



**Dissertation Title - “The Applications of Data Mining Techniques in
Detecting Occupational Fraud: A Qualitative Review of Forensic
Accounting Practices”**

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DECLARATION

I declare that this dissertation that I have submitted to Dublin Business School for the award of MSc in International Accounting and Finance is the result of my own investigations, except where otherwise stated, where it is clearly acknowledged by references. Furthermore, this work has not been submitted for any other degree.

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ABSTRACT

This study examines the application of data mining techniques to forensic accounting in terms of fraud detection. The research methodology involves qualitative methods, which include case studies and in-depth interviews with veteran forensic accountants concerning how data mining tools are used to perform their work. It then compares the results of such applications to those obtained through traditional forms of expert opinion analysis. It becomes clear from the study that traditional accounting methods are powerful but often inadequate for handling big data and unable to do real-time analysis. One of the most important topics highlighted in this research is deep learning and artificial intelligence, which are providing increasingly complex fraud schemes with powerful tools. Also, it examines the ethical and legal aspects of data mining in fraud detection. This research makes a contribution to the academic debate on forensic accounting and data mining, offering practical advice for improving occupational fraud detection capabilities.

Keywords: Forensic Accounting, Data Mining Techniques, Occupational Fraud Detection, Qualitative Research, Fraud Detection Tools, Real-Time Analysis

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1. CHAPTER 1: Introduction

1.1 Research Background

Data mining is a process of extracting patterns from data and using them for refined data capabilities search and statistical algorithms to correlations and designs which can be useful in applications variety, including fraud detection (Alasadi and Bhaya, 2017). According to the study by Baader and Krcmar (2018), data mining can also help organisations control weaknesses, unusual transactions, missing invoices, duplicate payments, procurement, deviant transactions and disbursement frauds. The term fraud refers to the abuse of an organisation's system profit without necessarily leading to direct legal consequences (Reurink, 2019). The study by Roszkowska (2021) highlighted that in a competitive market, fraud can become a critical problem in business, and it is a very preventive and prevalent procedure that is not fail-safe. Specifically, occupational fraud makes up a key aspect of broader fraud control systems aimed at reducing the need for manual examinations and screening processes (Reurink, 2019). Nevertheless, data mining as applied alongside forensic accounting not only strengthens the fraud detection capacity but also influences a developed commercial and administrative information setting. A preventative approach in fighting such fraud could be one of the ways employed to stop this fraud through an examination of how such data mining would be used in qualitative analysis of such applications of data mining. Furthermore, occupational fraud poses a significant threat to organisations worldwide, jeopardising financial stability, integrity, and public trust (Mazumdar, 2020). As businesses become more complex and interconnected, the need for practical tools to detect and prevent fraudulent activities becomes paramount. In line with that, the likelihood of fraud depends on various sectors (see below Figure 1) that show experiences proportion and business fraud. The below graph illustrates that the financial business and insurance service sector experienced 21% fraud, and the mining and quarrying industry also faced 21% fraud as compared to other sectors. While legal services experienced 12%, communication and information 15%, real estate and construction 18% and wholesale and retail 19% likely to have experienced fraud (Gov.UK, 2020).

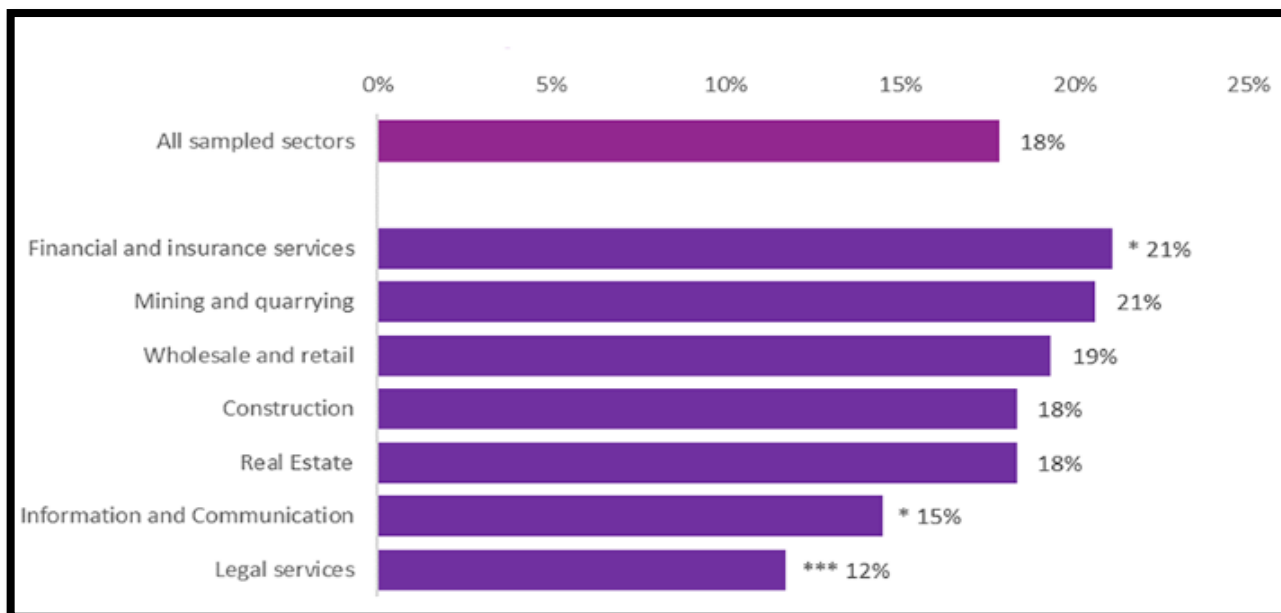


Figure 1: The proportion of businesses that experience fraud varied by Sector

Source: (Gov.UK. (2020)).

However, forensic accounting has emerged as a significant discipline to investigate and uncover financial irregularities and employee fraud (Afriyie et al., 2023). Data mining is a powerful tool technique within forensic accounting, which shows remarkable promise in identifying anomalies, patterns, and fraud indicators in big data sets. With the convergence of technology and financial crimes, data mining has risen to the forefront of forensic accounting practices. When confronted with shifting fraudulent strategies, established fraud detection technologies often fail. In this context, data mining is a proactive and dynamic approach to scan large databases for hidden patterns and correlations that may signal fraud and this methodological change consents prevention and fraud detection to be more adaptable instead of standard techniques.

Forensic accounting is essential to uncover financial mysteries and it combines on investigative skills and auditing of accounting to review transactions and financial records to uncover fraudulent conduct (Bhavnani, 2020). As well as the need of efficient tools also increasingly to identify professional fraud develops complexities in data mining. In forensic accounting data mining comprises on statistical techniques, patterns from unstructured and structured datasets (Tymchyshyn et al., 2022). These databases also contain on monetary transactions like as, job records, and other relevant information that can be show fraudulent behaviour. Subsequently,

forensic accountants can quickly sift through big data volumes through discovering abnormalities and data mining that can discover through methods of auditing.

1.2 Aims and Objectives

1.2.1 Aim

The aim of this study is to examine the applications of data mining techniques for detecting occupational fraud by conducting a qualitative analysis of forensic accounting practices.

1.2.2 Objectives

- ✓ To identify the data mining techniques integration for detecting occupational fraud.
- ✓ To investigate the developed strategies for identifying and preventing data mining techniques
- ✓ To analyse emerging trends of data mining application trends for occupational fraud detection.
- ✓ To evaluate the comparative effectiveness of traditional forensic accounting techniques and data mining applications.
- ✓ To formulate recommendations for organisations and forensic accountants to increase fraud detection capabilities.

1.3 Problem Statement

Occupational fraud represents a pervasive and escalating threat to organisations, undermining financial stability and eroding trust (Ajala, 2023). Despite the vigilance exercised by forensic accountants, traditional fraud detection methods are often insufficient in unmasking the ever-evolving strategies employed by fraudulent actors. In forensic accounting practices, the data mining techniques ensures to increase the effectiveness and efficiency of fraud detection efforts. Besides this, a critical gap occurs in the data mining understanding that is practically integrated to investigate forensic accountants and the extent to which it decreases the challenges that posed by occupational fraud (ÖZCAN, 2019; Akinbowale et al., 2020; Osaloni, 2023; Navarrete and Gallego, 2023). In which, the primary challenges of forensic accountants' to face data generated complexities by operations of modern business. The study by Coss et al. (2020) stated that the method of traditional accounting struggle to move through vast datasets efficiently, leading to a potential oversight of crucial indicators of fraudulent activities. In continuance, the dynamic nature of occupational fraud ids the key problem where perpetrators constantly adapt and refine their tactics to escape detection. There is a demanding need to assess and explore the actual-world of data mining application in forensic accounting practices particularly focusing to handle large datasets and identify indirect patterns of fraudulent behaviour.

The techniques of data mining used to identify inconsistency in procurement operations, like as unsupervised learning which serve as an automated tool to make detection processes for creating procurement fraud that need in-depth verification (Berru and Batista, 2021). Besides this, there is a lack of comprehensive insights of forensic accountant's leverage data mining hinders the development of guidelines and best practices for the broader industry. According to the study by Aguayo, Aguiar and Jiménez (2021) that understanding practitioners' problems, accomplishments, and limits is critical for improving existing approaches and influencing the development of future fraud detection systems (Aguayo, Aguiar, and Jiménez, 2021).

This study addressed this issue by comparing two unsupervised data mining algorithms to automate control functions for fraud detection in the procurement process. Thus, this study aims to address this critical gap by conducting interviews with experienced forensic accountants, unravelling the practical nuances of integrating data mining into their investigative toolkit and thereby contributing to advancing effective countermeasures against occupational fraud.

1.4 Research Questions

- ✓ Q1: What are the most commonly used data mining techniques to detect occupational fraud in the context of forensic accounting?
- ✓ Q2: What are the effective ways to identify and prevent the data mining techniques of different types of occupational fraud?
- ✓ Q3: What are the emerging trends in advancements in the data mining applications for the detection of occupational fraud to compare the traditional forensic accounting techniques in terms of accuracy and efficiency?
- ✓ Q4: What are the challenges and opportunities of combining data mining with conventional forensic methods of accounting?

1.5 Research Rationale

Fraud continues to pose a substantial threat to the financial well-being and integrity of business organisations worldwide (Taherdoost, 2021). As businesses navigate an increasingly complex and interconnected landscape, the methods employed by fraudulent actors evolve in the cycle. Traditional forensic accounting practices, while indispensable, often struggle to keep pace with the sophistication and dynamism of occupational fraud. In this context, the application of data mining techniques presents a promising avenue to fortify the store of forensic accountants, offering the potential to unearth patterns, anomalies, and indicators that may escape conventional detection

methods (Okechukwu, 2020). Regarding that, the rationale for this research that there is need to fill the existing gap to understand that how data mining is practically incorporated into the forensic accountants investigative processes. In continuance, there is a need of more insights into the real-world application within the specialised field of forensic accounting. So, the rationale of this research study is based on prospective to inform to shape the fraud detection strategies. In which, organisations can contract with data influx and capability to connect the data mining power becomes imperative. With regard to that, the aim of this research study is to provide a deep understanding that how data mining matches with traditional forensic accounting methods in vast datasets to identify crucial indicators of occupational fraud. The study by Amani and Fadlalla (2017) highlighted that the understanding of these problems is significant to emerging personalised solutions and improving existing approaches to solve the fraud detection complexities in today's fast-paced corporate environment. Accordingly, this research study not only contribute in the academic discourse surrounding data mining and forensic accounting but also offer practical guidance for organisations to give strengthen occupational fraud detection. This research accomplishments to provide a proactive and adoptive, approaches to contending the ever-evolving of occupational fraud landscape through unravelling the data mining challenges and practical applications of forensic accountants experienced,

1.6 Dissertation Structure

This research study comprises five chapters: introduction, literature review, methods, results analysis, discussion, and conclusion. The first chapter is based on contextual background, aims, objectives, search questions, problem statement, and research rationale. The Dissertation comprises six chapters. Chapter The literature review discusses the previous literature connected with the research topic, while chapter three discusses tools and techniques to collect the qualitative study's data. Additionally, chapter 4 is based on the analysis of results that interpret the results of collected data and take the study's findings. Finally, chapter 5 is a discussion, conclusion, and recommendation chapter that analyses the survey results with literature, summarises the whole Dissertation, and provides practical and effective recommendations for the future direction of the study.

2. CHAPTER 2: Literature Review

2.1 Introduction

This chapter of the dissertation gives a comprehensive survey of all literature to date on the topic, and deals in detail with possible applications for data mining in cross-checking cases of occupational fraud. This chapter focuses on five main objectives i.e. to explain how different data techniques can be combined for fraud detection; to consider various strategies used in identifying and fighting fraud, to look at some new developments, such as social networking sites, fax machines, blogging software and spam email address generators would encourage or dissuade others from engaging in similar behaviour. The focus of this literature review is to lay the groundwork for future research in and around this topic by making critical evaluations of some relevant scholarly works.

2.2 Data Techniques Integration for Detecting Occupational Fraud

Bako and Ayuba (2022) argue that fraud detection techniques must be improved because there is still a chronic problem of occupational fraud in companies. One such strategy comprises integrating data approaches, making it possible to detect fraud. Occupational fraud can be detected through various techniques, including data analysis. But, as previously noted by Ikechukwu et al. (2020), traditional methods have been in use for a long time: statistical analysis, data visualisation and pattern recognition. Besides, Jain et al. (2022) note that advanced data mining techniques have become effective tools for flagging fraud inside the company. Making use of a variety of techniques known as data mining, hidden patterns are sought out and revealed within the vast databases. This is how fraudulent transactions and behaviours are identified. Using these methods, forensic accountants can quickly and easily plough through piles of data looking for anomalies and irregularities. Eko, Adebisi and Moses (2020) further claim that the use of unsupervised learning methods like association rule mining and clustering helps to uncover patterns and correlations which would otherwise remain hidden. These mining data methods have been integrated into organisational practices and used to detect fraudulent practices.

Several other data mining algorithms are found being applied in the detection of occupational fraud. Of these, logistic regression, decision trees and neural networks have come to the fore. For example, decision trees are often used to detect fraudulent financial transactions (Oyedokun 2022). They enable us to write rule-based models that classify transactions as either legitimate or questionable. Oyedokun's (2022) claim supported the assertion made in Saleh, Azhar and Azeez's

(2020)work that one of the best data mining techniques for discovering occupational fraud is decision tree algorithms. This type of occupation fraud can involve inappropriate procurement practices which by design cannot de facto ensure customer loyalty In the real world there are many case studies, which provide very enlightening information on what are the applications of data approaches to Fraud Detection (such as those in connection with Enron). In the case of Enron, researchers like Kranacher and Riley (2019) have explained how data techniques--like textual analysis of emails or financial records for example--revealed fraudulent activities. Analysing the attitude and natural language of staff emails discovered not only inconsistency but also dishonesty trends, helping reveal fraudulent practices.

Unlike the others, Mittal, Kaur and Gupta (2021) have found that despite their efficacy methods for data on fraud detection are not without dilemmas and restrictions. One of the biggest problems is simply the vast amounts and variety of data, which can easily swamp more traditional systems. Moreover, data approaches can produce false positives or negatives and are far from infallible. Thus, to fight back against occupational fraud using data approaches, it needs a well-informed and balanced strategy (Ezenwafor and Udukeke, 2019). That is why Kılıç (2020) stressed that these difficulties illustrate just how important it is to have an integrated strategy which combines data collection methods with the experience and judgement of human beings. Oyedokun (2022) states that data methodologies that lack human knowledge can lead to consequences wrongly understood. Moreover, privacy and ethical issues are big considerations when integrating data-based methods for fraud detection. Yet to make good use of them requires thorough knowledge of the most popular data mining algorithms, as well as critical thinking in evaluating case studies from real life. One must also be aware that even if these methods are not perfect, they still provide more useful information than would otherwise have been available.

Such a critical approach towards building up organisational resistance against financial problems is displayed in the use of sophisticated forms of data techniques to detect occupational fraud. As for data analytics, AI and machine learning, organisations can spot anomalous patterns indicating fraudulent works. Here are some of the methods that enable the study of large data sets, which identify any disparities that convention might otherwise mask (Kılıç, 2020). These technologies must be adopted cautiously. First, the application of false positives achieves a trade-off between sensitivity and specificity to avoid unnecessary checking. An approach for guaranteeing compliance with ethical and legal standards is needed in the thought strategy of maintaining

potential privacy. Monitoring occupational fraud is the most important part of the data technique (Ezenwafor and Udukeke, 2019). These successful incorporations protect the continuing interplay between ethical considerations, human expertise and technology. Maintaining the balance is essential for organisations to prevent occupational fraud.

2.3 Strategies for Identifying and Preventing Data Mining Techniques in Occupational Fraud

To detect and prevent workplace fraud both proactive strategies and vigilance are required. Proactive fraud detection measures are primarily used to prevent occupational fraud. One of the basic strategies is to set up strong internal controls and access limitations. Jain and Lamba (2020) are among the researchers who emphasise the importance of strong access restrictions to prevent unauthorised access to sensitive data and limit which data can be edited. Besides the above, Mittal, Kaur and Gupta (2021) advise that library user access records be periodically checked as a way of detecting and stopping data mining operations. In addition, Active fraud detection heavily depends on anomaly detection methods. The authors added that statistical and machine learning algorithms can discover aberrant patterns and deviations from the norm. For example, predictive modelling and clustering techniques can identify transactions or behaviours that differ greatly from typical patterns.

Some chronic illness prevention case studies from real-life situations are good examples, such as Target Corporation. Scholars such as Akinbowale, Klingelhöfer and Zerihun (2020) have explored how Target defeated a huge data breach in 2013 by vigilantly protecting its digital assets with strong encryption strategies. Pre-emptive data protection: Owing to access patterns, Target was able to avoid a catastrophe. Besides, there are some types of occupational fraud which only data mining tools can prevent. In the case of healthcare fraud prevention, for instance, data mining algorithms can be used to determine whether any billing patterns look suspicious or indicative of possible fraud among claims data.

Moreover, such data mining algorithms can examine purchasing and inventorying information to detect anomalies or discrepancies to help prevent fraud around the supply chain. Organisations can prevent procurement fraud by spotting abnormal buying trends. For example, strategies like these have been proven effective by Papik and Papikova (2021). They posited preventive techniques have great promise, but implementing them can be tough. One major constraint is the expenditure and resource allocation required to maintain these precautions properly. Likewise, Kılıç (2020) notes that because of a lack of financial resources, smaller businesses could not take effective

preventive measures. Furthermore, occupational fraud is a changing field. In time preventive efforts will be less effective because fraudsters will adapt and develop new techniques for evading detection. One must continue to observe and change methods. One method to minimise risk involves detecting and halting data mining techniques employed in occupational fraud. These tactics were often quite effective. However, they also have drawbacks: resources are limited and fraud is always changing. These case examples lay out the merits of offensive strategies and awareness in thwarting attempts to data mine as well as various forms of professional fraud. It takes a flexible and varied approach to stay one step ahead of fraudsters (ÖZCAN, 2019).

2.4 Emerging Trends in Data Mining Applications for Occupational Fraud Detection

Occupational fraud detection data itself is constantly changing with the times, and new trends and technologies are continually emerging. There are several trends in the field of data mining for fraud detection. Another such trend is to detect fraud with more accuracy and sophistication by using deep learning methods like neural networks. Researchers such as Oladejo and Jack (2020) note that deep learning can discover fine patterns of aberration in large volumes of data. This enhances the ability to uncover occupational fraud. A further finding in surveying relevant literature is that real-time analytics enable organisations to catch fraud when they are in the act, thus avoiding losses. SARIGÜL and SAVSAR (2021) found that real-time data mining methods capable of detecting fraud quickly are becoming the rage.

To the changing face of occupational fraud, highly developed data mining technology is most needed. Researchers are now using some novel techniques such as graph analytics to ferret out phony networks and links. For example, as illustrated in Ikechukwu et al. (2020), graph-based methods can reveal complex money laundering structures. Other breakthroughs in natural language processing (NLP) have made it possible to analyse unstructured text data--documents and e-mails, from which clues of fraud can be culled. Furthermore, a study by Eko et al. (2020) shows how powerful NLP is in revealing trends indicative of fraudulent behaviour from textual data.

Furthermore, one example is the use of blockchain technology. Some scholars, like Bako and Ayuba (2022), have looked into just how much blockchain technology is capable of producing secure transaction records that by their very nature are nearly impossible to falsify. They said in the study that because of innovative distributed ledger technology, which is a characteristic of

blockchain, records are inherently impossible for fraudsters to alter. The better data accuracy, the more effective trend mining with data within an organisation.

Despite this, it has been noted that many developments in data mining techniques for occupational fraud detection have only been proven through the combination of machine learning (ML) and artificial intelligence (AI). Algorithms based on AI and ML are adapting to changes in fraud trends. For example, Saleh, Azhar and Azeez (2020) show that adaptive machine-learning models can detect new forms of fraud even without explicit programming. Furthermore, AI and ML can be used to automate fraud detection procedures, increasing accuracy and saving you time in the process. This argument lends credibility to Kranacher and Riley (2019), who note that interpreting and explaining patterns of this type is difficult. Such models are also sometimes described as "black boxes" because it is hard to get inside their heads and fully understand how they make decisions. Deep learning, real-time analytics, blockchain and AI technologies all hold great promise. These trends are exemplified in case studies, but resource requirements and model interpretability should not be ignored. As the nature of occupational fraud continues to evolve, organisations that hope to guard against this threat must keep up (Oyedokun, 2022).

2.5 Comparative Effectiveness of Traditional Forensic Accounting Techniques and Data Mining Applications

Understanding the strengths and limitations of each strategy for detecting occupational fraud requires an analysis of whether conventional forensic accounting methods or data mining software (or some combination) is relatively more effective. The traditional methods of forensic accounting, including expert judgment, financial statement analysis and manual audit procedures constitute the groundwork for the discovery of fraud (Jain and Lamba 2020). In addition, according to the authors of this booklet, what makes them strong is their ability to see irregularities trends and contradictions that foreshadow fraud. These experts are forensic accountants. These techniques can also be tailored for different kinds of fraud and industries. Nevertheless, traditional methods have their disadvantages. They are not as suitable for big data sets or real-time analysis, since they take much time and effort. Besides, they rely greatly on subjective evaluation, which can cause bias and inaccuracy in fraud detection (Ezenwafor & Udukeke 2019).

Data mining apps provide an automated and data-driven way of detecting fraud. Using statistical techniques and algorithms these approaches quickly find patterns and anomalies in large datasets. Data mining is more objective and can handle larger quantities of data faster than traditional

methods. Experts like Jain and Lamba (2020) have undertaken comparative studies that indicate that because data mining can process and analyse large amounts of data, it can identify fraud indicators which more traditional means would ignore. Data mining is a good fraud detection technique because it can adapt to changing fraud patterns. Cases from the real world demonstrate how effective data mining software is at detecting unscrupulous practices in business. One notable example is the case of Wells Fargo, as studied by Mittal, Kaur and Gupta (2021). To detect fraudulent account activity among millions of customer accounts, Wells Fargo used data mining techniques. Eventually, the automated analysis of transaction data led to unauthorised account openings and fraudulent transactions being discovered. Otherwise, losses for the bank would have been enormous.

In terms of comparative efficiencies, factors to be considered are accuracy and efficiency. Data mining tools can narrow the margin of human error and pick up on subtle patterns, reducing inaccuracy. Automated data mining procedures also increase efficiency by allowing real-time or near real-time fraud detection and thus narrowing the window of opportunity for fraudsters. But data mining software may miss subtle fraud schemes or generate false alarms (Sahloul, Self and Simmons, 2019) Akinbowale, Klingelhöfer and Zerihun (2020) say that understanding the value of balanced accuracy is essential because relying too heavily on data mining can lead to an alarming number of false alarms. Both traditional forensic accounting techniques and data mining applications are compared for their effectiveness, detailing the advantages and disadvantages of each approach. C: With data mining the analysis is automated and data-driven, not based on subjective human experience like for older techniques which can involve a time-consuming process. As the following real-world case studies show, data mining can indeed help to look for fraud; but accuracy and efficiency problems still need to be overcome. Perhaps the most effective method of dealing with occupational fraud is to integrate the virtues of both strategies.

2.6 Ethical and Legal Implications of Data Mining in Occupational Fraud Detection

Also in the area of forensic accounting, a matter under debate is that occupational fraud detection by data mining has both an ethical and legal side. The following is a literature review of several scholarly views to provide some insight into this complicated matter. As Amani and Fadlalla (2017) point out, data mining is especially good at discovering fraud patterns that are more complex than traditional methods can uncover. Their work also showed that these techniques can be applied to large volumes of data, not only helping detect anomalies and trends (as in the peaking

of suspicious activities), but crucially suggesting fraud. They did however caution, the balance between good fraud detection and data privacy can be tricky. Ikechukwu et al. (2020) extended this discussion by enquiring whether files withdrawal is accountable to algorithmic favouritism. Looking to these systems, they found that while good at pattern recognition their results are clearly impacted by the prejudices in programs and data. It is easy to get biased results that are not representative, which may affect the fairness and accuracy of forensic accounting. Seen from another perspective, Eko et al. (2020) considered the legal issues linked to data mining in fraud detection. He exposed a regulatory labyrinth, and that forensic accountants must find their way through the data protection law Gordian knot along with its AI regulations. Williams comments that in addition to the legal fallout, noncompliance with the law can damage an organization's reputation and stakeholder trust.

Moreover, Zainal, Md Som and Mohamed (2017) examined the law respecting mis-applied or incorrectly understood results of data mining. They upheld the position that these are exceptionally powerful tools for analysis. However, one can easily become too reliant upon them or misinterpret information gathered by such software and end with faulty conclusions. This could even threaten an organization's legal position. In light of how rapidly technology is changing, Ewa (2022) puts forward a progressive approach to standards of ethics and law. Some suggested that in an environment of continuous change with respect to technology and regulations, education should be frequent so as not to lose the ability of forensic accountants at work. To sum up, opinions on the ethical and legal ramifications of data mining are very different in occupational fraud detection literature. Some of these techniques suffer from the problems of issues implementing them: Privacy and data protection mechanisms, algorithmic bias or legal compliance and liability. Then too, as the experts fall into line with each new step forward made by technology these dialogues help us understand just how mistaken it would be to think that data mining is all-powerful and omniscient.

2.7 Impact of Technological Evolution on Forensic Accounting Practices

One important thing to reflect upon is the impact of this technological revolution on forensic accountancy practices. Tutino and Merlo (2019) explored the integration of blockchain technology in forensic accounting. They concluded that the inherent transparency and immutability of blockchain significantly improve financial records--with less fraud. However, they also pointed

out that this kind of technology would present problems for learning professionals and require restructuring of existing accounting systems 'infrastructure. Oyedokun (2022) examined the role of artificial intelligence in fraud detection. Their study revealed that these technologies have greatly enhanced both the accuracy and speed of fraud discovery processes. They reasoned that AI's ability to make sense of unstructured data and find subtle patterns is a considerable advantage over traditional methods. However, they added that we cannot expect too much from these devices. Guessing about data sets is a very messy business. It requires the judgment of mankind to determine what's important and which options are most suitable for any given situation. Broader still, economics factors into Rezaee and Wang (2019)'s study of the impact of introducing new technology. He says that big corporations can afford the costs of implementing sophisticated technologies, but small firms may not. Such disparity leads to doubts that the degree of equity in accessing such an important tool is realistic and whether it will further widen a gap between large organizations 'and small ones as far out as fraud detection.

Also, Akinbowale et al. (2020) examined how the skill sets of forensic accountants have changed in response to technological progress. They accorded continuing education and training in new technologies the highest priority for being professional. Their research reveals that the nature of forensic accounting is changing, and will require not only proficiency in traditional accountancy but also comfort with new forms of information technology such as data analytics or machine learning. Moreover, Mittal et al. (2021) included a forward-looking viewpoint concerning how the constant advancement of technology would determine future versions of forensic accounting. They considered the possibility that even better AI systems could perform audits and fraud detection themselves, completely revolutionizing this whole field of endeavor. The literature is full of views about technological change and its impact on forensic accounting which are as diverse as they can be. Moreover, as these systems are more and more reliant on new technologies such as blockchain. Actually, this sort of integration provides greater efficiency and accuracy in fraud detection. But there are challenges here too--skill upgrade requirements; economic factors; systematic balance between technological dependency and human enthusiasm: That's another story. So these discussions that happen all over the field reminds us: Even with the development of technology, forensic accounting is not static.

2.8 Challenges and opportunities while combining data mining with conventional forensic methods of accounting

The research studies revealed that data mining with classic forensic approaches in accounting has a polar landscape: challenges and opportunities. With respect to challenges, the availability of data sources and formats represents an obstacle (Sahloul et al., 2019). Due to the change in data quality and detailed information, there are rigid requirements for delicate pre-processing methods. These need both accuracy as well as relevancy. Interpreting difficult data mining is hard for forensic accountants. There is a requirement for specialised skills in both data science and accounting that represents the skills gap that organisations must address. The opportunity shown by this incorporation is important (Jain and Lamba, 2020). The efficiency and speed of automated processes of data increase the timeliness of forensic investigation. This allows for prevention and fraud detection. The combination helps in a more detailed and multifactorial strategy for forensic accounting that provides a detailed understanding of financial activities (Papik and Papikova, 2021). The challenges exist but the combination of data mining and the convention of forensic techniques helps in redefining forensic accounting that also offers a potent against financial frauds.

2.9 Recommendations for Enhancing Fraud Detection Capabilities

- **Utilise Emerging Technologies:** Stay up to date with the latest developments in machine learning, artificial intelligence and data mining. Think about integrating new technologies like blockchain, deep learning and natural language processing (Kılıç 2020) to help improve fraud detection skills.
- **Data Privacy and Ethics:** When using data mining tools, please observe reasonable norms of ethics as well as data protection laws. When using data to discover fraudulent activity, ensure people's privacy and be open (ÖZCAN, 2019).
- **Integrate Data Mining with Traditional Techniques:** By combining traditional forensic accounting methods with data mining software, organisations can take a comprehensive approach. This strategy leverages the strengths of both techniques, to enhance the precision and effectiveness of detecting fraud (Papik and Papikova 2021).
- **Continuous Training and Skill Development:** To know how to get the most out of data mining tools, organisations should invest in training and skill development for their forensic accounting practitioners. These current knowledge and skills are nevertheless important for occupational fraud to be a moving target.

- **Real-Time Monitoring:** Also real-time or almost real-time monitoring of financial transactions and behavioural patterns. The window of opportunity for fraudsters can be dramatically shortened with automated analytics techniques that pinpoint abnormalities as they occur (Kılıç, 2020).
- **Evaluate and Adjust Strategies:** Periodically assess the performance of fraud detection techniques. Assess the ratio of false negatives to false positives on an ongoing basis for maximum accuracy.
- **Report and Whistleblower Programs:** Using whistleblowing initiatives, prompt these staff members and other parties to report suspicious activity to give responds and investigate occupational fraud (ÖZCAN, 2019).

2.10 Theoretical Framework

A theoretical framework is a set of theories, assumptions, ideas and concepts that help to understand a particular problem or phenomenon in a research study. In this context, this research study theoretical framework revolves comprises on probability theories and Fraud Triangle Theory (FTT) and probability theories in the context of techniques of data mining to detect occupational fraud. The FTT theory postulates that three factors including opportunity, rationalisation and pressure to contribute to the occupational fraud occurrence (Owusu et al., 2022). In addition to that, this theoretical framework provides a complete understanding of environmental and psychological elements that lead by individuals to commit activities of activities. In continuance, the pressure component signifies the motivation and financial need to drive an individual commit of fraud in the context of fraud detection. Also, data mining techniques can be employed to analyse employee behaviour and financial transactions to identify patterns indicative of financial pressure (Souza et al., 2019). Besides this, historical data anomalies leverages can be detected for further investigation and the opportunity element states to the conditions that allow fraud to occur. It has been accentuated by the study Mughal (2018) that data mining give permits through ML algorithms and advanced analytics that can scrutinise vast datasets to identify weak points and vulnerabilities in internal controls. By assessing transaction records access logs and user activities, the system can pinpoint potential opportunities for fraud and enhance preventive measures. Fraud theory another aspect is 'rationalisation that comprises on an individual fraudulent actions. Data mining techniques can reveal behavioural indicators and linguistic cues associated with rationalisation with the help of textual analysis of communication records. Consequently, the natural language

process and sentiment analysis can assist to identify dissatisfaction or expression that can be followed by activities of fraud.

The study by Kolmogorov and Reid (2018) stated that the probability theory incorporated into the Fraud Triangle theoretical framework complements through increasing the fraud detection accuracy. Probability theory provides a statistical foundation for assessing the likelihood of events occurring. In continuation, probability models can assign probabilities in different scenarios and help to fraud risks in data mining process. So, this probabilistic approach aids to investigative efforts on high-risk areas and optimising resource allocation. Though, probability theory and Fraud Triangle Theory data mining framework give support to this research study to develop a robust methodology for preventing and identifying occupational fraud (Maulidi and Ansell, 2021). Thus, the integration of these theories recognises the complex interplay of situational, statistical and psychological factors that contribute to fraudulent activities in organisational settings. Consequently, this theoretical framework proposed an insight information to integrate data mining techniques with the help of probability and Fraud theories. Thus, this approach provides a brief understanding of occupational fraud and prepare organisations with practical tools to prevent and detect.

2.11 Research Gap

The aim of this research study is to contribute and explore to the existing knowledge in fraud detection and forensic accounting. Though there has been considerable research on forensic accounting and fraud detection, but in the context of occupational fraud there is a literature gap in the data mining integration techniques and qualitative interview analysis. In this context, the existing literature mainly focuses on lacks of comprehensive examination and traditional forensic accounting methods that how current data mining techniques can increase the fraud detection effectiveness. Additionally, there is an urgent need to investigate novel ways to use data mining tools to filter through massive databases and detect patterns suggestive of fraudulent activity with the fast evolution of technology. Forensic accounting and understanding of data mining is critical for establishing efficient and proactive fraud detection techniques. Fraud detection framework is crucial for advancing the field of forensic accounting to investigate that how these approaches complement each other and contribute to a more robust. Thus, this research study pursues to make bridge between current and existing literature gap through examining techniques of data mining with analysis of qualitative interview in the context detection of occupational fraud. Consequently,

this research study contributes to improve practices of fraud detection to give valuable insights for both practitioners and researchers in the forensic accounting field. So, this research study identifies the gaps of current practices to concentrate on the research of fraud detection and data mining process to give advantages to research practitioners, scholars and policy makers.

2.12 Chapter Summary

It has been identified from the above chapter that data on occupational fraud detection itself is constantly changing with the times, and new trends and technologies are continually emerging. There are several trends in the field of data mining for fraud detection. Data mining techniques have become effective tools for flagging fraud inside the company, and using a variety of techniques known as data mining, hidden patterns are sought out and revealed within vast databases. Proactive fraud detection measures are primarily used to prevent occupational fraud, and proactive strategies and vigilance are required to detect and prevent workplace fraud. Additionally, data mining algorithms can examine purchasing and inventorying information to detect anomalies or discrepancies to help prevent fraud around the supply chain, and organizations can prevent procurement fraud by spotting abnormal buying trends through strategies like these that have been proven effective. There are several trends in data mining for fraud detection, and occupational fraud detection data itself is constantly changing with the times, and new trends and technologies are continually emerging. In continuance, the challenges exist, but combining data mining and the convention of forensic techniques helps redefine forensic accounting and protects against financial fraud. The theoretical framework is based on the probability theory and Fraud triangle theories to provide the groundwork for data mining techniques and fraud detection in forensic accounting. The identified research gap also contributes to improving fraud detection practices to give valuable insights to practitioners and researchers in the forensic accounting field.

3. CHAPTER 3: Methods

3.1 Introduction

Snyder (2019) connoted research methodology as the structured framework and underlying principles employed to design, execute, and assess research endeavours within a dissertation or any scholarly investigation. Research methodology aims to identify and utilise suitable research methodologies and approaches to address particular research inquiries or aims. In this study, the methodology steps, including interpretivism research philosophy, qualitative design, inductive approach, purposive sampling, and thematic analysis, allow the aim and objective of the study for a deeper assessment of fraud detection practices, making them relevant to the study. To understand data mining integration, they will explore forensic accountants' subjective experiences and viewpoints. To investigate occupational fraud detection's intricacies, problems, and best practices. Utilising a research methodology is crucial for ensuring the research's reliability, validity, and general quality. , the purpose of the methodology is to minimise the likelihood of errors or biases in the gathering and interpreting of data. Using the right methodology offers guidelines that facilitate the progression of the complete investigative process, ensuring coherence and focus for the researcher (McCombes and George, 2023).

3.2 Research Philosophy

Research philosophy can be defined as a set of underlying assumptions that shape the approach and methods utilised in investigating a certain matter (Gupta and Gupta, 2022). Four main philosophical paradigms are commonly employed in research: positivism, interpretivism, realism and pragmatism (Jansen and Rautenbach, 2023). The present study employed interpretivism as the selected theoretical framework based on its pertinence and suitability to the investigation. Thorne (2016) defined interpretivism as a theoretical framework within research that significantly emphasises comprehending and interpreting human behaviour and social phenomena within their inherent contextual setting. The reason for choosing interpretivism is because the phenomenon under consideration is distinguished by its emphasis on subjectivity, contextualisation, and the significance attributed to individual experiences and views.

Moreover, occupational fraud and forensic accounting are intricate and contingent domains that require a comprehensive understanding of the context. Interpretivism allows researchers to thoroughly examine the subtle aspects of these practices while considering the distinct

circumstances and experiences of the individuals involved (Throne, 2016). Interpretivism is valid for this study because it emphasises the subjective viewpoints and interpretations of forensic accountants, investigators, and fraud perpetrators since they offer valuable insights into the difficulties, tactics, and incentives associated with identifying fraudulent activities. The potential limitations of using this philosophy are that it has yet to assist in determining information about one specific population, and less statistical data have been acquired, which means that the probability of biased information could be, hence, limiting the credibility of the study.

3.3 Research Approach

Hassan (2023) stated that the research approach is the choices and strategies used to examine a study. There are three more basic research methods: Abductive, logical, and inductive (Azungah, 2018). This research uses an inductive approach to develop a theory or idea that goes beyond current answers and can be used in more situations. Jebb, Parrigon, and Woo (2017) alluded that the inductive method goes from specific facts and findings to bigger ideas and conclusions. The process involves looking at specific examples, data points, or cases to find repeating patterns, themes, and trends. These are then used to come up with big ideas or hypotheses. The inductive method was chosen for this study because data analysis is a key part of understanding professional fraud and forensic accounting, both very complicated fields with always-changing situations. An inductive method lets you start your research by looking at specific facts and stories from real-life situations. This makes it easier to develop insights and theories based on what have seen (Grey, 2021).

The inductive method works for the study because it looks into the complicated and changing parts of finding fraud in experimental forensic accounting. New ideas and thoughts that need clarification when using a deductive method can be found using this method. Inductive research is very useful for developing theories or models that can explain the thing being studied, like how data mining methods can be used effectively to find fraud. The inductive method could improve by ensuring that the results can be used in different situations or cultures. However, a deductive approach may fail subtle details or creative possibilities in fraud detection, thereby obscuring hidden complications. Forensic accounting entails complex processes of dynamic interplay, which can be complicated by deductive approaches that reduce the depth of understanding (Nassaji, 2020).

3.4 Research Design

The term "research design" pertains to the methodical technique utilised by a researcher in carrying out a study, which includes their overarching strategy and methodology (Beins, 2017). Qualitative and mixed-method approaches and quantitative research designs are the predominant research designs (McCusker and Gunaydin, 2015). This study employed qualitative research design and chose it because it effectively identified and refined the research questions, ultimately leading to a definite conclusion and interpretation. In this study, the research questions are as follows: What are the effective ways to identify and prevent the data mining techniques of different types of occupational fraud? The qualitative study will help explore effective ways to identify and prevent data mining techniques in expert interviews. The qualitative method will provide detailed insights for contextual understanding in the real world. Ngulube (2015) defined qualitative research design as a framework that emphasises comprehending and interpreting the significance and context of social occurrences.

Qualitative research design is integrated because it seems valid in examining forensic accounting practices and preparing a case of diverse yet authentic techniques. Qualitative methodology is deemed appropriate for this research endeavour because it can comprehensively examine a specific organisation or phenomenon by implementing a case study design. This approach enables the reader to understand the subject matter deeply. The study of occupational fraud and forensic accounting practises encompasses the intricate nature of human behaviour, encompassing various aspects such as motivations and decision-making processes. Qualitative research facilitates an in-depth exploration of complexities and the identification of underlying reasons that motivate fraudulent acts (Ngulube, 2015). Qualitative methodologies provide a comprehensive investigation of real-life instances and practical encounters, thereby offering a comprehensive comprehension of the application of data mining techniques within the domain of professional fraud.

3.5 Data collection method

Sutton and Austin (2015) explained the data-collecting process, which entails obtaining data to respond to research inquiries or accomplish research objectives. Moser and Korstjens (2018) alluded to a conceptual framework for categorising the process of data collecting into two overarching classes. The "primary" and "secondary" terminology is frequently employed within

scholarly discussions. This study utilises a primary data gathering method wherein the researcher requested the data collection method employed in this study, which involved semi-structured interviews. Semi-structured interviews are valid for the study because they will provide in-depth answers. Moreover, they are flexible and let the researcher ask planned and open-ended questions. This study's primary data collection method aims to thoroughly investigate a novel or unfamiliar subject matter to enhance understanding of the fundamental concepts, motivations, and contexts involved. It holds great importance and credibility in a study that uses data mining techniques to identify occupational fraud within forensic accounting practices. The primary data collection method is valid for the study because utilising primary data gathering methods enables researchers to obtain data that is specifically aligned with their research aims.

By including certain criteria, you can be sure that the data you get is directly related to your study. It makes it easier to get real-life evidence from direct encounters and interviews with forensic accounting experts. The problem is that reporters may add their own bias, and it takes a long time and is hard to analyse the data because people give different answers. One problem with quantitative surveys is that they might not get to the bottom of things; answers might be too simple, leading to shallow results, and it might be hard to measure contextual or subtle information. So, this method makes it possible to understand the problems and methods used in this field fully. According to Scanlan (2020), semi-structured interviews are important because they give researchers and data collectors more freedom and allow for more in-depth study. By digging deeper into themes, changing questions, and exploring complicated ideas, these tools help qualitative researchers get more nuanced insights.

3.6 Sample

Sampling is a way to research when studying a whole community is impossible for picking a sample, which is a representative subset, we can conclude the whole group based on what we see in the sample (Sharma, 2017). 10 participants were chosen from forensic accountants, data analysts, fraud investigators, business managers, IT experts, industry experts, and law advisors to help the study conclude the relationship between the global academic and research community. The demographic including male or female, education, role of job were included. Professional forensic accountants from businesses, colleges, and networks will be hired as a sample. The method used in this study was reasoned sampling, another name for planned sampling (Neelankavil, 2015).

There are many good reasons to use purposeful sampling as to find theft in forensic accounting, this study uses purposeful sampling. They can carefully choose people who know much about investigative accounting and data mining to participate in the study using purposeful sampling. This careful selection process ensures the study gets useful and important ideas. The study is more likely to be true since it used purposeful sampling to find people with the right skills and knowledge (Schreier, 2018). It's more valid because this method fits the research questions and goals well.

3.7 Inclusion-Exclusion criteria

Inclusion Criteria	Exclusion Criteria
Participants with forensic accounting experience were included based on employment backgrounds.	Participants without accounting experience were excluded.
The participants included seasoned forensic accountants, fraud detection specialists, and data mining experts.	Participants other than the age group 25 to 50 were excluded.
Participants from the age group of 25 to 50 were included.	

3.8 Data Analysis

The data analysis approach describes the specific methods and tools used to look at the data gathered (Rahi, 2017). Many data types have been examined using different methods, such as content analysis, topic analysis, and primary and secondary data treatments and analyses. The link between dependent variables, like the rate of fraud discovery and the accuracy of practices, and the independent variable, like cyber or financial fraud, can be found through data analysis and interview analysis. This study will select thematic analysis because it tells variables what to look for by pulling out repeating themes. This turns qualitative insights into measurable parts, which is important for finding complex patterns in research studies. Thematic analysis has been chosen as the methodology due to its ability to incorporate interpretative findings within each identified

topic, exploring the communities and specified trends. The data was obtained through interviews and analysis using a thematic process. Castleberry and Nolen (2018) connoted that theme analysis is a flexible qualitative research method. It can have a big effect on how theory moves forward and also means looking for themes and trends and giving them some thought. This helps people learn more about the subject and think of new things to say.

3.9 Ethical Consideration

Ethics are very important in many fields of study and research. Morals and ideals need to be considered when these things are thought about. To ensure the study is ethical, getting the subjects' permission before interviewing them is important. To get someone's informed agreement, researcher need to tell them everything they need to know about the interview's purpose, method, and possible risks. Keeping things secret is a very important part of the study because it is important to keep people safe and protect their identities. It is important to protect the participants' identity and the replies they give. It is also important for study results to protect people's anonymity. One way to do this is not to reveal the names of the people who took part (Connelly, 2014). Damage minimisation i means not hurting or bothering people by not asking them sensitive or annoying questions. It is very important to ensure that people participating in the study do so voluntarily and can stop without facing any bad consequences. Reliability is vital in research; researchers must be open about their study goals and any possible conflicts of interest.

3.10 Limitations of the research

The problem could be that the subjective findings of forensic accountants are used, which could mean that information needs to be included or biased. Another area for improvement could be that data mining technology changes quickly, making it hard to grasp the newest changes fully. The study may have looked at only some businesses or scams, so the results may only be useful for some. It might also be hard to get people to take part or get access to private company data, which could reduce the level of analysis and change the study's overall scope and depth.

4. CHAPTER 4: Analysis Of Results

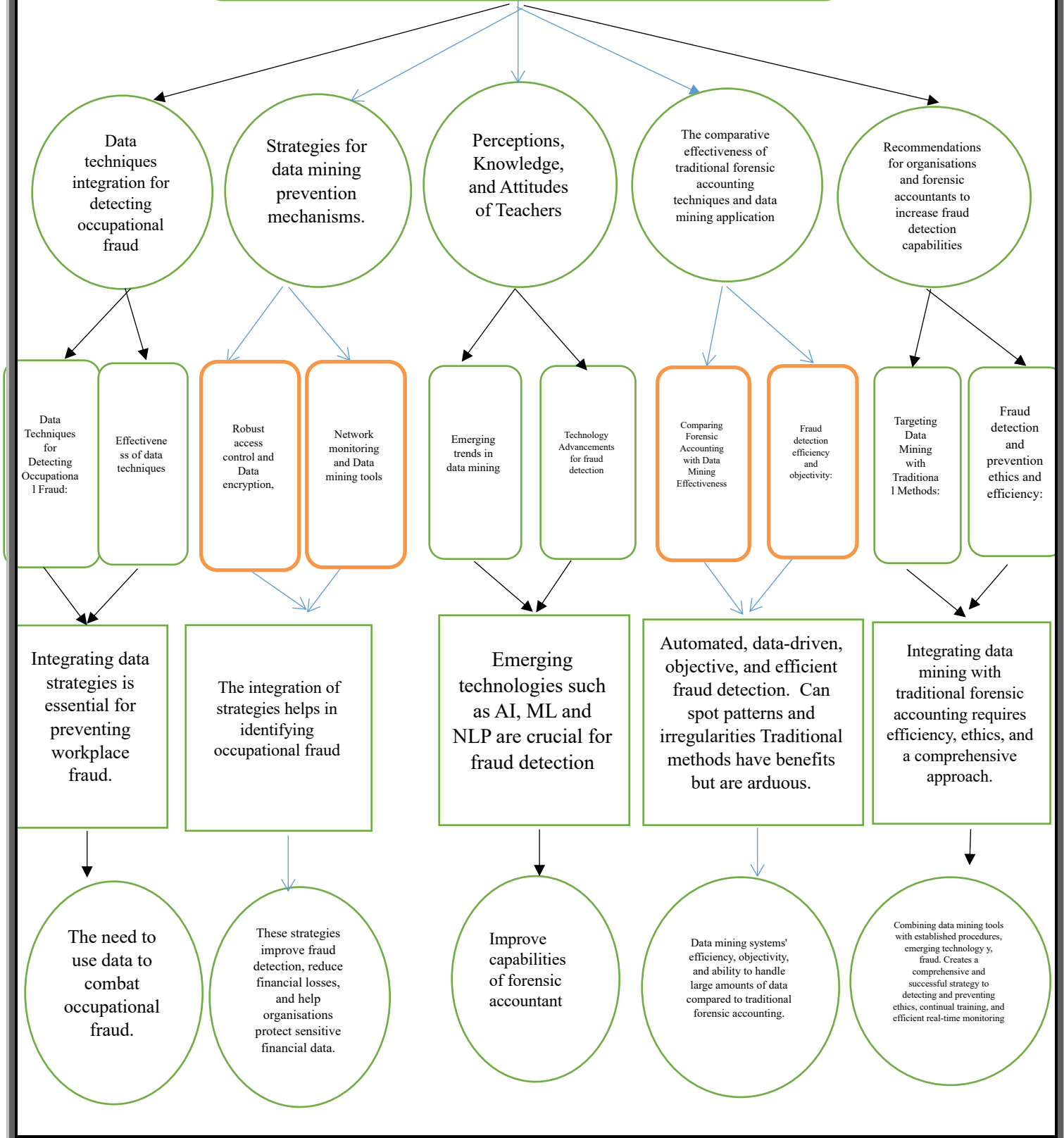
The dissertation results chapter presents and discusses research findings and offers data, analysis, and interpretation of the study's results to assist readers in comprehending their significance for the research questions. It proves the research's value and supports the dissertation's argument.

4.1 Summary of the findings

The study found that conventional forensic accounting methods can identify occupational fraud, but they are subjective, require a lot of manual work, and cannot manage large datasets or perform real-time analysis. The study explored that data mining tools, including statistical analysis, data visualisation, and pattern recognition, can detect fraud using enormous amounts of data. Most of the respondents agree that data analysis can uncover fraud, which is the research's goal. Data mining and encryption help identify fraud quickly, reducing financial losses and improving data security. Monitoring and mining data are proven methods for reducing workplace fraud. These tactics include network surveillance and predictive analysis, fraud detection, and proactive prevention. Due to trends like deep learning, Machine learning (ML), Artificial intelligence (AI), and natural language processing, fraud detection is changing therefore these innovations are improving fraud detection accuracy and efficiency.

4.2 Thematic Graph

“The Application of Data Mining Techniques in detecting Occupational Fraud an interview Analysis of Forensic Accounting Practices”



4.3 Thematic Analysis

4.3.1 Theme 1: Data techniques integration for detecting occupational fraud

The theme 'Data techniques integration for detecting occupational fraud' implies that the integration of data techniques is a crucial tactic for detecting fraudulent activities. Data techniques encompass a wide range of methodologies employed to detect instances of occupational fraud. Conventional methodologies, such as statistical analysis, data visualisation, data analysis and pattern discovery, have been employed over an extended period. According to respondent 2,

'Statistical analysis techniques, data visualisation methods, and pattern detection methodologies.

According to Ikechukwue al. (2023), by employing these methodologies, forensic accountants can efficiently and expeditiously scrutinise vast quantities of data to identify aberrations and discrepancies. Forensic accountants utilise statistical methods to assess financial data reliability and uncover discrepancies and can also predict fraud and anomalous transactions. Data visualisation tools help forensic accountants analyse complex financial data by turning it into charts, graphs, and dashboards. Data visualisation helps identify aberrant trends, outliers, and patterns. This helps investigators communicate with stakeholders and decision-makers. Pattern identification methods use algorithms and machine learning to reveal hidden patterns in large datasets. Statistical analysis, data visualisation, and pattern discovery provide a systematic framework for anomaly detection. This method reduces the chance of missing important data, ensuring a thorough abnormality investigation. The study by Akinbowale, Klingelhöfer and Zerihun (2020) stated that the ability to quickly and accurately discover abnormalities deters organisational violators. Advanced data analysis technologies prevent employee fraud, improving financial governance.

4.3.2 Develop strategies for identifying and preventing data mining techniques

The detection and prevention of workplace fraud require the implementation of proactive tactics and the maintenance of monitoring (Afriyie et al., 2023). The prevention of occupational fraud primarily relies on the use of proactive methods for detecting fraudulent activities. One of the fundamental tactics involves the implementation of robust internal controls and restrictions on access. The utilisation of data mining tools, data encryption, network monitoring, and anomaly detection techniques plays a pivotal part in the identification of occupational fraud within the field of forensic practice. According to respondent 7

'The use of data mining technique with predictive analysis analytics allow us to detect suspected fraud'.

Data mining and predictive analysis are highly effective methodologies utilised in forensic jobs to uncover instances of fraud, hence significantly augmenting the capacity to detect and proactively mitigate fraudulent activity. It helps in pattern recognition is a field that involves the application of data mining techniques to analyse extensive datasets encompassing financial transactions, employment records, and other pertinent information (Amani and Fadlalla, 2017). Through the process of identifying patterns and trends within the data, individuals can discern abnormalities or deviations from established norms. These patterns may encompass irregular transaction frequencies, unconventional vendor connections, or unanticipated anomalies in the data. Predictive analysis helps in anomaly detection by utilising statistical models and machine learning methods to find deviations or anomalies within a dataset. These irregularities may suggest the presence of fraudulent operations, for instance, predictive models can identify atypical surges in transactional values, instances of unauthorised entry into confidential data, or dubious conduct exhibited by employees.

Data mining with the help of data encryption can contribute to the improvement of fraud detection. According to respondent 10,

'The utilisation of data mining with data encryption enables the early detection of occupational fraud, leading to a reduction in financial losses, enhanced operational efficiency, and the identification of distinctive patterns within extensive datasets.'

Data encryption is a security measure that protects sensitive information by rendering it unavailable to individuals who do not have authorisation to view it. Organisations enhance their security measures by implementing encryption techniques to safeguard financial records and important data. Data mining techniques are subsequently employed to analyse these encrypted records, to discover trends and anomalies that may potentially indicate fraudulent activities (Ezenwafor and Udukeke, 2019).

Data monitoring and data mining are highly effective strategies utilised in the field of forensic practice. According to respondent 5

'Data monitoring and data, mining is a very effective method in the field of forensic practice to mitigate workplace fraud through the augmentation of network surveillance, timely identification, and proactive measures for fraud prevention'.

Network surveillance refers to the ongoing monitoring of network activity, encompassing the observation of data access, user conduct, and system interactions. By monitoring these actions, forensic experts can get valuable knowledge about the typical functioning of the network and detect any anomalies that could potentially signify fraudulent behaviour (Berru and López Batista, 2021). In the study conducted by Berru and López Batista (2021), data mining systems use anomaly detection to locate outliers and abnormal financial transactions, personnel behaviour, and data access patterns that may indicate fraud. Compliance and reporting procedures are employed by organisations to ensure adherence to regulatory mandates about data protection and fraud prevention. Detailed reports and documentation can be supplied by these entities, guaranteeing that the organisation maintains adherence to legal norms.

4.4 Emerging Trends in Data Mining Applications for Occupational Fraud Detection

The subject of data mining for occupational fraud detection is undergoing a constant evolution due to the influence of emerging trends including deep learning technologies, integration of ML and AL and Natural Language Processes (NLP). The topic of data mining for fraud detection exhibits several noteworthy trends. One notable trend in the field of fraud detection involves the utilisation of deep learning techniques, specifically neural networks, to enhance the precision and complexity of the detection process. According to respondent 1 *'Deep learning technologies like neural networks for fraud detection are trending'.*

Deep learning can find complex patterns and abnormalities in massive datasets, increasing occupational fraud detection. Pattern recognition is a task in which neural networks demonstrate exceptional proficiency, particularly when confronted with extensive and intricate datasets. In the field of fraud detection, analysts possess the ability to discern inconspicuous trends and abnormalities that serve as indicators of fraudulent behaviour (Bhavnani, 2020).

According to respondent 4, *'The integration of Machine Learning (ML) and Artificial Intelligence (AI) empowers forensic accountants to improve their capacity in identifying occurrences of workplace fraud with greater effectiveness'.*

Machine learning algorithms can analyse extensive datasets, enabling them to detect potentially fraudulent activities by recognising suspicious patterns and abnormalities (Souza et al., 2019). Artificial intelligence (AI) possesses the capability to identify and develop fraudulent schemes without the need for explicit programming, due to its adaptive learning abilities. Moreover, the implementation of automation facilitated by artificial intelligence (AI) and machine learning (ML) optimises the process of fraud detection, guaranteeing continuous monitoring and prompt action against fraudulent behaviours (Ikechukwu et al., 2020). In forensic accounting, specifically for the identification of workplace misconduct, the application of Natural Language Processing (NLP) is critical.

As stated by respondent 4 *‘to analyse unstructured textual data, such as emails, papers, and conversation records, forensic accountants employ natural language processing (NLP) methodologies.*

Natural Language Processing (NLP) algorithms are capable of detecting linguistic patterns, keywords, and moods that have the potential to suggest fraudulent acts, such as collaboration or misleading intent. Through the analysis of textual data, NLP improves the capacity to reveal concealed evidence, comprehend communication networks, and identify emerging fraudulent schemes.

4.5 The comparative effectiveness of traditional forensic accounting techniques and data mining applications.

It is imperative to evaluate the comparative effectiveness of traditional forensic accounting techniques and data mining tools to gain a comprehensive understanding of the capabilities and constraints of each approach in detecting occupational fraud. According to the respondent, 4

‘Financial statement analysis finds inconsistencies, patterns, and irregularities that may suggest fraud or mismanagement. This early detection of financial problems stimulates investigation or rectification’.

The strength of individuals lies in their capacity to discern abnormalities, patterns, and inconsistencies that may serve as indicators of fraudulent activities. The individuals in question possess expertise in the field of forensic accounting. These strategies can also be tailored to suit various types of fraud and industries. However, conventional approaches do have certain

limitations (Bhavnani, 2020). Data mining has demonstrated its ability to process and analyse vast quantities of data, enabling the detection of fraud indicators that may be overlooked by traditional approaches.

4.6 Recommendations for Enhancing Fraud Detection Capabilities

The integration of data mining techniques with traditional procedures allows businesses to adopt a holistic approach by combining conventional forensic accounting methodologies with specialised software. According to respondent 2,

'I think we must use new technologies such as Artificial Intelligence, skill enhancement training, promote the reporting of potentially unethical or illicit behaviour and crisis response plans.

To employ Emerging Technologies such as artificial intelligence AI and data mining to enhance one's proficiency in detecting fraudulent activities, it is advisable to consider the integration of new technologies such as blockchain, deep learning, and natural language processing. Moreover, data privacy and ethics are imperative to adhere to ethical norms and comply with data protection legislation when utilising data mining techniques. The implementation of automated analytics techniques enables the prompt detection of anomalies, hence significantly minimising the timeframe in which fraudsters might exploit vulnerabilities. To foster a culture that promotes the reporting of potentially unethical or illicit behaviour by employees and other relevant stakeholders through the utilisation of whistleblowing mechanisms. It is imperative to swiftly investigate and address reports of occupational fraud to effectively halt its occurrence and ascertain its nature (Jain and Lamba, 2020).

4.7 Conclusion

Data mining tools outperform forensic accounting in detecting occupational fraud. The data analysis emphasises the importance of data mining and encryption to quickly detect fraud. New developments are changing fraud detection and modern advice emphasises technology, training, and creating a culture that supports unethical behaviour reporting.

5. CHAPTER 5: Discussion, Conclusion and Recommendation

5.1 Discussion

5.5.1: Data techniques integration for detecting occupational fraud

The study aimed to explore the data techniques integration for detecting occupational fraud. Most of the respondents agreed that the imperative nature of incorporating effective fraud detection techniques arises from the enduring problem of occupational fraud within organisational settings. Therefore, the results and objective of the study align with each other. According to Bako and Ayuba (2022), conventional methodologies, such as statistical analysis, data visualisation and pattern detection, have been employed over an extended period. Moreover, advanced data mining techniques have shown to be efficacious tools in the identification and prevention of fraudulent activities within an organisation. Similar perspectives were shared by interviewees that to detect instances of fraudulent transactions and behaviours, researchers employ new techniques such as the data mining algorithm. This method is utilised to uncover concealed patterns inside extensive databases (Ikechukwu et al., 2020). By employing this method, forensic accountants can efficiently and expeditiously examine vast quantities of data to identify any aberrations or discrepancies. Moreover, the authors Saleh, Azhar, and Azeez (2020) showcased the importance of decision tree algorithms, an exceptionally valuable data mining technique, in detecting occupational fraud which may encompass improper procurement practices that could potentially impact customer loyalty.

A similar statement was presented by interviewees that data mining tools are utilised by forensic accountants to facilitate the analysis of intricate financial data by the transformation of such data into visual representations, including charts, graphs, and dashboards. The study conducted by Torres-Berru and López Batista (2021) stated that the utilisation of data visualisation facilitates complements by data mining technique and it helps in the identification of anomalous trends, exceptional data points, and recurring patterns. This facilitates effective communication between investigators and stakeholders as well as decision-makers. Pattern identification approaches employ algorithms and machine learning techniques to unveil concealed patterns within extensive datasets. However, the LR claims are diverse but as interviewees revealed there are still limited skills in terms of the utilisation of these techniques that can assist forensic accountants in identifying irregularities within patterns. Unusual payment behaviours, bill anomalies, and

financial report discrepancies can be observed. There are numerous impacts associated with these procedures.

The process of manual examination poses significant limitations in evaluating extensive volumes of data, as compared to the capabilities of forensic accountants. Efficiency enhancements yield time and cost savings in the context of investigations. In the same way, Kılıç (2020) found that using data mining can help uncover fraudulent activities in an organisation. To use this approach effectively, it is important to have a thorough understanding of common data mining algorithms, the ability to analyse real-world case studies, and knowledge of the challenges and limitations of these methods. The implementation of data-driven methodologies in addressing occupational fraud necessitates the adoption of a comprehensive and informed approach. Data mining techniques provide a systematic framework for anomaly detection and reduce the chance of missing important data, ensuring a thorough abnormality investigation. The ability to quickly and accurately discover abnormalities deters organisational violators. Advanced data analysis technologies prevent employee fraud, improving financial governance (Akinbowale, Klingelhöfer and Zerihun, 2020). However, automated data mining algorithms have the potential to generate false positives, which can result in unwarranted inquiries and potentially detrimental effects on employee morale. Similar perspectives were shared by interviewees, considering privacy problems may arise due to the potential intrusion on individuals' personal information resulting from the widespread collection and analysis of data. It is imperative for corporations to diligently address these limitations while capitalising on the benefits of data mining for fraud detection.

5.5.2: Develop strategies for identifying and preventing data mining techniques

The study aimed to investigate and develop strategies for identifying and preventing data mining techniques. Most of the respondents agreed that the detection and prevention of workplace fraud require the implementation of proactive tactics and the maintenance of monitoring. Therefore, the findings of the result and objectives of the study align with each other. The detection of fraudulent acts in the workplace is predominantly dependent on the implementation of preventive measures to avoid occupational fraud (Afriyie et al., 2023). One of the primary strategies entails the adoption of comprehensive internal controls and stringent access limitations. The implementation of rigorous access controls plays a crucial role in effectively limiting unauthorised access to sensitive data and minimising the risk of data modification. Similar perspectives were shared by

interviewees, considering that organisations are required to allocate resources towards implementing several measures, including the adoption of data mining tools, utilisation of data encryption techniques, and implementation of network monitoring and anomaly detection systems. The application of data mining technologies, data encryption, network monitoring, and anomaly detection techniques is crucial in the detection of professional fraud in the domain of forensic practice. The utilisation of data mining techniques in conjunction with predictive analysis enables the identification of potentially fraudulent activities (Papik and Papikova, 2021). Torres-Berr and López Batista (2021), data mining and predictive analysis are widely employed methodologies in forensic investigations to identify cases of fraud. These techniques greatly enhance the ability to detect and proactively mitigate fraudulent activities.

Pattern recognition is a discipline that encompasses the utilisation of data mining methodologies to evaluate vast datasets, which may include financial transactions, job records, and other relevant information (Amani and Fadlalla, 2017). However, the LR claims are diverse but as interviewees revealed there are still limited skills in terms of practical effectiveness associated with patterns and trends that can help people find things that don't fit with the existing rules when they are analysing data. The above trends could be caused by strange changes in the number of transactions, strange connections with vendors, or strange things happening in the dataset. Papik and Papikova (2021) alluded that predictive analysis is a key part of finding anomalies because it uses statistical models and machine learning to find differences or oddities in a dataset. If these things are not normal, it could mean that theft is continuous for example, predictive models can detect unusual increases in transactional values, illegal access to secret data, or suspicious behaviour displayed by personnel.

The utilisation of data monitoring and data mining techniques is widely recognised as an extremely effective procedure within the domain of forensic practice. The utilisation of data monitoring and data mining techniques has proven to be highly beneficial in the realm of forensic practice to mitigate workplace fraud. This is accomplished by improving network surveillance, promptly identifying fraudulent actions, and implementing proactive measures to avoid fraud. Network surveillance refers to the ongoing process of systematically monitoring network activity, encompassing the careful observation of data access, user behaviour, and system interactions. Employing monitoring these activities, experts in the field of forensic investigation can gain valuable knowledge regarding the typical operations of the network and detect any abnormalities

that might potentially reveal instances of fraudulent behaviour (Berru and López Batista, 2021). Similar perspectives were shared by interviewees, considering the adoption of data monitoring systems can assist in the rapid and accurate detection of anomalies or potentially dangerous network activities. For instance, individuals possess the capacity to detect instances of unlawful entry into confidential data, atypical login behaviour, or unexpected data transfers to unknown destinations. The prompt emphasises the criticality of promptly identifying fraudulent activities as a key measure in effectively mitigating their incidence.

Data mining techniques are utilised to evaluate data obtained from various activities to detect trends and patterns that may indicate potential fraudulent behaviour. The capacity to identify and analyse patterns holds significant significance within this particular setting. The procedure involves the identification of vendor relationships that present a significant risk, the detection of transaction rates that depart from the established standard, and the recognition of peculiar procurement trends. The identification of fraudulent activity is heavily reliant on the process of pattern recognition. Berru and López Batista (2021) conducted research that highlights the utilisation of anomaly detection techniques in data mining systems. These strategies are utilised to detect outliers and anomalous events in diverse areas, such as financial transactions, human behaviour, and data access patterns. Similar perspectives were shared by interviewees, considering the identification of such irregularities bears importance as they have the potential to suggest the existence of deceptive behaviours.

Furthermore, through the utilisation of aggregated data obtained from surveillance and data analysis, forensic professionals can formulate proactive approaches aimed at reducing occurrences of fraudulent behaviour. One effective strategy for mitigating the problem of occupational fraud involves the implementation of a range of measures, including the imposition of access limits, the adoption of security protocols, and the establishment of alarm systems. According to Taherdoost (2021), the use of these methods shows the potential to efficiently reduce the frequency and impact of fraudulent activities inside an organisational setting. Organisations implement compliance and reporting standards as a means to ensure compliance with regulatory requirements about data protection and the prevention of fraudulent behaviour. However, the LR claims are diverse but as interviewees revealed there are still limited skills in terms of practical effectiveness associated with these organisations that demonstrate the capability to provide comprehensive reports and

documentation, thereby guaranteeing the organisation's compliance with regulatory rules. However, it is crucial to recognise that there exist further possible disadvantages associated with these approaches. For example, the adoption of data mining and monitoring protocols can impose a substantial burden on organisations, necessitating the allocation of substantial time and financial resources. Moreover, the dependence on pattern recognition and anomaly detection may give birth to false positive outcomes, perhaps initiating unwarranted inquiries and raising concerns surrounding employee privacy.

5.5.3: Emerging Trends in Data Mining Applications for Occupational Fraud Detection

The study discussed the emerging trends in data mining for fraud detection in occupation. Most of the respondents agreed that the subject of data mining for occupational fraud detection is undergoing a constant evolution due to the influence of emerging trends including deep learning technologies, integration of ML and AL and Natural Language Processes (NLP) Therefore the findings of the study and objectives of the research align with each other. A prominent development in the domain of fraud detection pertains to the application of deep learning methodologies, particularly neural networks, to augment the accuracy and intricacy of the detection procedure. In light of the previous literature, it is evident that the user's text can be revised. The utilisation of deep learning technology, such as neural networks, for fraud detection is now experiencing a surge in popularity (Kılıç, 2020).

Deep learning can identify intricate patterns and anomalies within extensive datasets, hence enhancing the identification of professional fraud. Pattern recognition is a cognitive process in which neural networks exhibit remarkable aptitude, especially when presented with vast and complex information. Within the domain of fraud detection, analysts possess the capacity to distinguish subtle patterns and deviations that function as markers of fraudulent conduct (Bhavnani, 2020). Fraudulent schemes may use complex relationships and hidden interconnections among databases. Neural networks exhibit the capacity to reveal complex associations, hence improving the detection of fraudulent networks and money laundering activities. Neural networks possess the capability to dynamically adjust and assimilate information from previously unseen material. The capacity to adapt is of paramount significance within the domain of fraud detection, given the persistent tendency of fraudsters to continuously alter and enhance their tactics. Neural

networks exhibit the capacity to adapt to new fraud patterns without requiring frequent reprogramming.

Despite the fact that developing innovations in data mining approaches for occupational fraud detection have mostly been supported by the combination of machine learning (ML) and artificial intelligence (AI). The utilisation of machine learning algorithms facilitates the analysis of large datasets, hence enabling the identification of potentially fraudulent activities through the recognition of suspicious patterns and anomalies (Souza et al., 2019). Artificial intelligence (AI) exhibits the capacity to detect and generate fraudulent schemes without explicit programming, owing to its adaptive learning capabilities. Additionally, the utilisation of automation enabled by artificial intelligence (AI) and machine learning (ML) enhances the efficiency of fraud detection, ensuring ongoing surveillance and timely intervention in response to fraudulent activities. Ikechukwu et al. (2020) noted that using this technology makes forensic accountants much more accurate and efficient when they are looking for cases of workplace fraud. Therefore, it is a strong tool for protecting financial purity and stopping dishonest behaviour in business settings. In forensic accounting, specifically for the identification of workplace misconduct, the application of Natural Language Processing (NLP) is critical. In an analysis of unstructured textual data, such as emails, papers, and conversation records, forensic accountants employ natural language processing (NLP) methodologies. Natural Language Processing (NLP) algorithms are capable of detecting linguistic patterns, keywords, and moods that have the potential to suggest fraudulent acts, such as collaboration or misleading intent. Through the analysis of textual data, Natural Language Processing (NLP) improves the capacity to reveal concealed evidence, comprehend communication networks, and identify emerging fraudulent schemes.

However, the LR claims are diverse but as interviewees revealed there are still limited skills in terms of practical effectiveness associated with the utilisation of this technology allows forensic accountants to effectively handle substantial quantities of textual data, eventually enhancing the scope and precision of fraud detection. This, in turn, ensures the promotion of financial openness and integrity within organisational settings. The financial implications associated with the implementation and ongoing maintenance of these technologies, along with the necessity for a proficient workforce, may pose an obstacle for certain organisations. The potential existence of adversarial attacks is when malicious entities endeavour to alter the behaviour of the AI system to

evade discovery. A thorough examination of these limitations is necessary to guarantee the responsible and efficient utilisation of these technologies in the realm of fraud detection.

5.5.4: The comparative effectiveness of traditional forensic accounting techniques and data mining applications

The study aimed to examine the comparative effectiveness of traditional forensic accounting techniques and data mining applications. Most of the respondents agreed that it is imperative to evaluate the comparative effectiveness of traditional forensic accounting techniques and data mining tools to gain a comprehensive understanding of the capabilities and constraints of each approach in detecting occupational fraud. Therefore, the findings of the study and research objective align with each other. Historically, the discovery and identification of fraudulent actions have been significantly aided by traditional forensic accounting procedures, including the investigation of financial accounts. Traditional techniques in forensic accounting, such as expert assessment, examination of financial statements, and manual audit processes, have historically been fundamental in uncovering instances of fraud (Jain and Lamba, 2020). According to these scholars, their strength is in their capacity to detect anomalies, patterns, and inconsistencies that may indicate fraudulent activity. Financial statement analysis is a method employed to identify discrepancies, trends, and anomalies within financial statements, which may potentially indicate instances of fraudulent activities or mismanagement. Similar perspectives were shared by interviewees, considering data mining as the effective approach that the prompt detection of financial issues catalyses conducting inquiries or implementing corrective measures. The ability of individuals to identify anomalies, trends, and inconsistencies can be seen as a key factor in detecting fraudulent actions (Clavería Navarrete and Carrasco Gallego, 2023). The individuals have a high level of proficiency in the domain of forensic accounting. These tactics can be customised to accommodate different forms of fraudulent activities and sectors. Nevertheless, traditional methods do possess significant constraints. The utilisation of these methods is not appropriate for handling large datasets and conducting real-time analysis, as they are characterised by their arduous and time-intensive nature.

Furthermore, there exists a notable reliance on subjective assessment, potentially leading to biases and discrepancies in the detection of fraudulent behaviours. Data mining applications provide a systematic and data-driven methodology for the identification and prevention of fraudulent

activities. These strategies effectively detect patterns and anomalies in large datasets through the utilisation of statistical techniques and algorithms. According to Bhavnani (2020), data mining exhibits a greater degree of objectivity and improved efficiency in managing large volumes of data as compared to traditional approaches. The utilisation of data mining has exhibited its capacity to effectively handle and analyse extensive volumes of data, hence facilitating the identification of indicators of fraudulent activity that could be disregarded by conventional methodologies. However, the LR claims are diverse but as interviewees revealed there are still limited skills in terms of practical effectiveness associated with traditional forensic accounting methods cannot handle big datasets or real-time analysis and are time-consuming procedures. On the other hand, data mining is better at detecting fraud because it manages enormous amounts of data objectively and efficiently.

5.5.5: Recommendations for Enhancing Fraud Detection Capabilities

This research provides recommendations to enhance fraud detection. The result of the study shows that the incorporation of data mining strategies into conventional procedures enables firms to embrace a comprehensive approach by amalgamating standard forensic accounting techniques with specialised software. The utilisation of emerging technology, such as Artificial Intelligence, the implementation of skill enhancement training programmes, the encouragement of reporting potentially unethical or unlawful activity, and the development of crisis response plans are recommended strategies. To strengthen one's ability to detect fraudulent actions, it is recommended to incorporate emerging technologies such as artificial intelligence (AI) and data mining. To do this, it is advisable to explore the integration of other technologies such as blockchain, deep learning, and natural language processing. Furthermore, it is crucial to prioritise data privacy and ethics to uphold ethical standards and comply with data protection laws while employing data mining methodologies. To uphold the principles of safeguarding individual privacy and promoting transparency, it is crucial to use prudence while employing data to identify fraudulent activities. Organisations are required to commit resources towards constant training and skill development of their forensic accounting personnel to effectively utilise data mining technology. Given the ever-changing landscape of professional fraud, it is imperative to obtain and employ current information and skills. Real-time monitoring encompasses the discipline of rapidly monitoring financial transactions and behavioural trends, either in real-time or with minimal delay.

As stated by Kılıç (2020), the utilisation of automated analytics methods facilitates the timely identification of anomalies, hence reducing the window of opportunity for fraudsters to exploit weaknesses. It is recommended to conduct regular assessments of the efficacy of fraud detection systems to enhance precision. To do this, it is advisable to periodically examine the ratio between false negatives and false positives. To cultivate an organisational environment that encourages the disclosure of potentially unethical or illegal conduct by employees and other pertinent individuals, it is imperative to deploy whistleblowing procedures. The prompt emphasises the crucial need to promptly conduct thorough investigations and take appropriate actions in response to reports of occupational fraud to successfully prevent its recurrence and determine its characteristics (Jain and Lamba, 2020). Moreover, it is imperative to develop a clearly defined methodology for expeditiously dealing with occurrences of fraudulent behaviour. The proposed strategy should use a holistic approach that integrates containment measures, an investigative process, and, if deemed appropriate, the start of legal actions.

6. CHAPTER 6: Conclusion

Lastly, deploying data mining techniques in detecting occupational fraud: A qualitative analysis of forensic accounting practices. Sophisticated database mining techniques can help the forensic accountant locate trends or anomalies in great amounts of data, which may indicate corporate fraud. Data mining detects fraud by identifying small-scale signs that a conventional audit would not. Businesses understand how financial transactions are being carried out, the conduct of their staff and other things that influence their operations. Forensic accountants are able to detect such irregularities in the data, correlations, and outliers, which would signify professional fraud. Interviews and data mining help in fraud detection. Data mining is enhanced by qualitative employee, key person, and stakeholder interviews. Interviews can supply some contextual details, such as the intentions and personal relationships that the data analysis does not offer. The overall picture of an institution's fraud landscape is achieved by using these methodologies together. Organisations also use data mining technology for monitoring in real-time, thereby enabling them to act quickly on emerging dangers or abnormalities. Organisations need to be nimble and agile in taking a pro-fraud stance, as fraud techniques are dynamic. However, issues pertaining to ethics and privacy protection arise when companies employ data mining in order to avert fraud. There should be a delicate equilibrium in ensuring the use of information while safeguarding privacy. Forensic accountants have immense importance in promoting the establishment of good data governance systems as a means of enforcing moral principles and the right usage of information. In combination, forensic accounting with data mining is a preventive and ethically justifiable tool to combat professional fraud.

Further still, the combination of data mining practices with forensic accounting techniques facilitates advanced fraud detection strategies. Instead of focusing too much on retrospective analysis, organisations should consider using monitoring systems that utilise data mining tools during ongoing activities. It also helps in the early detection and elimination of possible fraud cases and loss, as well as the preservation of reputation. Data mining efficiency for fraud detection depends on the quality of data. Hence, firms should focus on effective data management policies that ensure their information is reliable, full, and up-to-date. Furthermore, constant education and enhancement of the skills of forensic accountants and fraud examiners is key to coping with emerging technologies and new types of fraud. Lastly, combining data mining methodologies with

interview analysis constitutes a strong and vigorous means for unveiling occupational deception. The multidimensional approach makes it possible to detect activities that may lead to fraud, explain their nature and prevent them, if possible. However, with changing and complex kinds of scams in the companies today, the association of data mining and forensic accounting becomes crucial because it is a necessary strategy to protect corporate funds and the confidence among various stakeholders. In addition, deploying data mining strategies in anti-fraud assists in detecting existing fraud and developing forecasting models. By studying past information and spotting tendencies pointing to deceptiveness, organisations are able to construct forecasting models for fraud activities. Acting beforehand makes it possible to take precautions against any dangers that might destroy the organisation.

Data mining offers a dynamic and quick mechanism to detect fraud in real-time. However, traditional auditing methods are usually done on a period basis, opening loopholes through which frauds could escape detection for long. However, data mining algorithms can constantly examine data streams and warn forensic accountants when anomalies emerge. Data mining is used in fraud detection, and it also helps a lot in forensic investigation. With large volumes of evidence typically associated with occupational corruption cases, it may pose a challenge for investigators to conduct manual analysis of such a magnitude. Automated sorting and analysis of data are done by data mining tools that enable forensic accountants to concentrate on interpreting findings and conclusions with meaning. Data mining brings flexibility and adaptiveness to meet the changing ground of occupational fraud. This enables forensic accountants to utilise data mining to remain at par with such fraudsters as they continue advancing their strategies to commit fraud. Adjustable algorithms and models allow for modification and adaptation to emerging patterns, thereby ensuring the relevance and effectiveness of fraud detection approaches in the light of advancing tactics. Nonetheless, one should note that data mining works best if incorporated holistically within a broader fraud risk management program. It is also concluded that through the utilisation of decision-tree algorithms, forensic accountants can effectively and promptly scrutinise extensive volumes of information to detect any anomalies or inconsistencies. Furthermore, it is imperative to acknowledge the significance of decision tree algorithms, a highly esteemed data mining methodology, in the identification of occupational fraud. This encompasses the detection of illicit procurement practices that have the potential to detrimentally affect customer loyalty.

It should be noted that forensic teams must work in conjunction with other parties, including information technology officers, to make sure that data mining exercises are in tandem with the goals and vision of an organisation. Subsection. Knowledge and effective communication among these heterogeneous cultures maximise the outcome of this activity in regard to fraud detection and prevention. Therefore, using data mining as an approach to fighting occupational fraud and conducting interviews in forensic accounting practice gives the organisation a plan against future schemes that may be devised against it. Moreover, this study concludes that data mining may reveal hidden fraud in a company. To use this strategy effectively, one needs to understand data mining methods, be able to analyse examples and understand their limitations.

A strong approach to understanding and fighting against occupational fraud is formed by the synergy of quantitative data analysis and insights obtained through the interviews. However, in the evolving world of technology and business, data mining will serve as an essential tool towards the fight against fraud through forensic auditing. This is a departure from traditional approaches to risk management, integrating data mining methods into forensic accounting for detecting occupational fraud. The traditional methods of detection have become obsolete in the wake of increasing complexities in financial transactions, the globalisation of business operations and the intricacy of fraud schemes. In addition, data mining gives the business an edge over fraudsters by helping identify possible cases of fraud. Data mining contributes significantly to enhanced anomaly detection in one notable way. Traditional auditing relies on identifying irregularities through the use of previously defined rules and thresholds that can be unable to detect subtle or novel patterns implying fraud. Unlike data mining algorithms, for instance, the programs used in machine learning can learn or be adapted depending on the analysed data. Such adaptability helps them identify variations that do not abide by established guidelines, which is key to unearthing new and sophisticated frauds. In addition, applying machine learning techniques to data mining improves the accuracy of fraud detection over time. However, it has been proved that as algorithms handle more data and different patterns emerge, the models of such learning algorithms keep changing so that they become increasingly accurate and precise. In this learning process, there is one important principle that must be applied in everyday activities – learning never ends, and as one learns, one shall improve more every day.

A combination of data mining practices and forensic accounting practices helps in identifying red flags, which are early warning indicators of future fraud. By examining financial reports, employee behaviours, and transactions, forensic accountants may be able to identify red flags before any fraud occurs. Early warning signs provide important precursors enabling the company to undertake a deeper analysis and establish deterrence mechanisms when the fraud has not yet reached its peak levels. Additionally, data mining during interview analysis further improves the effectiveness of fraud detection processes. Qualitative data, which comes from interviews, add depth and context to the quantitative results gathered via data mining. This interdisciplinary approach also enables forensic accountants to verify their outcomes, understand the reasons for committing fraud, and unearth connections that could play a central role in creating a strong argument. Another issue that addresses data mining involves massive data volumes present in the case of fraud investigations. The process of manually analysing huge datasets is tedious as well as inaccurate. This involves the use of data mining tools that make the whole effort of analysing data easy and fast. The efficiency promotes faster detection of fraudulent acts, which results in a better distribution of resources in addressing as well as averting any risk. Although it is true that the advancement of data mining techniques for detecting occupational fraud has predominantly relied on the integration of machine learning (ML) and artificial intelligence (AI). The application of machine learning algorithms enables the examination of extensive datasets, thereby facilitating the detection of potentially deceitful behaviours by discerning unexpected patterns and anomalies.

There is also a need for data mining in forensic accounting because it enables ongoing monitoring of internal controls. Analysing real-time data helps organisations quickly detect anomalies that stray away from normal standards, hence reducing fraud occurrences that might escalate into serious crimes. Real-time monitoring is in line with modern organisations need to be flexible and quick at responding to new threats. However, the necessity to make note of ethical issues involving personal privacy when using data mining in fraud prevention cannot be denied. Organisations must comply with privacy requirements, protect stakeholders' trust, and ensure data are collected and analysed appropriately. Therefore, forensic accountants should not use the powerful data mining approach at all costs but use it while observing people's right to privacy by creating a strong data governance framework that protects sensitive information. Therefore, using data mining methods for detecting occupational fraud and interviewing analysis in forensic accounting practice becomes a revolutionary approach to crime avoidance. The multidimensional nature of this approach utilises

statistical data, machine learning technology and qualitative findings into a flexible and anticipatory fraud risk management system. Amidst a more complicated and interwoven business climate, the consolidation of data mining with criminal accounting methods proves vital in strengthening anti-occupational fraud measures, shielding financial security, and maintaining good standing for firms today.

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APPENDICES

Appendix 1

INTERVIEW QUESTIONS

1. Can you share your knowledge about the different techniques forensic accountants employ to identify instances of fraud in the workplace?
2. What specific red flags or indicators do you think forensic accountants look for during their investigations?
3. Could you provide examples of tools or methodologies used to detect financial irregularities or manipulations?
4. What newest trends do you see in the detection of fraud in the workplace by forensic accountants?
5. Can you provide insights into the ways forensic accountants utilise data mining techniques, along with other methodologies, to detect and prevent fraud in the workplace?
6. How do data mining techniques complement other investigative methods employed by forensic accountants?
7. Could you share an example where the integration of data mining with other techniques enhanced the detection and prevention of fraud?
8. From your perspective as a forensic accountant (or as an expert), what are the primary challenges and opportunities associated with the use of data mining tools in fraud detection?
9. What are the key hurdles or limitations encountered when implementing data mining techniques in forensic accounting practices?
10. In your experience, what potential benefits or opportunities do data mining tools offer in terms of efficiency and effectiveness?
11. Why do you think forensic accountants need data mining to detect discrepancies?
12. Based on your expertise, what recommendations do you have to enhance the incorporation of data mining tools into forensic accounting practices for detecting and preventing workplace fraud?

13. How can organizations overcome the challenges related to data quality and accessibility in implementing data mining techniques?

14. Are there specific training or skill development initiatives you would recommend to enhance the proficiency of forensic accountants in utilizing data mining tools?

15. What are the main benefits of using data mining techniques in detecting occupational fraud, in your opinion?

Appendix 2

INFORMATION SHEET FOR PARTICIPANTS

PROJECT TITLE: The Applications of Data Mining Techniques in Detecting Occupational Fraud: A Qualitative Review of Forensic Accounting Practices.

ABOUT THE PROJECT: You are being asked to take part in a research study on the applications of data mining techniques in detecting occupational fraud: a qualitative review of forensic accounting practices.

Introduction: I am a Master's student at Dublin Business School and I am carrying out my thesis project under the direct supervision of Dr. Monika Smatralova on the subject of "The application of data mining techniques in detecting occupational fraud: A qualitative analysis of forensic accounting practices".

Aims: The research aims to discuss the applications of data mining techniques in detecting occupational fraud through a systematic review of forensic accounting practices.

WHAT WILL HAPPEN: As a participant in the study, you would be required to answer questions about the topic at hand, and share your experiences/feelings of regarding it. Also, 25 minutes interview questions will be conducted from the participants.

TIME COMMITMENT: The study usually lasts between 20-25 minutes. Participants are asked to respond to questions verbally as part of their commitment. There is no requirement to address all questions if they create a conflict of interest.

PARTICIPANTS' RIGHTS: You may decide to stop being a part of the research study at any time without explanation required from you. You have the right to ask that any data you have supplied to that point be withdrawn / destroyed. You have the right to omit or refuse to answer or respond to any question that is asked of you. You have the right to have your questions about the procedures answered (unless answering these questions would interfere with the study's outcome. A full debriefing will be given after the study). If you have any questions as a result of reading this information sheet, you should ask the researcher before the study begins.

CONFIDENTIALITY/ANONYMITY: The information I gather does not include any personal details about you or your workplace, except for the broad category of industry and your role, kept at a general level. When presenting the study results, I will only mention industry and business types generally, without disclosing any specifics about participant companies or individuals. Your data will be aggregated into a larger dataset and analyzed collectively rather than individually. It will be exclusively utilized for academic purposes and will not be shared for any commercial use.

FOR FURTHER INFORMATION

I or / and academic Supervisor of the Research Project, Dr. Monika Smatralova will be glad to answer your questions about this study at any time. You may contact my supervisor at monika.smatralova@dbs.ie and 01 4177 500.

INFORMED CONSENT FORM

PROJECT TITLE: The Applications of Data Mining Techniques in Detecting Occupational Fraud: A Qualitative Review of Forensic Accounting Practices.

PROJECT SUMMARY: The aim of this research is to address a knowledge gap concerning the utilization of data mining by forensic accountants for the detection of occupational fraud.

Although data mining tools can effectively uncover instances of professional fraud, there is insufficient awareness or understanding of their capabilities among individuals. The main goal is to perform a thorough analysis of existing practices in forensic accounting to assess the current application of data mining in identifying professional fraud.

By signing below, you are agreeing that: (1) you have read and understood the Participant Information Sheet, (2) questions about your participation in this study have been answered satisfactorily, (3) you are aware of the potential risks (if any), and (4) you are taking part in this research study voluntarily (without coercion).

Participant's signature

Participant's Name (Printed)

Researcher Consent:

Nissa Sara Thomas

Dated: 7th January 2024