Revista Catarinense da CIÊNCIA CONTÁBIL

ISSN 2237-7662, Florianópolis, SC, v. 24, 1-22, e3536, 2025

https://doi.org/10.16930/2237-7662202535362

Available at http://revista.crcsc.org.br

MEASURING OPERATIONAL RISK IN BRAZILIAN CREDIT UNIONS

FERNANDA CORDEIRO[1]
Federal University of Minas Gerais
https://orcid.org/0000-0003-4206-9447
fernandaest@yahoo.com.br

VALÉRIA GAMA FULLY BRESSAN
Federal University of Minas Gerais
https://orcid.org/0000-0001-6340-9717
vfully@face.ufmg.br

JOSE ROBERTO DE SOUZA FRANCISCO
Federal University of Minas Gerais
https://orcid.org/0000-0002-1880-5304
jroberto@face.ufmg.br

HUDSON FERNANDES AMARAL
Unihorizontes University Center
https://orcid.org/0000-0001-8455-0285
hfamaral.cepead@gmail.com

NIARA GONÇALVES DA CRUZ
Federal University of Maranhão
https://orcid.org/0000-0003-1559-1686
niaragc@hotmail.com

ABSTRACT

The objective of this study is to propose observable proxies to measure operational risk in credit unions. This work is significant for several reasons: it enhances transparency by utilizing publicly accessible metrics, enables comparisons between institutions facilitating the identification of best practices and areas for improvement and promotes financial stability by evaluating performance over time, contributing to effective operational risk management in the cooperative sector. Based on a systematic literature review, the results demonstrate that it is possible to measure operational risk in credit unions without access to internal information. These proxies can be tested by cooperatives, improving decision-making processes in risk situations and fostering debate among researchers. The study's implications include increased transparency in the sector, greater trust from members and the public, support for regulators in identifying weaknesses in the cooperative financial system, and broadening the discussion on operational risk measurement. Unlike studies that rely on internal data, this work offers proxies that enable comparability and sectoral analysis.

Keywords: Cooperatives. Operational risk. Observable proxies.

Edited in Portuguese and English. Original version in Portuguese.

[1] **Address for correspondence:** Avenida Presidente Antônio Carlos, 6627 | Pampulha | 31270-901 | Belo Horizonte/MG | Brazil.

Received on 09/22/2024**. Revised on** 10/24/2024**. Accepted on** 12/10/2024 by Prof. Dr. Rogério João Lunkes (Editor-in-Chief)**. Published on** 01/24/2025.

1 INTRODUCTION

Credit unions can promote access to financial services for the most disadvantaged populations, as they generate income and employment for these individuals (Greatti & Sela, 2021). According to de Freitas et al. (2008), while credit unions do not aim for financial profit but rather for efficiency in providing services to their members, they need to be attentive to the management of risks involved in their operations.

In alignment with the Basel Accord (*Basel Committee on Banking Supervision - BCBS, 2006*), risk management including the identification, measurement, monitoring, and control of risks should be considered by market participants when evaluating an institution. Accordingly, Resolution No. 4,557/2017 (Bacen, 2017) stipulates that financial institutions' risk management frameworks must address credit risk, market risk, interest rate risk for instruments classified in the banking portfolio, operational risk, liquidity risk, socio-environmental risk, and other relevant risks defined by the institution's criteria.

Studying operational risk is particularly important, as related events can cause substantial losses, potentially undermining the performance of affected institutions (Chernobai et al., 2021). Operational risk events can lead to significant financial damages and, as outlined in Resolution No. 4,557/2017 (Bacen, 2017), encompass the following: internal and external fraud; labor disputes and workplace security issues; inappropriate practices involving customers, products, and services; damage to physical assets owned or used by the organization; circumstances causing interruptions in institutional activities; failures in systems, processes, or IT infrastructure; and shortcomings in the execution, timeliness, or management of institutional activities.

The measurement of operational risk presents unique challenges, as its inherent characteristics and associated theoretical and practical developments differ substantially from those of other financial risks. This divergence has prevented the establishment of a consensus on the best methodology for its measurement (Goulart, 2012).

Risk assessments that fail to consider all probable consequences may lead to improper resource allocation in corporate risk management processes and a significant underestimation of the importance of preventive measures related to operational risk (Eckert & Gatzert, 2017). The frequency and magnitude of operational risk events increase significantly with the complexity of financial institutions (Chernobai et al., 2021).

In the context of credit unions, a discrepancy is evident between the complexity of these entities and the simplicity with which they approach operational risk. These organizations must invest in operational risk measurement methods to enhance their performance indicators and prevent potential losses (Amaral et al., 2009).

Given the lack of consensus on the best methodology for operational risk measurement, stakeholders in financial institutions seek academic contributions to establish consistent, reliable, and robust guidelines capable of accurately reflecting the degree of operational risk to which these organizations are exposed (Goulart, 2012).

In this context, the present study aims to propose observable proxies for measuring operational risk in credit unions. Advancing research on operational risk contributes to a cultural transformation within financial institutions, largely because these organizations have historically been resistant to providing data to researchers interested in studying operational risk (Goulart, 2012).

Under these circumstances, this research aligns with the existing literature on credit unions by offering a proposal for measuring operational risk and discussing parameters to be managed to minimize losses. This approach seeks to ensure that cooperatives remain capable of serving citizens who rely on these institutions to meet their financial needs

.

2 LITERATURE REVIEW

2.1 Credit unions Worldwide and in Brazil

Credit unions play a crucial role in increasing competition in the credit market. A plausible explanation for this is that economies of scale, the absence of a profit-seeking obligation, tax benefits, and the positive feedback loop between members and the institution can lead to reduced interest rates in these transactions (Azevedo & Gartner, 2020).

On the international stage, research highlights additional roles of credit unions beyond their social function, such as fostering competition in the credit sector (World Bank & International Monetary Fund, 2005; Rubin et al., 2013).

In this context, cooperatives emerge as alternative institutions to banks, as they assume risks in their investments to benefit the local communities they serve. By doing so, they promote local development through the creation of savings and the provision of microcredit aimed at supporting local entrepreneurial initiatives (Jacques & Gonçalves, 2016).

2.2 Operational Risk in Financial Institutions

Although operational risk has long been present in institutions, concern about its formal definition and the development of reliable metrics to measure it is relatively recent (Goulart, 2012). According to Resolution No. 4,557/2017 (Bacen, 2017), operational risk is defined as the possibility of losses arising from external events or from failure, deficiency, or inadequacy in internal processes, people, or systems.

In line with Resolution No. 4,557/2017 (Bacen, 2017), operational risk events include: internal and external fraud; labor disputes and inadequate workplace security; improper practices related to clients, products, and services; damage to physical assets owned or used by the institution; situations causing interruptions to the institution's activities; failures in systems, processes, or information technology infrastructure; and failures in execution, deadlines, or activity management within the institution.

According to Goulart (2012), financial losses resulting from operational risk in financial institutions have become increasingly significant. This trend is attributed to changes in the financial market since the 1980s, a period characterized by increased operational and product complexity, faster transaction speeds, market internationalization, corporate growth, and the sophistication of information technologies used.

Unlike credit and market risks, operational risk presents extremely limited and challenging information for study. This is partly due to the fact that financial institutions with high operational risks may already be out of the market (Trung et al., 2018).

3 METHODOLOGY

This research is characterized by a literature review on the subject, aiming to identify definitions of operational risk proxies applicable to credit unions. To achieve this, a systematic search was conducted in reputable academic databases, such as the **American Accounting Association**, **Elsevier**, **Emerald Insight**, **Google Scholar**, **Springer**, and **Wiley Online Library**, considering publications up to the year 2022. The goal was to capture the most recent and relevant advancements on the topic aligned with the research context.

The keywords used included combinations in English, such as *operational risk*, *risk management in financial institutions*, *credit unions*, *operational risk proxies*, and *operational losses in cooperatives*, ensuring a broad scope to identify studies related to operational risk management in financial institutions.

The applied filters restricted the search to peer-reviewed publications, book chapters, and systematic reviews, prioritizing studies published in English, although works in Portuguese were included when relevant. Additionally, the Qualis-Capes classification of journals was considered, with preference given to articles classified in the A1, A2, and B1 strata. The analysis also emphasized studies from developing countries, given the interest in understanding contexts similar to those of Brazilian credit unions.

The search resulted in a total of 86 works from various academic sources and fields. These included articles published in high-impact international journals such as the *Journal of Corporate Finance*, *European Financial Management*, and *Journal of Monetary Economics*, as well as institutional guidelines and reports from entities like the Central Bank of Brazil and the Basel Committee on Banking Supervision. The selection reflects a multidisciplinary and international approach, highlighting studies conducted in countries such as Brazil, the United States, the United Kingdom, Pakistan, China, and Taiwan.

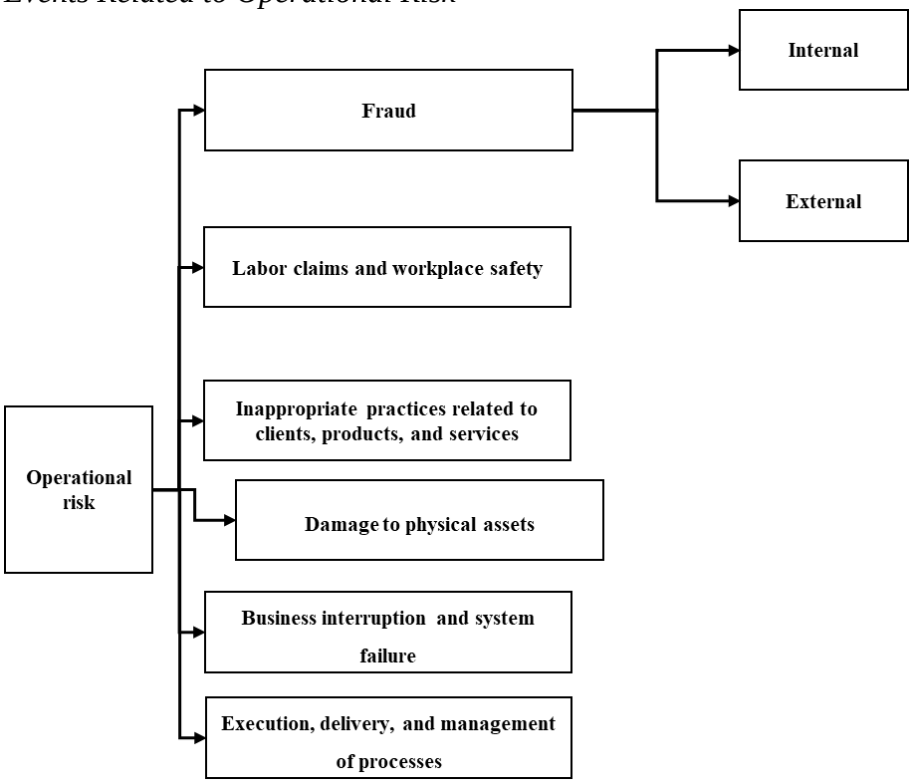
The decision to focus the research on credit unions is justified by the importance of these institutions in the Brazilian economic and social context. Cooperatives play a crucial role in financial inclusion, particularly in regions where access to banking services is limited. Furthermore, their unique structure characterized by democratic management and a focus on meeting the needs of members creates specific opportunities and challenges that set them apart from traditional banks, making them a valuable subject of study.

With regard to credit unions, a gap is observed between the level of complexity of these entities and the simplicity with which they have addressed operational risk. In this context, cooperatives need to invest in methods for measuring operational risk, aiming to improve their performance indicators and prevent potential losses (Amaral et al., 2009). Analyzing the performance of these organizations, while considering the specificities and challenges they face, is essential to ensuring their sustainability and contribution to the national financial system.

4 THEORETICAL FRAMEWORK AND PROPOSAL FOR MEASURING OPERATIONAL RISK IN CREDIT UNIONS

The Basel Committee on Banking Supervision (BCBS) outlines a framework comprising seven broad categories of loss events, which are further subdivided into subcategories with examples of related activities. These categories are detailed in Figure 1 (BCBS, 2001):

Figure 1
Events Related to Operational Risk



Source: Prepared by the authors.

Operational risk events can be defined as any occurrences with the potential to cause losses to institutions where this type of risk is present. Below, each of the categories outlined by the BCBS is detailed, along with the proposed proxies for measuring operational risk.

4.1 Category 1: Internal Fraud

According to Basel II, fraud can be defined as losses arising from acts intended to unlawfully appropriate assets or circumvent regulations, laws, or policies associated with a given institution. Fraud can occur in two distinct environments concerning the organization: internally or externall.

Internal fraud is associated with the risk of unexpected financial, material, or reputational loss resulting from fraudulent actions by individuals within the organization (e.g., directors, employees, or contractors) (BCBS, 2006). According to Wang and Hsu (2013), mitigating internal fraud requires the implementation of stringent internal controls that encompass both systems and processes within the institution. Furthermore, it is essential to promote a risk-aware culture among employees, ensuring alignment with the organization's risk management framework. The BCBS (2011) emphasizes that operational risk management reflects the effectiveness of the board of directors and executive management in overseeing the institution's portfolio of products, activities, processes, and systems. Significant losses in the banking sector often stem from operational risk and can be prevented through proper identification, analysis, monitoring, and control. Good corporate governance practices, therefore, play a critical role in fostering effective operational risk management (Altaf et al., 2021).

The board of directors is responsible for ensuring that the financial institution's policies and strategies are consistent with sound risk management practices. An effective risk management system should be implemented under the board's guidance. Additionally, employees must be

aware of both the risks the institution faces and the systems in place to monitor and control such events (Altaf et al., 2021). This highlights the role of corporate governance in integrating risk management within banking operations (Shabbir et al., 2021).

The literature identifies several board characteristics that can be used to measure good governance practices, including board size, gender diversity, and board independence (Endrikat et al., 2020).

he boards of directors of financial institutions can perform their functions more effectively to safeguard the interests of shareholders or members if there is a greater presence of external (or non-executive) directors (Fama & Jensen, 1983). In this regard, Dahya and McConnell (2005) argue that boards with a higher proportion of external directors make better decisions, particularly more assertive ones regarding CEO appointments. Similarly, Beasley (1996) highlights that organizations with a higher percentage of external directors experience lower rates of financial fraud.

In this context, it is observed that as the number of independent members on the board of directors increases, so does the effectiveness and control of management (Liao et al., 2014). Another argument supporting the increase in independent members is that such individuals are less aligned with management, thus serving as an important mechanism for achieving balance. This ensures that companies prioritize the interests of shareholders, stakeholders, and society at large (Sharif & Rashid, 2014).

Board size can be defined as a governance mechanism tied to management control that may influence an organization's internal control processes (IBGC, 2009). According to the Brazilian Institute of Corporate Governance (IBGC), the optimal size for a board of directors is between five and eleven members. When the board exceeds this recommended range, monitoring inefficiencies may arise. The literature further suggests that as the number of board members increases, so does the potential for enhanced monitoring. However, the benefits of this improved effectiveness may be offset by incremental costs resulting from less efficient communication and slower decision-making processes, which are common in larger boards (Lipton & Lorsch 1992).

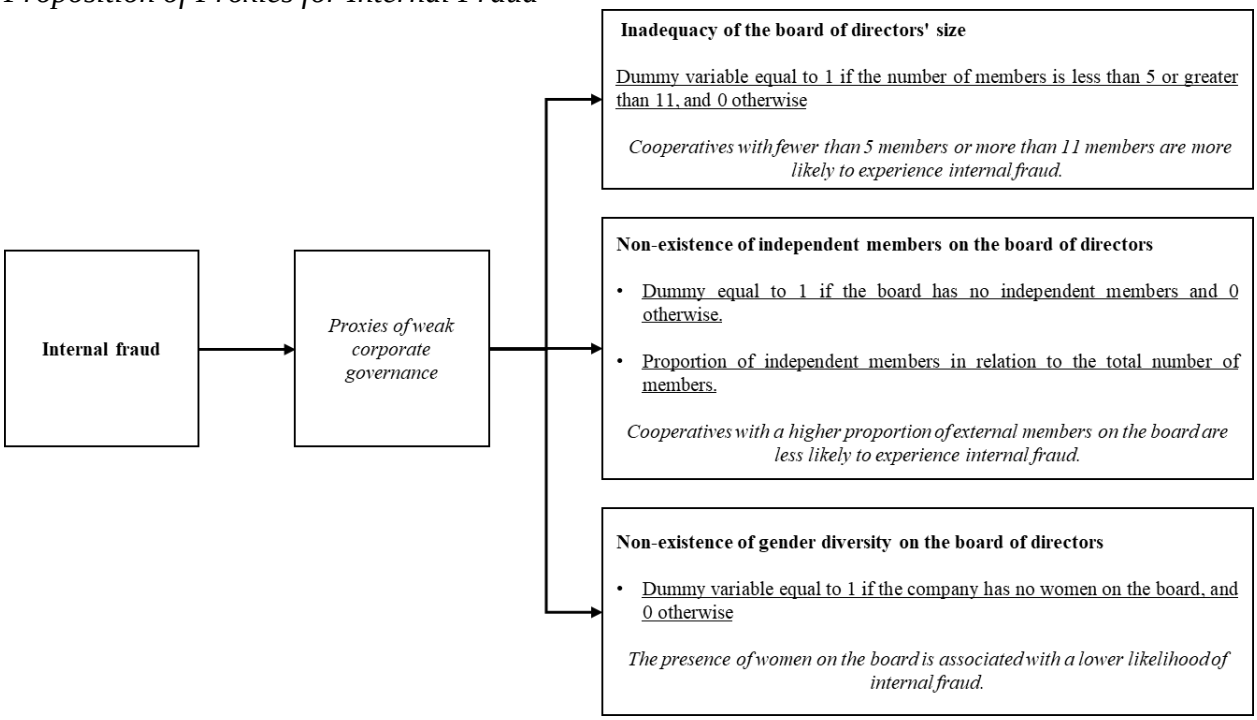
Finally, gender diversity on the board of directors is linked to the number of women represented on the board. Since the presence of men and women often stems from traditionally, culturally, and socially distinct perspectives, gender diversity on the board can be considered a critical dimension of corporate governance (Liao et al., 2014).

4.1.1 Proposed Proxy for Operational Risk in Category 1: Internal Fraud

This research proposes the use of board characteristics that may indicate weak corporate governance as a proxy for internal fraud risk. These characteristics include: (i) Board size; (ii) Proportion of independent directors; and (iii) Gender diversity.

The primary factors contributing to internal fraud are linked to deficient internal controls (KPMG, 2009) and inadequate corporate governance practices (Beasley, 1996). In this context, institutions with larger boards, a higher proportion of independent directors, and female representation on the board are expected to exhibit better monitoring of their practices and, consequently, lower probabilities of internal fraud. Figure 2 illustrates an approach to indicate internal fraud risk, captured through the lens of weak corporate governance.

Figure 2
Proposition of Proxies for Internal Fraud



Source: Prepared by the authors.

4.2 Category 2: External Fraud

External fraud refers to losses caused by third parties (e.g., clients, suppliers, contractors, or legal representatives) who commit specific acts intended to defraud, misappropriate property, or circumvent the law (BCBS, 2001). External fraud poses a significant business risk, with its impact often manifesting as financial losses, damage to organizational reputation, and the need for rework (Rahman & Anwar, 2014).

In this context, examples of external fraud include theft, counterfeiting, damage caused by hackers, security breaches, and the theft of information that can result in financial losses (BCBS, 2001). Therefore, external fraud exists in three main forms: (i) credit card fraud; (ii) money laundering; (iii) Collateral Fraud (Sanusi et al., 2015).

a) Credit Card Fraud

Credit card fraud is characterized by the unauthorized use of a credit card to make purchases or by counterfeiting a credit card (Balan & Popescu, 2011). The remote use of credit cards is the most commonly employed tool for fraud. It is often sufficient to have just a few pieces of information to conduct transactions with someone else's card using the Internet (Abdelhamid et al., 2014).

External fraud can occur in various ways, such as through the loss or theft of a credit card or via other fraudulent applications capable of extracting information related to a specific credit card (Ettredge et al., 2014). Notable methods of committing card fraud include "skimming," "phishing," and declaring bankruptcy (Barker et al., 2008).

The practice of "skimming" is associated with the theft of credit card information during a legitimate transaction process (ACFE, 2007). Phishing occurs when a fake website is created to resemble a legitimate one, where victims will enter their personal information, such as usernames, passwords, and other credit card details (Kenney, 2007). Finally, bankruptcy fraud involves buyers

using their credit cards knowing they cannot pay for the purchases. The only way to mitigate this type of fraud is by adopting a pre-verification process through credit agencies to obtain information about the clients' banking history (Delamaire et al., 2009).

b) Money laundering

Money laundering constitutes one of the most significant risks for financial institutions. This is due to the lack of an effective means of assessing the likelihood of money laundering within financial institutions, which can result in considerable costs associated with fines (McLaughlin & Pavelka, 2013).

It is important to highlight that, in addition to the level of competence, the ability of employees to assess existing risks within an organization can be impacted by both internal and external factors, such as the strength of internal control systems or the application of technology that can assist them in performing this task (Isa et al., 2015).

Studies show that risk assessments supported by IT systems are more effective when used in conjunction with human knowledge (judgment) (Morton & Fasolo, 2009). In support of this argument, Isa et al. (2015) explain that using an IT system for managing money laundering risk, without the involvement of employees capable of interpreting the information collected from these systems, may not be effective in mitigating this type of fraud. However, the implementation of sophisticated systems represents a valuable tool in the process of risk assessment for financial institutions (Isa et al., 2015).

Regarding the assessment of money laundering risk, the compliance function through compliance practices serves as the second line of defense. This is based on the assumption that the first line of defense against such fraud lies with the financial institution's management. In this sense, the Compliance Department acts as a secondary layer of screening to identify potential money laundering risks. The compliance sector is responsible for transaction analysis and may include tasks such as the pre-selection of clients with an imminent risk of money laundering (Isa et al., 2015).

c) Collateral Fraud

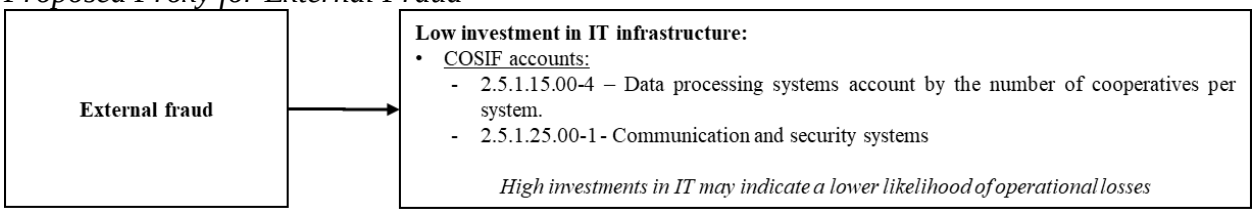
The granting of credit to a client by a financial institution is typically tied to a collateral guarantee to ensure the repayment of the loan, protecting the institution against potential payment difficulties by the client. However, many clients present false or overestimated collateral to banks, which prevents the financial institution from recovering the credit provided. This type of fraud constitutes a significant portion of the losses observed in banking institutions (Abdelhamid et al., 2014). In this regard, the occurrence of collateral fraud is associated with the provision of false statements, misrepresentations, or omissions during the loan acquisition process (Carswell & Bachtel, 2009).

4.2.1 Proposed Proxy for Operational Risk in Category 2: External Fraud

This research also proposes the use of the value of Cosif accounts 2.5.1.25.00-1 and 2.5.1.15.00-4, which refer to investments in IT, as a proxy for operational risk related to external fraud. In this context, it is expected that higher investments in IT will indicate greater security of information and processes within the cooperatives, thereby mitigating operational risk, in accordance with Resolution No. 4,893 of 2021 (BACEN, 2021).

However, it is important to note that these Cosif accounts do not provide direct data for collection. Therefore, it is necessary to verify with the Bacen or the cooperatives themselves the possibility of disclosing these accounts. Below, Figure 3 illustrates the proposed operational risk proxy discussed in this section.

Figure 3
Proposed Proxy for External Fraud



Source: Prepared by the authors.

4.3 Category 3: Labor Claims and Workplace Safety

The existence of labor claims and the lack of safety in the workplace lead to losses for financial institutions due to actions that are inconsistent with labor laws, health and safety agreements, or the payment of personal injury claims. These losses may also result from events related to diversity and/or discrimination occurring within the institution (BCBS, 2001).

In this way, companies that fail to comply with labor demands tend to become involved in legal actions, leading to the possibility of financial losses. These potential losses are related to direct costs associated with the legal process, such as court fees, attorney fees, fines, or settlements (Autore et al., 2014), as well as indirect costs, such as a decrease in market value, loss of employee motivation, and reputational damage (Karpoff et al., 2008; Karpoff & Lott, 1993; Haslem et al., 2017). As a result, litigation negatively impacts the value of the company by diverting cash flow.

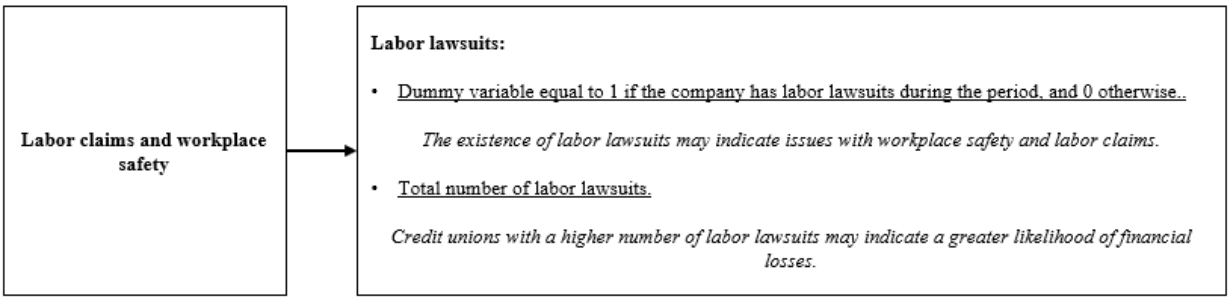
In this context, employees represent a crucial group of stakeholders that contribute to the business's success. Therefore, fostering a good relationship with employees can have a significant effect on the company's value creation capacity, as a positive relationship with staff can increase their productivity (Zuo et al., 2022). According to Rachman (2013), in Brazil, the issue of labor losses in financial institutions has gained prominence due to the billions of reais associated with it.

4.3.1 Proposed Proxy for Operational Risk in Category 3: Labor Claims and Workplace Safety

Building on Rachman's (2013) study, this research proposes using a variable that reflects the presence or absence of labor lawsuits linked to the legal entity's CNPJ (Brazilian taxpayer ID) as a proxy for measuring operational risk inherent to credit unions.

The total number of labor lawsuits can also be used as a variable to measure operational risk, as cooperatives with a higher number of labor disputes may have a greater probability of incurring financial losses. Alternatively, a dummy variable could be used, where the value is set to 1 if the cooperative has an ongoing labor lawsuit listed on the JusBrasil website, and 0 otherwise. Figure 4 illustrates the proposed operational risk proxy in this study for events related to labor claims and workplace safety.

Figure 4
Proposed Proxy for Labor Claims



Source: Prepared by the authors.

4.4 Category 4: Inadequate Practices Related to Clients, Products, and Services

The risk associated with inadequate practices related to clients, products, and services refers to operational losses arising from events related to unintentional or negligent failures to meet professional obligations to clients, or related to a product or service (BCBS, 2001; An et al., 2020).

In accordance with Circular No. 3,979 of January 30, 2020, there are five subcategories in this category of event linked to operational risk: (i) product suitability for clients, disclosure of information about products and services, breach of fiduciary duty; (ii) improper business and market practices; (iii) product failures; (iv) selection, sponsorship and exposure; and (v) consulting activities. (BACEN, 2020).

Customer product suitability, disclosure of product and service information, breach of fiduciary duty includes any activities where a customer's privacy has been violated, aggressive selling or misuse of confidential information (Crouhy et al., 2004). Improper business and market practices can include insider trading, money laundering, unlicensed activity, or any form of market manipulation (Ferreira & Dickason-Koekemoer, 2019). Product failures are related to defects in products or errors in the structure model of a particular product offered. Selection, sponsorship and exposure occur when a given financial institution fails to investigate its clients according to guidelines or exceeds the level of exposure in relation to those who use its services (Ferreira & Dickason-Koekemoer, 2019). Finally, the advisory activities subtype involves any losses that arise from advisory activities (BCBS, 2006).

Losses related to inadequate practices concerning clients, products, and services are regarded as some of the most severe types of operational risk events (Soprano et al., 2009; Chernobai et al., 2009). The authors provide examples of some of the largest operational losses experienced by U.S. financial institutions, which are presented in Table 1 below.

Table 1

Examples of Losses Related to Inadequate Practices Concerning Clients, Products, and Services

Year	***Company***	***Value of Losses***	***Reason***
1980	*Prudential Insurance*	US $ 3 bilhões Payments of restitution and fines.	Questionable sales practices led to a major lawsuit that plagued the company throughout the 1990s and ultimately tarnished its reputation.
2005	*Citigroup*	US $ 2 bilhões	Paid the SEC (U.S. Securities and Exchange Commission) and a class of Enron shareholders in settlement of charges, as the bank helped and encouraged the energy company to hide its true financial condition since 1997.

Source: Prepared by the authors.

4.4.1 Proposed Proxy for Operational Risk in Category 4: Inadequate Practices Related to Clients, Products, and Services

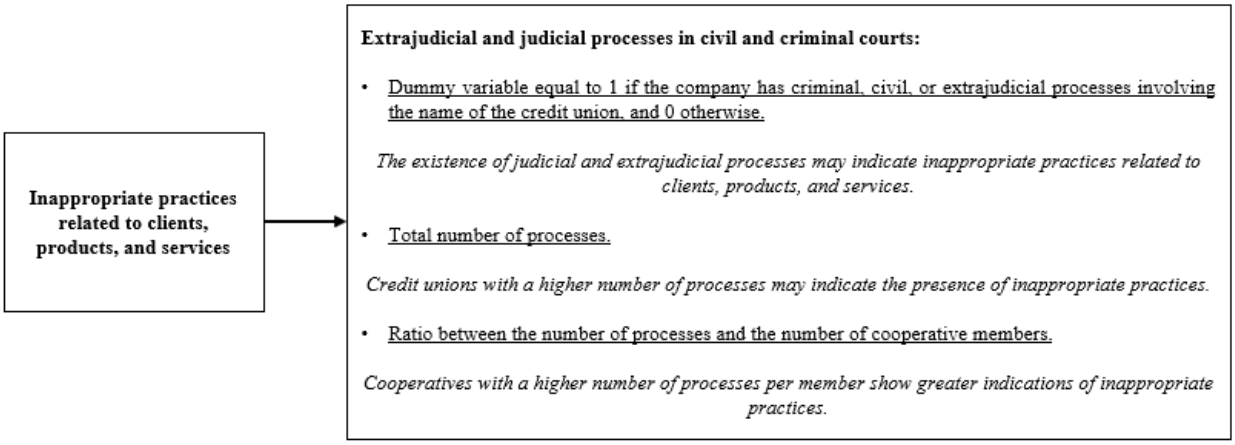
This research proposes, as a proxy for operational risk inherent to credit unions, the existence of criminal and civil lawsuits linked to the cooperative's CNPJ (legal entity identifier). The presence of such lawsuits can be verified by consulting the JusBrasil website. The operational risk proxy is represented by a dummy variable that takes the value of 1 if there are criminal and civil lawsuits linked to the credit union's CNPJ, and 0 otherwise. It is expected that cooperatives involved in litigation will have a higher likelihood of engaging in inadequate practices.

It is also suggested to use the total number of annual litigations involving the cooperatives. Thus, cooperatives with a higher number of judicial and extrajudicial actions may indicate a greater

probability of financial losses. Another proposed proxy could be the ratio between the total number of lawsuits and the number of cooperative members. In this way, cooperatives with a higher number of lawsuits per member would show greater indications of operational failures. Figure 5 illustrates the proposed operational risk proxy for events related to inadequate practices concerning clients, products, and services.

Figure 5

Proposed Proxy for Inadequate Practices Related to Clients, Products, and Services



Source: Prepared by the authors.

4.5 Category 5: Damage to Physical Assets

Damage to physical assets is associated with losses that can arise from natural disasters or other events (BCBS, 2001). According to Ko et al. (2019), losses caused by damage to physical assets are considered less common events, such as those associated with natural disasters, fires, terrorism, vandalism, among other factors.

The level of exposure to risk events caused by damage to physical assets is tied to the accounting of the reduction in the values of fixed assets. Financial institutions must comply with Technical Pronouncement CPC 01 (2010), which addresses the recognition, measurement, and disclosure of asset impairment (Resolution 3566, Article 1).

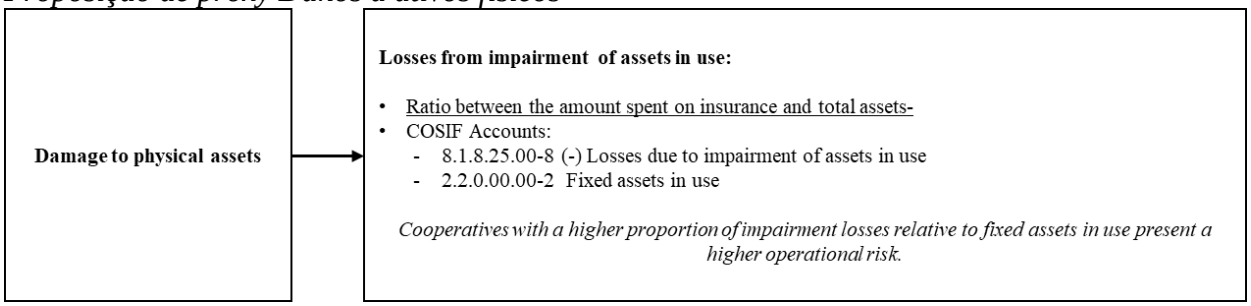
According to Circular No. 3,941/2019 and Technical Pronouncement CPC 01 (2010), institutions are required to assess at the end of each period whether there is any indication that a fixed asset may have suffered impairment. If there is evidence and the impairment is confirmed through the recoverable amount test (Impairment), the loss must be recognized in a specific income statement account (BACEN, 2019).

4.5.1 Proposed Proxy for Operational Risk in Category 5: Damage to Physical Assets

The proposed proxy for operational risk in credit unions is the ratio between the value of losses due to impairment of fixed assets identified in the impairment test, as outlined in Circular No. 3,941/2019, and the total value of fixed assets. Thus, cooperatives with a higher proportion of impairment in their physical assets would show greater indications of operational losses related to damage to physical assets.

In the context of credit unions, this account refers to Cosif 8.1.8.25.00-8, which includes losses from impairment of use assets. However, this Cosif account is not available for consultation on the Bacen website (2024), requiring verification of information in the explanatory notes or direct requests to cooperatives for access to such information. Figure 6 illustrates the proposed operational risk proxy for damage to physical assets.

Figure 6
Proposição de proxy Danos a ativos físicos



Source: Prepared by the authors.

4.6 Category 6: Business Disruption and System Failures

Business disruption and system failures encompass events such as those arising from the malfunctioning of IT systems (Chernobai et al., 2021). It is important to note that such events also include losses caused by disruptions to the normal course of business due to hardware or software breakdowns, telecommunications failures, programming errors, computer viruses, or power failures (Ko et al., 2019).

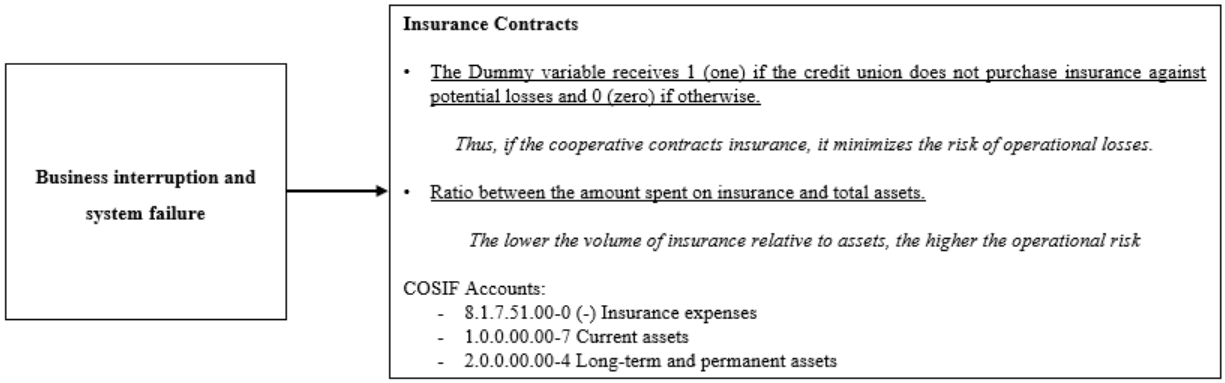
Many of the risks covered by the Basel Committee's definition of operational risk have traditionally been managed through the acquisition of insurance. For example, fraud committed by employees of banking institutions has long been insured under what is known as the bankers' blanket bond, and damage to physical assets is traditionally covered by property insurance. In this sense, it can be seen that the purchase of insurance by financial institutions serves as a strategy to mitigate operational losses resulting from system failures (Mendonça et al., 2008).

4.6.1 Proposed Proxy for Operational Risk in Category 6: Business Disruption and System Failures

A proposed proxy for operational risk related to business disruption and system failures could be a dummy variable indicating whether or not the cooperative has insurance coverage against potential losses from such events. In this case, the dummy variable would take the value of 1 if the credit union does not purchase insurance for potential losses and 0 otherwise. This suggests that by purchasing insurance, the cooperative minimizes the risk of operational losses.

Another proposition is the ratio of the amount spent on insurance relative to the total assets of the credit unions. Thus, the lower the amount spent on insurance relative to assets, the higher the risk. This proxy can be obtained from the Cosif account, which records the insurers' responsibility for risk coverage (9.0.8.70.00-6), related to insurance contracts. These data can be found in the explanatory notes of the cooperatives. Figure 7 illustrates the proposed operational risk proxy for events related to business disruption and system failures.

Figure 7
Proposed Proxy for Business Disruption and System Failures



Source: Prepared by the authors.

4.7 Category 7: Execution, Delivery, and Process Management

Events related to operational risk arising from execution, delivery, and process management correspond to losses resulting from failures in transaction processing or the management of processes, relationships with business counterparts, and suppliers (BCBS, 2001). In this context, these events encompass failures associated with transactions, monitoring and reporting of processes, documentation, customer management, as well as losses from merchants, vendors, and suppliers (Ferreira & Dickason-Koekemoer, 2019). The BCBS (2001) divides this type of loss into six subcategories, presented in Table 2**.**

Table 2
Losses Related to Execution, Delivery, and Process Management

Category		***Subcategory***	***Examples of activities***
Execution, Delivery, and Process Management		Capture, execution, and maintenance of transactions	• Communication failure; • Data entry, maintenance, or loading errors; • Missed deadlines or responsibilities; • Incorrect operation of model/system; • Accounting error/entity assignment error; • Poor task performance; • Delivery failure; • Collateral management failure..
		Monitoring and Reporting	• Failure to comply with mandatory reporting; • Inaccurate reporting.
		Customer consumption and documentation	• Missing/incomplete documents.
		Customer account management	• Incorrect client records (incurred loss); • Negligent loss or damage to client assets
		Commercial counterparts	• Poor counterparty performance; • Counterparty disputes.
		Vendors and suppliers	• Outsourcing; • Supplier disputes..

Source: Prepared by the authors.

In this context, it is observed that the losses caused by this type of event are frequent, as they can result from human errors, communication failures, data entry errors, accounting mistakes, and missing documents, which are commonly encountered in an environment where financial institutions need to process millions of transactions daily (Ferreira & Dickason-Koekemoer, 2019).

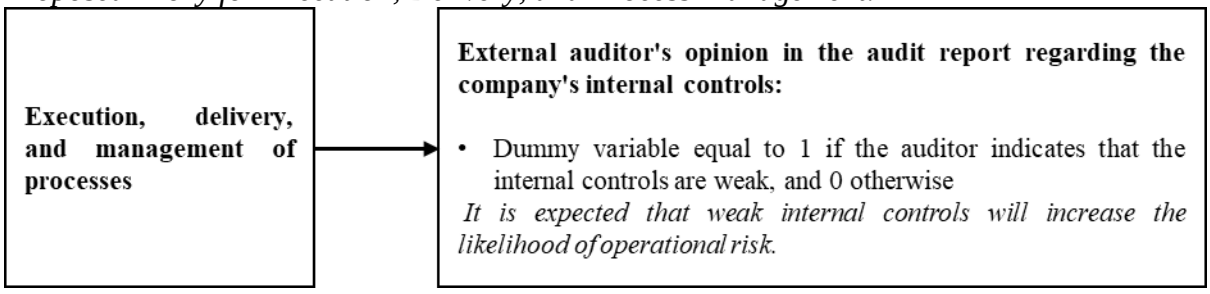
According to Maximiano (2000), operational control encompasses activities and resource consumption in any functional area of an institution. Timetables, flowcharts, and budgets are the primary mechanisms for planning and operational control. In this regard, internal control is responsible for the effectiveness of the process in minimizing the possibility of failures in conducting business. It is defined as a management tool that, through computerized systems and administrative techniques, can provide means for processes to develop as planned—efficiently, effectively, and economically.

4.7.1 Proposed Proxy for Operational Risk in Category 7: Execution, Delivery, and Process Management

The study proposes an operational risk proxy that reflects the external auditors' opinion regarding the internal controls (established by the financial institution) and the Compliance department (audit report). The suggested proxy is a dummy variable, which takes the value of 1 if the auditor indicates that the internal controls are weak, and 0 if the auditor reports that the internal controls are well-structured. Figure 8 illustrates the operational risk proxy for events related to execution, delivery, and process management.

Figure 8

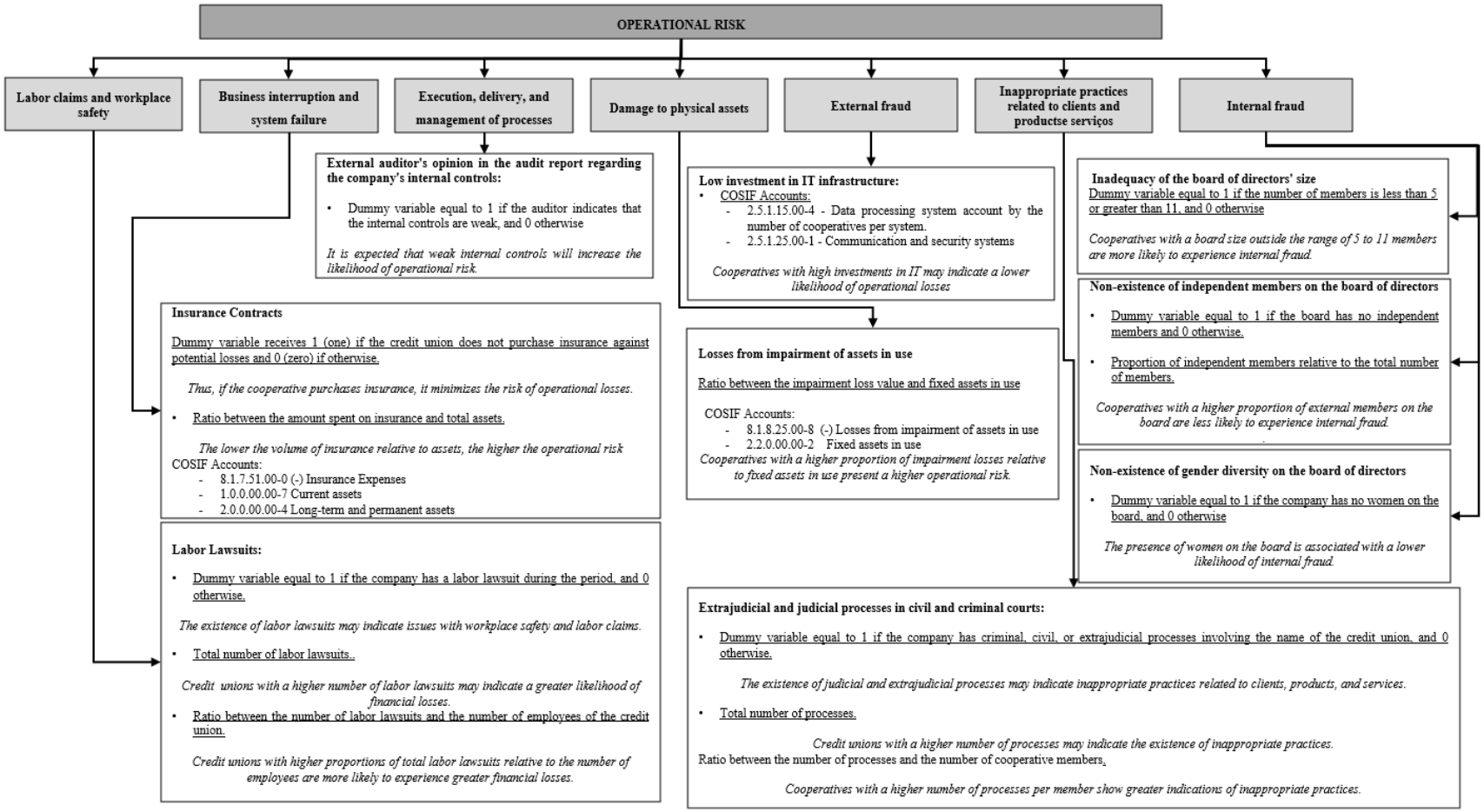
Proposed Proxy for Execution, Delivery, and Process Management.



Source: Prepared by the authors.

Figure 9 shows the synthesis of the proxies proposed in this study based on the seven categories linked to loss events that can occur in financial institutions, as evidenced by the Basel Committee on Banking Supervision (2006).

Figure 9
Proposal for Measuring Operational Risk in a Credit Union



Source: Prepared by the authors.

5 FINAL CONSIDERATIONS

Advancing research on operational risk contributes to a profound cultural transformation within financial institutions. This is due to the fact that these organizations have historically been reluctant to share their data with researchers interested in studying operational risk.

Some studies on the topic measure operational risk using internal data from financial institutions (Amaral et al., 2009; Goulart, 2012; Eckert & Gatzert, 2017; Chernobai et al., 2021). Therefore, the lack of observable proxies to capture operational risk has led to the frequent use of case study methodology in research on the topic. In this context, the present study achieves its goal and aligns with the literature on credit unions, discussing potential proxies that can be used to measure operational risk, thus contributing to the development of the literature on this subject.

Drawing from various studies on operational risk in both national and international literature, this research highlights the proposition of observable proxies for measuring this type of risk. The proposed observable operational risk proxies in this study are related to: i) labor claims and workplace safety, and ii) inadequate practices related to clients, products, and services. Both are evidenced by the existence of labor lawsuits and civil, criminal, and extrajudicial lawsuits involving credit unions. It is important to emphasize that the proposed variables in this research consist of 13 (thirteen) operational risk proxies that total 7 (seven) categories, as grounded by the Basel Committee on Banking Supervision (BCBS). The relevance of this study lies in its contribution to the literature on the subject, as it helps mitigate the lack of attention to the risk inherent to credit unions using observable data.

Furthermore, this research allows stakeholders in credit unions to understand the operational risks of the cooperative without having access to internal company information. Operational risk, the focus of this study, is linked to significant losses and is crucial in decision-making processes under risk conditions, particularly in the current Brazilian context, marked by the political and economic crisis that began in 2014 and the COVID-19 health crisis.

Thus, through a literature review, this study proposes 13 (thirteen) proxies for measuring the operational risk of institutions. The proposed variables can be collected from financial reports and court records. It is suggested that future research utilize these variables for studying operational risk and discuss the validity of this proposition, expanding the discussion on operational risk, especially in Brazilian credit unions.

Additionally, this research can serve as a solid foundation for future investigations aiming to incorporate operational risk into the analysis of financial institutions. The use of these proxies enables the construction of econometric models with panel data, allowing for the collection of multiple observations over time. This approach facilitates the identification of indicators related to operational risk and the analysis of how this risk can impact the key economic and financial indicators of institutions. By integrating these proxies into future studies, researchers will deepen their understanding of the influence of operational risk on the financial performance of organizations, thereby contributing to the formulation of more robust and effective policies for mitigating this risk, promoting more efficient and resilient management.

Therefore, by incorporating non-observable proxies into this research, the contribution to the risk management literature is significantly expanded, providing a more comprehensive evaluation of the factors impacting operational risk in credit unions. Consequently, the research contributes to the formulation of more effective policies aimed at mitigating these risks, enhancing operational and financial management. This approach also opens new possibilities for future investigations, offering opportunities to apply these proxies in ways that strengthen

the resilience and sustainability of financial institutions in an increasingly complex risk landscape.

REFERENCES

Abdelhamid, D., Khaoula, S., & Atika, O. (2014). Automatic Bank Fraud Detection Using Support Vector Machines. *Proceedings of the International Conference on Computing Technology and Information Management*.

Altaf, K., Ayub, H., Shabbir, M. S., & Usman, M. (2021). Do operational risk and corporate governance affect the banking industry of Pakistan? *Review of Economics and Political Science*, ahead-of-print(ahead-of-print). https://doi.org/10.1108/REPS-12-2019-0156

Amaral, I. D. C., Neves, M. D. C. R., Freitas, A. F. de, & Braga, M. J. (2009). Gerenciamento dos riscos operacionais: os métodos utilizados por uma cooperativa de crédito. *Revista de Contabilidade e Organizações, 3*(7). https://doi.org/10.11606/rco.v3i7.34752

An, Z., Cao, Z., Chen, Z., & Li, D. (2020). Does individualistic culture impact operational risk? *European Financial Management, 26*(3), 808-838. https://doi.org/10.1111/eufm.12246

Association of Certified Fraud Examiners [ACFE]. (2007). *Fraud Examiners Manual*. Association of Certified Fraud Examiners.

Autore, D. M., Hutton, I., Peterson, D. R., & Smith, A. H. (2014). The effect of securities litigation on external financing. *Journal of Corporate Finance*, *27*, 231-250. https://doi.org/10.1016/j.jcorpfin.2014.05.007

Azevedo, M. de A., & Gartner, I. R. (2020). Concentração e Competição no Mercado de Crédito Doméstico. *Revista de Administração Contemporânea*, *24*(5), 380-399. https://doi.org/10.1590/1982-7849rac2020190347

Balan, L., & Popescu, M. (2011). Credit card fraud. The USV Annals of Economics and Public Administration, 11(1), 81–85.

Banco Central do Brasil [BACEN]. (2024). Banco Central do Brasil. https://bcb.gov.br

Banco Central do Brasil [BACEN]. (2017). Carta Circular n° 3.854 de 19/12/2017. Detalha rubricas contábeis a serem utilizadas na apuração da parcela dos ativos ponderados pelo risco na forma simplificada (RWAS5) referente ao cálculo do requerimento de capital para cobertura do risco operacional.

Banco Central do Brasil [BACEN]. (2019). CARTA CIRCULAR No 3.941, DE 22 DE MARÇO DE 2019 . Cria e exclui rubricas contábeis no Plano Contábil das Instituições do Sistema Financeiro Nacional (Cosif) para registro de ativo imobilizado.

Banco Central do Brasil [BACEN]. (2021). Resolução CMN nº 4.893, DE 26 DE FEVEREIRO DE 2021. Dispõe sobre a política de segurança cibernética e sobre os requisitos para a contratação de serviços de processamento e armazenamento de dados e de computação em nuvem a serem observados pelas instituições autorizadas a funcionar pelo Banco Central do Brasil.

Banco Central do Brasil [BACEN]. (2020). *Circular n° 3.979 de 30/1/2020. Dispõe sobre a constituição e a atualização da base de dados de risco operacional e a remessa ao Banco Central do Brasil de informações relativas a eventos de risco operacional.* https://www.bcb.gov.br/pre/normativos/busca/downloadNormativo.asp?arquivo=%2FLists%2FNormativos%2FAttachments%2F50913%2FCirc_3979_v1_O.pdf

Barker, K. J., D'Amato, J., & Sheridon, P. (2008). Credit card fraud: awareness and prevention. *Journal of Financial Crime, 15*(4), 398-410. https://doi.org/10.1108/13590790810907236/FULL/XML

Basel Committee on Banking Supervision [BCBS]. (2001). *QIS 2 - Operational Risk Loss Data*. https://www.bis.org/bcbs/qisoprisknote.pdf

Basel Committee on Banking Supervision [BCBS]. (2011). *Principles for the Sound Management of Operational Risk*. https://www.bis.org/publ/bcbs195.htm

Basel Committee on Banking Supervision [BCBS]. (2006). *Basel II: International convergence of capital measurement and capital standards - revised framework.*

Beasley, M. S. (1996). An Empirical Analysis of the Relation between the Board of Director Composition and Financial Statement Fraud. *The Accounting Review, 71*(4), 443-465. https://www.jstor.org/stable/248566

Carswell, A. T., & Bachtel, D. C. (2009). Mortgage fraud: A risk factor analysis of affected communities. *Crime, Law and Social Change, 52*(4), 347-364. https://doi.org/10.1007/S10611-008-9186-5

Chernobai, A., Jorion, P., & Yu, F. (2009). The Determinants of Operational Risk in U.S. Financial Institutions. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.1360266

Chernobai, A., Ozdagli, A., & Wang, J. (2021). Business complexity and risk management: Evidence from operational risk events in U.S. bank holding companies. *Journal of Monetary Economics, 117*, 418-440. https://doi.org/10.1016/j.jmoneco.2020.02.004

CPC. (2010). *Pronunciamento técnico CPC 01 (R1) redução ao valor recuperável de ativos*.

Crouhy, M. G., Galai, D., & Mark, R. (2004). Insuring versus Self-Insuring Operational Risk. *The Journal of Derivatives, 12*(2), 51-55. https://doi.org/10.3905/jod.2004.450968

Dahya, J., & McConnell, J. J. (2005). Outside directors and corporate board decisions. *Journal of Corporate Finance, 11*(1-2), 37-60. https://doi.org/10.1016/j.jcorpfin.2003.10.001

Delamaire, L., Abdou, H., & Pointon, J. (2009). Credit card fraud and detection techniques: a review. *Banks and Bank Systems, 4*(2), 1-13.

Eckert, C., & Gatzert, N. (2017). Modeling operational risk incorporating reputation risk: An integrated analysis for financial firms. *Insurance: Mathematics and Economics, 72*, 122-137. https://doi.org/10.1016/j.insmatheco.2016.11.005

Endrikat, J., de Villiers, C., Guenther, T. W., & Guenther, E. M. (2020). Board Characteristics and Corporate Social Responsibility: A Meta-Analytic Investigation. *Business & Society*, *60*(8), 2099-2135. https://doi.org/10.1177/0007650320930638

Ettredge, M. L., Xu, Y., & Yi, H. S. (2014). Fair Value Measurements and Audit Fees: Evidence from the Banking Industry. *Auditing: A Journal of Practice & Theory*, *33*(3), 33-58. https://doi.org/10.2308/ajpt-50701

Fama, E. F., & Jensen, M. C. (1983). Separation of Ownership and Control. *SSRN Electronic Journal*. https://doi.org/10.2139/SSRN.94034

Ferreira, S., & Dickason-Koekemoer, Z. (2019). A conceptual model of operational risk events in the banking sector. *Cogent Economics & Finance*, *7*(1), 1706394. https://doi.org/10.1080/23322039.2019.1706394

Freitas, A. F. de, Amaral, I. D. C., & Braga, M. J. (2008). A influência dos riscos de liquidez e de crédito no processo de conversão das cooperativas de crédito rural em cooperativas de crédito de livre admissão: um estudo de caso. *Revista de Contabilidade e Organizações*, *2*(4). https://doi.org/10.11606/rco.v2i4.34725

Goulart, C. P. (2012). Modelos avançados para risco operacional: uma análise empírica da abordagem de distribuição de perdas [Tese de doutorado em Administração. Faculdade de Ciências Econômicas. Universidade Federal de Minas Gerais].

Greatti, L., & Meurer Sela, V. (2021). Atuação das cooperativas de crédito no processo de inclusão financeira no Brasil. *Enfoque: Reflexão Contábil*, *40*(3), 21-37. https://doi.org/10.4025/enfoque.v40i3.52027

Haslem, B., Hutton, I., & Smith, A. H. (2017). How Much Do Corporate Defendants Really Lose? A New Verdict on the Reputation Loss Induced by Corporate Litigation. *Financial Management*, *46*(2), 323-358. https://doi.org/10.1111/fima.12171

Instituto Brasileiro de Governança Corporativa (IBGC). (2009). *Código das melhores práticas de governança corporativa* (4th ed.).

Isa, Y. M., Sanusi, Z. M., Haniff, M. N., & Barnes, P. A. (2015). Money Laundering Risk: From the Bankers' and Regulators Perspectives. *Procedia Economics and Finance*, *28*, 7-13. https://doi.org/10.1016/S2212-5671(15)01075-8

Jacques, E. R., & Gonçalves, F. de O. (2016). Cooperativas de crédito no Brasil: evolução e impacto sobre a renda dos municípios brasileiros. *Economia e Sociedade*, *25*(2), 489-509. https://doi.org/10.1590/1982-3533.2016v25n2art8

JUSBRASIL. (2024). Consulta Processual. https://www.jusbrasil.com.br/consulta-processual

Karpoff, J. M., & Lott, J. R. (1993). The Reputational Penalty Firms Bear from Committing Criminal Fraud. *The Journal of Law and Economics*, *36*(2), 757-802. https://doi.org/10.1086/467297

Karpoff, J. M., Lee, D. S., & Martin, G. S. (2008). The Cost to Firms of Cooking the Books. *Journal of Financial and Quantitative Analysis*, *43*(3), 581-611. https://doi.org/10.1017/S0022109000004221

Kenney, B. (2007). From ID To IP Theft. *Industry Week*, *256*(7).

Ko, C., Lee, P., & Anandarajan, A. (2019). The impact of operational risk incidents and moderating influence of corporate governance on credit risk and firm performance. *International Journal of Accounting and Information Management*, *27*(1), 96-110. https://doi.org/10.1108/IJAIM-05-2017-0070/FULL/XML

KPMG. (2009). *A Fraude no Brasil Relatório de Pesquisa 2009*. http://www.faculdadedelta.edu.br/downloads_alunos/1346933209_perfil_do_fraud186ador_III.pdf

Liao, L., Luo, L., & Tang, Q. (2014). Gender diversity, board independence, environmental committee and greenhouse gas disclosure. *The British Accounting Review*, *47*(4), 409-424. https://doi.org/10.1016/j.bar.2014.01.002

Lipton, M., & Lorsch, J. W. (1992). A Modest Proposal for Improved Corporate Governance. *The Business Lawyer*, *48*(1), 59-77. https://www.jstor.org/stable/40687360

Maximiano, A. C. (2000). *Introdução à Administração.* Atlas.

McLaughlin, J. S., & Pavelka, D. (2013). The use of customer due diligence to combat money laundering. *Accountancy Business and Public Interest*, *1*, 57-84.

Mendonça, H. F. de, Galvão, D. J. C., & Loures, R. F. V. (2008). Risco Operacional nas Instituições Financeiras: Contratar Seguro ou Auto-segurar-se? *Revista EconomiA*, *9*(2), 309-326. http://www.anpec.org.br/revista/vol9/vol9n2p309_326.pdf

Morton, A., & Fasolo, B. (2009). Behavioural decision theory for multi-criteria decision analysis: a guided tour. *Journal of the Operational Research Society*, *60*(2), 268-275. https://doi.org/10.1057/palgrave.jors.2602550

Rachman, L. (2013). Modelagem de perdas com ações trabalhistas em instituições financeiras. [Dissertação (MPFE) - Escola de Economia de São Paulo, Escola de Economia de São Paulo da Fundação Getúlio Vargas].

Rahman, R. A., & Anwar, I. S. K. (2014). Types of Fraud among Islamic Banks in Malaysia. *International Journal of Trade, Economics and Finance*, *5*(2), 176-179. https://doi.org/10.7763/IJTEF.2014.V5.365

Rubin, G. M., Overstreet, G. A., Beling, P., & Rajaratnam, K. (2013). A dynamic theory of the credit union. *Annals of Operations Research*, *205*(1), 29-53. https://doi.org/10.1007/s10479-012-1246-7

Sanusi, Z. M., Rameli, M. N. F., & Isa, Y. M. (2015). Fraud Schemes in the Banking Institutions: Prevention Measures to Avoid Severe Financial Loss. *Procedia Economics and Finance*, *28*, 107-113. https://doi.org/10.1016/S2212-5671(15)01088-6

Shabbir, M. S., Bashir, M., Abbasi, H. M., Yahya, G., & Abbasi, B. A. (2021). Effect of 195 domestic and foreign private investment on economic growth of Pakistan. *Transnational Corporations Review*, *13*(4), 437–449. https://doi.org/10.1080/19186444.2020.1858676

Sharif, M., & Rashid, K. (2014). Corporate governance and corporate social responsibility (CSR) reporting: an empirical evidence from commercial banks (CB) of Pakistan. *Quality & Quantity*, *48*(5), 2501-2521. https://doi.org/10.1007/s11135-013-9903-8

Soprano, A., Crielaard, B., Piacenza, F., & Ruspantini, D. (2009). Measuring Operational and Reputational Risk: A Practitioner's Approach. *Wiley Finance*.

Trung, M., Hsiao, C. L., Shen, D. B., & Chen, B. S. (2018). Impact of operational risk toward the efficiency of banking-evidence from Taiwan's banking industry. *Asian Economic and Financial Review*, *8*(6), 815-831. Doi: 10.18488/journal.aefr.2018.86.815.831

Wang, T., & Hsu, C. (2013). Board composition and operational risk events of financial institutions. *Journal of Banking & Finance*, *37*(6), 2042-2051. https://doi.org/10.1016/j.jbankfin.2013.01.027

World Bank, & International Monetary Fund. (2005). Financial Sector Assessment. The World Bank. https://doi.org/10.1596/978-0-8213-6432-1

Zuo, J., Zhang, W., Hu, M., Feng, X., & Zou, G. (2022). Employee relations and stock price crash risk: Evidence from employee lawsuits. *International Review of Financial Analysis*, *82*, 102188. https://doi.org/10.1016/j.irfa.2022.102188

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding this submitted work.

AUTHORS' CONTRIBUTIONS

Roles	1ª author	2º author	3º author	4º author	5º author
Conceptualization	♦				♦
Data Curation	♦		♦		
Formal Analysis	♦	♦			
Funding Acquisition		♦			
Investigation	♦	♦			♦
Methodology	♦	♦	♦		
Project Administration		♦			
Resources		♦			
Software	♦				
Supervision		♦	♦		

Validation		♦	♦	♦	
Visualization		♦	♦	♦	
Writing – Original Draft	♦	♦			
Writing – Review and Editing	♦	♦	♦	♦	♦