company capital by managers who intend to mislead or confuse the shareholders.

4.1 Profitability analytics

By using profitability analytics, auditors can predict the client's accurate net profit figures. An examination of sales, expenses, accruals, cash and non-cash revenue and costs concerning net profit is included in this process. Also, an analysis of income and expenses over a long period (e.g., 5 to 10 years) may provide a better picture of the client's future.

But the primary goal of an auditor in net profit analysis is to determine the actual net profit value, allowing users to make accurate decisions. That is, auditors should calculate the real profit as follows:

$$ONI_i = NIM_i \pm \sum_i (R_u - E_u) \pm \sum_i (G_U - L_U)$$

where

ONI_i optimal net income in year i

NIM_i net income reported by management in year i

R_U	all those unrealistic revenues although measured based on accounting standards
E_U	all those unrealistic expenses although measured based on accounting standards
G_U	all those unrealistic gains although measured based on accounting standards
L_U	all those unrealistic losses although measured based on accounting standards.

Having calculated the optimal net profit, the auditor should now compare this profit with the industry's net profit. The auditor should interpret the user's upward and downward trends by analysing the trend. It is recommended that the degree of comparison between the industry's net profit in each interval is described in terms of the following: very low, low, medium, high, and very high. Based on comparing the industry's net profit with the customer's optimal net profit, provide a competitive analysis of the customer's profitability.

4.2 Profitability issue in audit report

The auditor can, instead of simply declaring the 'accurate and fair view of the net profit, state the degree of the profit figure's realness both in monetary terms and as a percentage (for example, *with 95% confidence, real net income is £X*) in the audit report.

5 Going concern issues

Due to CPAs' erroneous assessments and opinions about companies' sustainability and continuity, the global financial crisis originated in the USA and spread around the world in 2008–2009. Based on accounting information, investors should be able to predict whether a company's activities will continue. According to auditing standards, the auditor must explicitly indicate the going concern issue in the audit report. An auditor's primary tool is to use analytical techniques such as financial ratios (Beaver, 1966), statistics, regression, forecasting, and mathematical calculations to evaluate the strength of the market competition for the customer. Suppose the auditor cannot apply these techniques to measure the continuity of the company's activity. In that case, they should not sign a contract with the client because he does not have sufficient competence to perform the audit. In any case, if the auditor can use these techniques, he should explain them in the audit report clearly and understandably, following the principles of professional conduct. In Countrywide's case, in 2017, the company's goodwill was adjusted by 193 million pounds, and when the company announced a loss the following year, its business ceased virtually.

There are two balance sheets in the financial statements of the group of companies: the consolidated balance sheet and the parent balance sheet, which differ from the legal entity. An aggregate of all subsidiaries is presented in consolidated financial statements to provide a composite, interrelated picture of the whole group. Additionally, there is the parent balance sheet, which reflects the assets and liabilities of the parent company from its investments in its subsidiaries. Two factors significantly impact the continuity of a company's operations. The first is the actual value of the assets, and the second is the yearly measurement of the company's profit or loss. The measurement of assets, particularly intangible assets, has a significant impact on the measurement of real profit. Two Big Four accounting firms could not detect Carillion's misstated accruals, including

amortisation expense, by £170 million. Even though the auditor reported the company's latest financial statements to be *true and fair* at the time of closing accounts, the company had only £29 million in cash. For 19 years, the auditor earned £29 million from Carillion. Still, there is no doubt that the audit firm did not apply the proper professional scepticism and quality judgement in its analysis.

For a company's activity to continue, it should be able to sell products and services to customers, including domestic and international markets, and receive cash from its customers to be competitive in the primary market. It has been said that profitability and liquidity are the two wings of a company's success and progress. A significant impact on the continuity of customer operations is also exerted through fraud control and management of the operational, financial, governmental, and commercial risks.

5.1 Machine learning and going concerns

Using machine learning techniques in the field of artificial intelligence is one of the most effective tools for predicting the continuity of customer activity (Di Vaio et al., 2020). As a first step, the auditor uses most of the historical data for training and forecasting using the long-term historical data of the customer and the industry. Consider a customer with 20 years of profitability and liquidity data (from 2000 to 2020). As a result of this information, the auditor uses, for example, 80% of the data (up to 2016) for training the machine and the remaining 20% (from 2017 to 2020) for forecasting.

Chi and Chu (2021) used deep learning algorithms to predict going concern issues in audit reports. They used two powerful deep learning algorithms to make going concern predictions: LSTM⁴ and GRU⁵. Using these two methods, auditors can issue more accurate audit reports based on various input variables, including financial and non-financial ones. They sampled data over 16 years (2004–2019). Non-financial variables, also known as corporate governance variables, are essential for evaluating the continuity of a company's activities and its development and sustainability. According to their study, both LSTM and GRU models perform well in terms of accuracy, precision, recall/sensitivity, specificity, F1 score, and type I and type II errors. LSTM and GRU models provide good accuracy performance with 96.15% and 94.23%, respectively. For going concern predictions, both the LSTM and GRU models are reliable and effective.

5.2 Going concern in audit report

The auditor's report should provide users with a clear understanding of the continuity of the client's activities. Even though this issue is foreseen in the audit reporting standard, if the auditor can determine with a high level of confidence (e.g., with 95% confidence) that the client's operations will continue in the future, the remaining 5% of the auditor's detection risk will be reduced.

6 Fraud and fraudulent reporting

ISA 240 defines fraud as “an intentional act involving the use of deception to obtain an unjust or illegal advantage” (ISA 240, 11). According to the FRC, auditors are more obligated to detect fraud in financial statements than under ISA 240 (Barbour, 2020). The

cost of mismanagement and fraud does not only impact the shareholders but the entire public as well. Carillion collapsed in 2018, resulting in the loss of approximately two thousand jobs and an estimated bill of £148 million for taxpayers. In his article, Jeppesen (2019) distinguishes between fraud and corruption and argues that corruption cannot be controlled and stopped by audit alone. Still, audit contributes to the fight against and elimination of corruption. Corruption in financial statements results from the auditor's inability to discover and find evidence and documentation to support the claim.

Brydon examined the performance of the Big Four concerning the current corporate failures in the UK. Approximately one-third of the total revenue earned by the big four in 2018 was derived from auditing activities worldwide. In 2018, revenues related to consulting and advisory services, including tax avoidance consulting, accounted for about 60% of total revenue. It is estimated that the big four employed more than one million employees worldwide in 2018. The big four audited almost all FTSE 100 and FTSE 250 companies in recent years, raising questions about competitiveness in this industry. In addition, three-quarters of listed companies outside the FTSE 250 were audited by big four accounting firms. In response to this high market concentration of big four accounting firms, the House of Commons recommends that smaller to medium audit firms be engaged in the audit of publicly reporting companies instead of just the big four and that consulting services be separated from audit services.

Brydon's opinion is that accounting standards should be revised to include a requirement that auditors attempt to detect material fraud by all reasonable means. Auditors should be adequately trained to identify significant fraud. Auditing standards do not currently provide auditors with a legal duty to detect fraud (Vincent, 2019). Generally, auditors are only obligated to detect significant risks in the financial statements. In dealing with suspicious cases, one of the primary responsibilities of a public accountant is to collect sufficient and appropriate evidence to make an informed decision. The auditing standards require the auditor to pay greater attention to doubtful matters.

Fraud reports should be made using two mechanisms: an external mechanism and an internal mechanism known as whistleblowing. When an excellent corporate structure for whistleblowing is in place, the external mechanism is implemented through the regulator, and the internal mechanism is implemented through the internal auditor, audit committee members, and client employees (Brennan and Kelly, 2007). The new reform allows the regulator to investigate and fine large company managers if they violate corporate reporting and auditing duties (Gov.UK, 2022).

As a result of the changes proposed in December 2021, auditors will be required to become more committed to detecting fraud in financial statements. Generally, auditors should use professional scepticism to collect sufficient evidence regarding material misstatements. Thus, the recent emphasis on the standard does not significantly affect the practical work of auditors. There is no easy way to detect significant fraud because those involved in the fraud try to destroy or conceal the relevant documents. In some cases, the auditor may need to consult with other experts and should obtain sufficient and reliable evidence from multiple sources, focusing on transactions or documents that are highly likely to be fraudulent. Consequently, the audit may cost more and take longer.

It is sometimes the case that a conflict of interest is raised as a result of a report regarding the continuity of an organisation's operations. In the case of some of the recent corporate fraud cases, the audit firm was simultaneously performing consulting and audit services.

7 Failure mode and effect analysis

Professional qualification will not only be limited to auditing and accounting knowledge in the future but also poses high analytical skills. Through the support of emerging technologies, the future perspective of the profession will require members to be proficient in using analytical techniques and be able to utilise big data. Using big data techniques in conjunction with BEIS's⁶ requirement to be more transparent about the financial affairs of a company should enable managers to assist users in making more informed decisions. As a result of these skills, the auditor should be able to identify fraud and risky anomalies more quickly and effectively. In the case of Patisserie Valerie, the audit firm's partner was personally required to pay a fine of £88,000, and the audit firm itself was fined £2.3 for failing to demonstrate professional competence. Auditors should be trained in analytics and be able to identify weaknesses in going concerns and the possibility of fraud, as recommended in auditing standards.

Many studies have examined the causes of corporate failures within the last 35 years (Balcaen and Ooghe, 2006). As discussed earlier, there have been numerous methods for predicting corporate failures, but none of them has been effective in preventing all of them. We use an experimental model called failure mode and effect analysis (FMEA) for external audits and users. FMEA is a kind of risk assessment method for information reliability. In 1963, NASA proposed FMEA as a formal design methodology based on their evident reliability requirements. The FMEA method is a reliability engineering method that we have modified so that auditors can use it innovative way. The FMEA does not primarily result from the desired failure. However, to understand the mechanism behind system failures and identify potential weaknesses of a fail-safe concept, it is necessary to perform a failure rate analysis, focusing on the critical components involved. FMEA is an analysis in which the degree of failure severity is also considered. Fraud could be interchanged with failure; the symptoms of failures and defects should be considered. In the FMEA method, fraud modes (defects), their causes, effects, and criticality are systematically analysed, including frauds of standard modes and common grounds. The impact of all possible forms of fraud (defects) (considered for the company), their causes, and consequences are investigated systematically, either in a single run or in several steps (FMEA design, FMEA process). The possibility of avoiding failure (defect) or minimising its consequences is assessed for critical cases, and corrective (or preventive) measures are implemented. Criticality describes the severity of the effects of a failure (defect) based on the risk of damage or loss of performance.

From the bottom up, FMEA is performed by the designer in collaboration with the other auditors. This method detects material misstatements in accordance with required auditing standards. It is simple to understand, but it can be time-consuming to analyse complex accounting anomalies transactions. Accordingly, it is recommended that efforts be concentrated on the critical areas of liquidity and profitability, mainly where fraud is most likely to occur. Other worksheet forms can be used for FMEA. Whenever an item possesses fail-safe behaviour or displays abnormal conditions, FMEA could be performed to verify the effectiveness of redundancy after a failure and identify the elements in series in the reliability block diagram. A safety issue and a liability claim may arise in the event of a breakdown. FMEA can also support maintainability analysis.

Three methods for measuring corporate failure risks are quantitative, qualitative, and semi-quantitative. Purely qualitative and descriptive methods can create a subjective risk

assessment. Additionally, quantitative methods can be time-consuming and complex and ignore a lot of information when describing failures in an organisation. In semi-quantitative measurement, qualitative and quantitative methods are combined. FMEA is a semi-quantitative method. In FMEA, the risk priority number (RPN) supports quantitative analysis of risk events. In addition to identifying the highest risk accurately and quickly, this method also eliminates the concern about information loss (Zhao and Bai, 2010). Potential risk can be assessed critically using FMEA (Murphy et al., 2011). FMEA is suitable for evaluating risks associated with hiding information in financial statements. FMEA applies to many organisations, including manufacturing and service industries, for-profit and non-profit organisations, private and public organisations, and government organisations (Muqimuddin and Singgih, 2020). Research risk cases determine the difference between FMEA and other methods for measuring information risk. Information security (confidentiality, integrity, and availability) is evaluated by FMEA.

Organisational dependence on information and potential failure are non-deterministic; the more accurate the information, the lower the risk of corporate failure (Albrecht et al., 2020). FMEA allows the auditor to establish a constant measurement degree between the degree of failure and the measurement information. Auditors should assist the organisation in calculating the impact of incorrect information evaluation results. Having the wrong assessment imposes higher costs and requires priority treatment. In the event of inaccurate measurement, the organisation will suffer double the losses from incorrect evaluations.

The consistency of traditional FMEA and improved FMEA is assessed. An action research methodology (plan, act, observe, reflect) is used in a two-cycle process. Cycle one examines and proves the traditional FMEA consistency, while cycle two analyses critical parts, synthesises an improved FMEA, and examines the improved FMEA consistency. The consistency measurement was based on the RPN scores for each account. The action research models compared the RPN scores from both accounts based on the level of risk (very high, high, medium, low, and very low). The difference between the levels of risk from both accounts determines inconsistency.

Information fraud management protects physical and digital information assets, including data, hardware, software, personnel, and facilities, from external threats, such as hackers and internal threats, such as technical error, sabotage, and unauthorised access (Rawat et al., 2016). FMEA has the advantage that it is based on the risk object to be measured. Information fraud is also a focus of this study's risk measurement. The focus of FMEA on information is sensitive data and information security (Dhillon, 2007). Auditors can use the FMEA framework to identify potential failure modes, causes, and mitigations (Sharma and Sharma, 2010). FMEA uses linguistic terms and priority risk numbers (RPN) to determine risk impact (severity), risk probability (occurrence), and risk opportunity (detection). There is no specific scale measuring procedure, so the risk team can customise it. Criteria scales are commonly used between 1 and 10. Multiplying the three parameters yields the RPN value. Kardos et al. (2021) assert that risks with high RPN values should be handled with high priority compared to risks with low RPN values.

Equation (1) calculates the risk priority number (RPN):

$$PRN = S_F \times S_O \times S_D \quad (1)$$

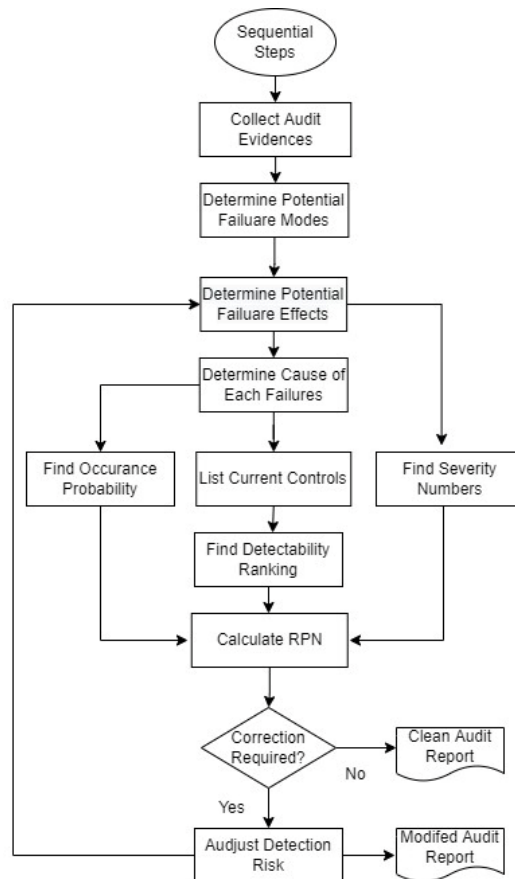
There are three terms: S_F – frequency of occurrence, S_O – severity of failure effects and S_D – severity of failure chance of not being detected. To calculate the priority risk number (PRN), the severity, occurrence, and detection parameters were multiplied. Based on these parameters, failures are rated from 1 to 10. Counting from 1 representing the best conditions for each mode to 10 representing the worst ones.

FMEA is primarily used to identify and correct unforeseen errors in data collection. FMEA involves two steps. The first step is to identify potential failure modes and their effects. This phase defines potential failures in audit samples, collects information, and concludes the audit. The second phase consists of performing a critical analysis to evaluate and rank (RPN) the severity of failure modes based on their necessary level.

8 Stages to use FMEA

To use this method of FMEA, a flowchart is prepared. The flowchart in Figure 2 illustrates the steps of using FMEA in auditing.

Figure 2 FMEA process flowchart adjusted for auditors



Source: Modified from Sharma et al. (2005)

It is necessary to analyse the accounting information system of the client. The system should be divided into subsystems and/or categories to localise the search for accounts. The auditor should collect enough evidence based on the accounts using the audit risk model (Askary et al., 2018). The auditor should then follow the checklists as shown in the table below:

Table 1 Checklist of failure modes and effect analysis (FMEA)

<i>Steps</i>	<i>Checklists</i>	<i>Justification</i>
1	Step numbering consecutively	Sequential steps to be followed
2	Identification of the account or group account under investigation, a brief description of potential fraud, and references to reliability plans, schedules, and financial reports.	AS 2401.56
3	The possibility of fraud should be considered (all possible fraud modes should be considered)	AS 2401.02
4	Identify the possible causes of the fraud assumed in step 3 (defects may also cause fraud in the design, implementation, maintenance, or control phases).	AS 2401.06
5	An examination of the symptoms associated with fraud and the consequences for the chart of accounts (output-input relationships, the possibility of breakdowns or secondary errors, etc.)	AS 2401.11
6	Identify the fraud mode's effects at higher integration levels (upwards to the system level) and the intended outcomes.	ISA240.02
7	Identify fraud detection provisions and corrective actions that can reduce the severity of the fraud condition assumed in step 3, reduce the likelihood of its occurrence, or initiate an alternative operating mode that allows operations to continue when fraud occurs.	AS 2401.54 and 56; ISA240:A45 and A67
8	Assess the possibility of avoiding the assumed fraud situation	ISA240:05
9	Rating the severity of fraud on a scale from very low to very high based on its severity.	ISA240:06
10	Calculate the probability of occurrence based on previous experience and updated information	AS 2401.85; ISA240:35
11	Remark and suggestion(s) for success.	AS 2401.11; ISA240:32©

This table combines the FMEA checklist with auditing standards, mainly from the AS2401, which refers to the consideration of fraud in financial statements as part of an audit. Table 2 considers four cases using FMEA regarding profitability, solvency, Fraud and going concern issues. Based on the three factors of profitability, liquidity, and fraud in the financial statements, the auditor should assess whether the client is likely to fail. After that, determine why these failures occurred. A test of internal controls is also needed to decide whether or not they can prevent fraud. Furthermore, the probability of detectability is entirely dependent on the auditor's professional experience. At this stage, the auditor can calculate the client's PRN.

Table 2 Typical failure modes and effect and criticality analysis (FMEA)

No.	Account(s), group account, class	Assumed fraud mode	Possible cause(s)	Symptoms, local effects	Effects on FS (1)	Fraud detection possibilities (2)	Possibilities to avoid the fraud mode	Materiality (severity)	Probabilities of occurrence (3)	Remarks and suggestions
1	Sales revenue	Fictitious invoices	Internal control weakness Fraud, management	Unread revenue Reporting revenue	Mid to high Mid to high	FD = 0, p(FD) = or > 0	Improving IC; high Improving IC; high	if M = high, p(S) = high	p = 10 ⁻³	Check ICS; redesign the part Analytics
			Fraud, employees	Misappropriate accounts receivable	Mid to high		Improving IC; high			Observation
2	Cash account	Unbalanced amounts	Fraud/errors	Cash shortages	High	FD > 0, p(FD) > 1	IC for cash transactions, high	If \$ > high, p(s) = high	p = 10 ⁻²	Check ethical standards, IC policy, etc.
3	Fraud in FS	FS items unreal	Fraud triangle	Inconsistency between figures in FS and books	High	FS = Ω , 0 < p(F) < ∞	Collect more external evidence	if M = high, p(S) = high	p < 0.99	Need to check all material balances
4	Going concern	Undisclosed issues of GC	Manipulated profit and cash elements	Actual revenue, expenses, and assets accounts differ	High	FS = Ω , 0 < p(F) < ∞	Using analytical procedures	If GC = high, p(GC) = high	0 < p < 1	Using analytics techniques to discover the issue

Table 3 FRN index to determine severity, occurrence and detectability

Rate	Severity	Occurrence	Detectability
10	<i>Hazardous</i> : It suspends business operation and/or involves non-compliance with law or regulations. It may cause auditors to be fined by a relevant authority	<i>Absolute high</i> (Failure occurrence rate: 95%+)	<i>Impossible to detect</i> : Internal controls cannot detect potential causes/mechanisms and subsequent failure mode (Probability of detection is 0–5%)
9	<i>Serious</i> : Failure involves severe outcomes and/or non-compliance with government regulations or standards. It may auditor being sued by users	<i>Very high</i> (Failure occurrence rate: 90–95%)	<i>Very remote</i> : The defect most likely remains undetected (Probability of detection is 6–15%)
8	<i>Extreme</i> : Failure is hazardous and occurs without warning. May auditor being sued by the client	<i>High</i> (Failure occurrence rate: 81–89%)	<i>Remote</i> : Remote chance that the internal control will detect a potential failure mode (Probability of detection is 16–25%)
7	<i>Major</i> : The audit report is severely affected but functions. The system may not operate; moderate to major accounting systems	<i>Moderate-high</i> (Failure occurrence rate: 71–80%)	<i>Very low</i> : The very low chance that the internal control will detect a potential failure mode (Probability of detection is 26–35%)
6	<i>Significant</i> : audit report is degraded. Business segments or department functions may not operate, and minor to moderate damage to the audit reputation.	<i>Medium-high</i> (Failure occurrence rate: 60–70%)	<i>Low</i> : The chance that the internal control will detect a potential failure mode is low (Probability of detection is 36–45%)
5	<i>Moderate</i> : Moderate effect on the audit report. The audit report requires a rewrite, with minor effects on audit reputations	<i>Medium</i> (Failure occurrence rate: 45–55%)	<i>Moderate</i> : Moderate chance that the internal control will detect a potential failure mode (Probability of detection is 46–55%)
4	<i>Low</i> : Small effect on the audit report. Minor or no effects on audit reputation.	<i>Medium low</i> (Failure occurrence rate: 30–45%)	<i>Moderately high</i> : The relatively high chance that the internal control will detect a potential failure mode. (Probability of detection is 56–65%)
3	<i>Minor</i> : Minor effect on audit report or accounting system performance, No effects on auditor reputation.	<i>Low</i> (Failure occurrence rate: 15–30%)	<i>High</i> : The chance that the internal control will almost certainly detect a potential failure mode is high. (Probability of detection is 66–75%)
2	<i>Very minor</i> : Very minor effect on audit report or accounting system performance, Slight customer complaints.	<i>Very low</i> (Failure occurrence rate: 6–15%)	<i>Very high</i> : Very high chance the design control will detect potential causes/mechanisms and subsequent failure mode. (Probability of detection is 76–85%)
1	<i>None</i> : No reason to expect failure.	<i>None</i> (Failure occurrence rate: 0–5%)	<i>High certainty</i> : Internal control will almost certainly detect a potential failure mode. (Probability of detection is 86–100%)

Source: Mainly adopted from Mohamadinejad et al. (2019)

In the first instance, we examine the accounts associated with sales or income. Fraud mode is mainly related to the existence of fake customers or invoices, or both. Sales determine the continuity and liveliness of a business enterprise. The main reason for not detecting fraud is weak internal control systems. However, even with the best internal control systems, fraud can exist by manipulating managers and employees. As a result, the auditor must monitor the ethics and professionalism of the client. The auditor needs to focus on unearned income to find fraud symptoms. It is necessary to determine the likelihood of fraud by referring to historical information.

In Table 3, the auditor can determine the three factors of occurrence, severity, and detectability rate. In this table, the highest risk level is ranked first (rate 10), and the lowest is ranked first (rate 1). The PRN would be $3 \times 3 \times 3$, equal to 27, if the three factors were rated 3. For determining the degree, there are three categories: 1 to 89, which is low risk; 90 to 200, which is moderate risk; and above 200, which is high risk. As a result, a score of 27 means a low risk of fraud. Based on the rate, the table confirms the low rate between 1 and 5, the balanced rate between 6 and 7, and the high rate above 7.

9 Conclusions

Recent reports by individuals such as Brydon indicate that the auditing profession in the UK requires major revisions and changes to meet the needs of a reliable financial market. All these changes should be reflected in the auditor's report to increase the user's awareness of the accounting information approved by the auditor. One of the 'trust level mechanisms' that ensures the reliability of the financial system is checking and verifying this financial information (Stringfellow et al., 2015). To ensure this assurance works effectively, the auditor must maintain independence and other values of professional ethics while using all the power of his updated expertise. The most challenging situation arises when the interests of the auditor conflict with the users of the financial reports and the general public. As a rule, the auditor should consider the public's interests, but the recent corporate failures in the UK have demonstrated that the public's interests have been adversely affected.

Corporate failures adversely affect the accounting profession's reputation (Stringfellow et al., 2015), public interest, social costs, capital markets, the national financial and monetary economic system, and finally, the waste of time and money of companies and companies' shareholders. As the Brydon report (2019) outlined, various strategies are recommended for strengthening the audit profession. Audit reports should emphasise liquidity, profitability, the reliability of the information, fraud prevention, and, finally, the ability to predict the continuation of a client's business. A failure analysis model is used in this article to introduce a renewed permanent audit reform that can prevent corporate failures in the future by analysing the factors at play. We have reconstructed the FMEA failure analysis model from reliability engineering to predict corporate failures. This research can benefit government agencies, standard setters, managers, and auditors. Its purpose is to protect the public interest eventually.

In this article, we provide more tools to aid the auditor in determining the percentage of higher probability of predicting corporate failure. The critical point is that even the best techniques will be ineffective if the auditor does not inform the user of the actual disclosure of the client's activity. This article provides a method that supervisory

institutions can use for audit work. It can be used by the auditor's clients or the managers of the companies. Using qualitative (not quantitative) judgement to determine PR is the only drawback of this method, which may be criticised. However, this method has been used in reliability engineering and has proven useful.

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Notes

- 1 The source of data: https://en.wikipedia.org/wiki/List_of_corporate_collapses_and_scandals.
- 2 <https://www.theguardian.com/business/2021/sep/27/patisserie-valerie-auditors-fined-frc-grant-thornton>.
- 3 Global health care GlaxoSmithKline LLC (GSK).
- 4 Long short-term memory networks, also known as LSTMs, are used in Deep Learning. A recurrent neural network (RNN) that learns long-term dependencies, especially in sequence prediction.
- 5 Gated recurrent units (GRUs) were introduced by Cho et al. in 2014 as a gating mechanism in recurrent neural networks. GRUs are similar to long-short-term memories (LSTMs) with forget gates and fewer parameters, as they lack an output gate.
- 6 The Department for Business, Energy and Industrial Strategy (BEIS).