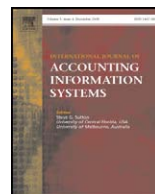




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Internal fraud risk reduction: Results of a data mining case study

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ABSTRACT

Corporate fraud represents a huge cost to the current economy. Academic literature has demonstrated how data mining techniques can be of value in the fight against fraud. This research has focused on fraud detection, mostly in a context of external fraud. In this paper, we discuss the use of a data mining approach to reduce the risk of internal fraud. Reducing fraud risk involves both detection and prevention. Accordingly, a descriptive data mining strategy is applied as opposed to the widely used prediction data mining techniques in the literature. The results of using a multivariate latent class clustering algorithm to a case company's procurement data suggest that applying this technique in a descriptive data mining approach is useful in assessing the current risk of internal fraud. The same results could not be obtained by applying a univariate analysis.

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1. Introduction

Saying that fraud is an important (however not loved) part of business, is nothing new. Fraud is a multi-million dollar business concern, as several research studies reveal and as reflected in recent surveys by the Association of Certified Fraud Examiners (ACFE, 2008) and PriceWaterhouse & Coopers (PwC, 2007). The ACFE study conducted in 2007–2008 in the United States reported that company's estimate a loss of 7% of annual revenues to fraud. Applied to US\$ 14,196 billion of United States Gross Domestic Product in 2008, this would translate to approximately US\$ 994 billion in fraud losses for the United States. The PwC worldwide study revealed that 43% of the companies surveyed had fallen victim to economic crime in the years 2006 and 2007 (PwC, 2007). The average financial damage to these companies was US\$ 2.42 million

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per company over two years. These survey reports demonstrate the magnitude of fraud that companies face today.

Numerous academic studies used data mining to investigate fraud detection (Brockett et al., 2002; Cortes et al., 2002; Estévez et al., 2006; Fanning and Cogger, 1998; Kim and Kwon, 2006) and (; Kirkos et al., 2007). Although prior research has investigated fraud within different domains and using different techniques, the studies all focused on external fraud³ and used predictive data mining. Our study differs in several ways. First, we focus on internal fraud as internal fraud represents the majority of costs as identified by the PwC and ACFE surveys. Second, while prior studies examined only fraud detection, our study investigates internal fraud risk reduction, the combination of fraud detection and fraud prevention. Companies' risk exposure would be substantially greater if they only focused on fraud detection, a reactive working method. Companies use a combination of detection and prevention controls to help minimize their fraud risk. Hence, our study provides a more comprehensive view of the real world. Third, prior research used predictive data mining or more precisely predictive classification techniques. The purpose of these techniques is to classify whether an observation is fraudulent or not. Because we are focusing on risk reduction rather than detection, we believe descriptive data mining is more suited. Descriptive data mining provides us with insights on the complete data set rather than only one aspect of it, i.e., fraudulent or not. This characteristic is valuable for assessing the fraud risk in selected business processes.

The aim of this paper is to provide a framework for both researchers and practitioners to reduce internal fraud risk and to present empirical results on this topic by applying this framework. Based on data collected from an international financial service provider, we investigated fraud risk reduction in the procurement process. The results are promising. In both a subset of recent and old purchasing orders a small cluster with a high risk profile is found. The population of old purchasing orders was of such size that full examination of the specified cluster was feasible. Our analysis suggested a closer examination of ten cases. Of these ten purchasing orders nine were circumventing procedures (creating windows of opportunity to commit fraud), and one was the result of an error.

In the following sections we explain the methodology used in this study, the data set, the latent class clustering algorithm, and the results of investigating the procurement business process of the case company. We first apply a univariate analysis to explore the data and thereafter a multivariate analysis. We compare the results of both analyzes and conclude with the implications of our findings.

2. Methodology

The applied methodology is the IFR² Framework of Jans et al. (2009), summarized in Fig. 1. The IFR² Framework, which stands for Internal Fraud Risk Reduction, is a conceptual framework to guide research in internal fraud risk reduction. As a first step, an organization should select a business process which it thinks is worthwhile investigating. Selection of a business process can be motivated by the following reasons: a business process that involves large cash flow, that is unstructured, that is known for misuses; or a business process that is not well understood by the company. Furthermore, the implementation of advanced IT can be a selection characteristic, because it is a breeding ground for employee fraud (Lynch and Goma, 2003). A characteristic that can counter this higher risk, is the employment of senior managers with more IT experience (Li et al., 2007b). Nevertheless, the risk is not completely discarded and accordingly Lynch and Goma's (2003) suggestion is followed. Also, because of auditors' general lack of IT proficiency and inefficient communication and interaction with IT personnel and information systems, auditors often resort to the traditional paper-based auditing approach, leading to a higher risk exposure of the business process. (Li et al., 2007a) This risk will naturally be more substantial for business processes with a higher IT integration.

In the second step, the stored data is collected, manipulated, and enriched. Manipulation involves organizing the data in the structure and format that is needed for processing. Enrichment is the creation of extra attributes by combining or transforming attributes, e.g., computing ratios and averages. This second step encompasses mainly technical transactions which can be performed by any data analyst.

³ The dimension internal versus external fraud refers to the relation between the perpetrator and the victim company.

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