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Thematic Analysis of Bank Operational Risk: A Systematic Literature Review

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ABSTRACT: Bank operational risk is a key challenge in the global banking industry, which continues to evolve with business complexity and regulatory changes. This risk includes internal process failures, human errors, technological system failures, or external events that can lead to significant financial losses. This study aims to thematically analyze these bank operational risks using a Systematic Literature Review (SLR) approach that follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The results show that ignoring standard operating procedures (SOPs) is the most significant cause of operational risk from internal process failures, followed by errors in account opening and transaction processes, and inadequate quality control. Mistakes in executing transactions and procedures are the most common operational risk events caused by human error, followed by fraud and unauthorized trading. Operational risk due to technological system failures is largely due to operational errors related to the ability to use technology, followed by cyber attacks and unauthorized use of technology. Operational risk in banking due to external events predominantly occurs when there are unexpected changes in legislation, which is the case in almost all existing studies that have a significant impact on operational risk management in the banking sector.

KEYWORDS: Bank Operational Risk, Thematic Analysis, Systematic Literature Review (SLR), PRISMA.

BACKGROUND

Bank operational risk is a key challenge in the global banking industry, which continues to evolve with business complexity and regulatory changes. This risk includes internal process failures, human error, technological systems, or external events that can lead to significant financial losses (Chernobai et al., 2021; Elamer et al., 2020). Over the past few decades, research on operational risk has evolved significantly. Early studies, such as Han et al. (2015), used Extreme Value Theory (EVT) to analyze operational risk in Chinese banks, particularly related to internal fraud. Later, McNulty et al. (2017) explored the relationship between bank legal expenses and operational risk in the United States, demonstrating the importance of internal controls in risk mitigation. Recent developments indicate that operational risk is increasingly influenced by external factors such as financial deregulation (Si et al., 2021) and technological innovation (Hu et al., 2024). Furthermore, research by Galletta et al. (2023) highlighted the role of bank reputation and Environmental, Social, and Governance (ESG) factors in operational risk management. Furthermore, new approaches such as dynamic systems (Jiravichai & Banomyong, 2022) and organizational information processing theory (Yin et al., 2024) are beginning to be used to understand the complexity of operational risk in the digital age. A study by Sobanova and Kudinska (2024) also emphasized the importance of operational risk management in the face of global instability, such as the COVID-19 pandemic and geopolitical conflicts. Adequate disclosure and mitigation of operational risk can maintain a bank's financial performance.(Neifar, 2025; Elbadry, 2025; Gadzo et al., 2019; Gya et al., 2021; Nguyen & Dang, 2023) Overall, research on operational risk continues to evolve, reflecting the need for a more holistic and adaptive approach to addressing dynamic global challenges.

In recent years, the topic of operational risk management has undergone significant changes and developments, particularly in the context of the influence of new technologies and environmental factors. Previously, research on operational risk tended to focus on internal factors such as corporate governance and oversight mechanisms (Neifar & Jarboui, 2018; Elamer et al., 2020). However, with increasing digitalization, technology has now become a key factor influencing operational risk in the banking and financial sector (Hu et al., 2024). Research by Hu et al. (2024) shows that technological innovation increases operational risk due to technical complexity that leads to malfunctions, particularly in banks without a history of technical failures. Furthermore, a study by Uddin et al. (2023) found that digital transformation increases operational risk exposure, particularly within the Basel capital provision framework, although the effect varies by technology regime. Another interesting development is the emergence

of Environmental, Social, and Governance (ESG) as a factor influencing operational risk. Galletta et al. (2023) found that higher ESG scores reduced banks' operational risks, suggesting that ESG practices can serve as a risk mitigation tool. Bruno et al. (2025) also revealed that cybersecurity policies and ESG have a synergistic relationship in improving bank performance, supporting the Risk-Return Trade-Off principle. This new approach differs from the older concept that focused more on internal governance and oversight structures, signaling a shift towards integrating environmental and social factors into risk management. Modern trends also show the increasing use of technologies such as blockchain to mitigate operational and supply risks, particularly in the context of the COVID-19 pandemic. Bai et al. (2024) found that blockchain-related companies experienced smaller market losses than non-blockchain companies, suggesting that blockchain technology can serve as a risk buffer during crises. This underscores the importance of technology as a risk mitigation tool in an increasingly complex business environment. Furthermore, Cornwell et al. (2023) introduced a Bayesian network-based approach to quantitatively and real-timely analyze the drivers of operational risk, replacing traditional, more manual and less precise methods. These changes have impacted risk management practices by encouraging a more proactive and data-driven approach. For example, Xu et al.'s (2019) study proposed a multiple correlation model for measuring operational risk, which significantly reduces diversification risk compared to traditional comonotonic models.This new approach is relevant to current trends emphasizing the importance of big data analytics and artificial intelligence in risk management. Therefore, research and discussion on this topic are increasingly relevant, especially in the context of evolving business dynamics and increasingly complex risk challenges.

Literature review has become an important method for exploring and synthesizing current knowledge in specific fields, including operational risk management in banking. Jiravichai and Banomyong (2022) proposed a systematic three-step methodology for identifying and developing keywords in a literature review, specifically in the context of operational risk management in banking. Through this approach, they uncovered significant gaps in the literature, such as controversies regarding measurement models and the reliability of loss data, and found that only a system dynamics approach has been applied in this field, albeit with significant methodological limitations. The review method used in this study helped identify underexplored research trends, such as the need for interdisciplinary approaches and further testing of system dynamics models in operational risk management. However, this study also has limitations, such as the exclusion of non-English and non-peer-reviewed sources, and limited validation to a small number of studies. Recommendations include interdisciplinary collaboration, conceptual model testing, and expanding the scope of databases for future research (Jiravichai & Banomyong, 2022). The results of this study indicate that a systematic literature review method can not only reveal consistencies and inconsistencies in previous research findings, but can also provide valuable directions for further research in a complex field such as banking operational risk management.

The evolution of research on operational risk in banking has been systematically mapped through various literature review approaches, but significant gaps remain in synthesizing contemporary developments. An initial systematic literature review (SLR) by Jiravichai and Banomyong (2022) identified critical gaps in the operational risk management (ORM) literature, particularly controversies surrounding measurement models and the reliability of loss data, while proposing system dynamics as an interdisciplinary approach to address these issues. However, their study was limited by its reliance on peer-reviewed English-language sources and its narrow focus on methodological gaps, leaving broader thematic and contextual synthesis unexplored. Nevertheless, the majority (84%) of the research methods used were quantitative due to the magnitude of the risks to be measured, which will impact company performance. This study attempts to examine operational risk in banks qualitatively through a thematic approach: internal business process failures, human errors, technology system failures, and external events.

AnThematic analysis will be used to examine each theme and case studies from various global banks. This analysis is designed to offer a distinct and innovative approach to operational risk management in banking, using the Systematic Literature Review method as the primary tool.

This systematic literature review aims to explore and analyze in depth various aspects of operational risk in the banking sector thematically, including:internal process failures, human errors, system and technology failures and external events that influence the emergence of operational risks(Chernobai et al., 2021; Elamer et al., 2020). The sub-themes of internal process failure include, among others:sending wrong documents, errors in the account opening process and customer transactions, inadequate quality control, and ignoring SOPs. Human error includesThese include: fraud, errors in transactions and procedures, unauthorized trading, understaffing, hiring and layoffs, workplace accidents, strikes, discrimination, inadequate training and management, and unclear separation of powers. System and technology failures include:cyber attacks, operational errors related to the ability to use technology, use of technology by unauthorized persons, failure of completeness and unavailability of hardware, security against hacking and firewall failure.Meanwhile, external events include, among others:unexpected changes in laws, robberies, terrorist attacks, natural disasters and climate change.

Thus, this SLR not only summarizes previous findings but also proposes an innovative perspective that can enrich the understanding of operational risk. It also fills a contextual gap by providing cross-cultural and regional analysis, enabling the

identification of both universal and specific operational risk patterns. This SLR is expected to provide relevant policy recommendations for regulators, risk managers, and banking industry practitioners. Overall, this SLR is expected to serve as a foundation for the development of more innovative and relevant operational risk management literature and practices in the future.

To address the research gaps and research questions, a Systematic Literature Review (SLR) method was used using the Scopus database, chosen for its broad coverage and international reputation. Selection criteria included peer-reviewed articles, publications within the last 10 years, and a focus on operational risk in banking. The SLR process involved systematically identifying, screening, and synthesizing literature to produce relevant and comprehensive findings.

Bank operational risk has become a major challenge in the global banking industry, particularly in the context of increasing business complexity and dynamic regulatory changes. This risk encompasses internal process failures, human error, technological system failures, and external events that can lead to significant financial losses and impact the stability of the financial system as a whole (Chernobai et al., 2021; Elamer et al., 2020). Among these four major themes and sub-themes, which are the most dominant causes of operational risk, and how operational risk in specific sectors affects global banks.

LITERATURE REVIEW

Definition and Historical Development

Operational risk, broadly defined as the risk of loss resulting from internal process failures, human error, inadequate or failed systems and technology, or external events, has grown significantly as a focus area in finance and organizational studies. Initially, operational risk was viewed as a residual category encompassing risks not classified as market or credit risk (Han et al., 2015). However, its conceptualization has expanded to include more specific dimensions such as internal fraud, technology failures, and external disruptions, particularly in the context of financial institutions (Siet al., 2021; Galletta et al., 2023). Historically, the Basel Accords played a significant role in shaping the operational risk discourse by introducing a standardized measurement framework and capital requirements, emphasizing the need for robust risk management practices (Xu et al., 2019). The rise of digitalization and financial deregulation has further complicated the operational risk landscape, highlighting the interplay between technological innovation and risk exposure (Hu et al., 2024; Yin et al., 2024). Recent studies have also explored the role of governance structures, such as the Shariah Supervisory Board in Islamic banking, in mitigating operational risk, underscoring the importance of cultural and institutional context (Elamer et al., 2020). Furthermore, interdisciplinary approaches, including Bayesian networks and system dynamics, have emerged as tools for causal analysis and risk modeling, offering deeper insights into the probabilistic nature of operational risk events (Cornwell et al., 2023; Jiravichai & Banomyong, 2022). As operational risk continues to evolve, its intersection with emerging themes such as cybersecurity, ESG (Environmental, Social, and Governance), and supply chain finance underscores its relevance across industries and geographies (Bruno et al., 2025; Xie et al., 2025). This conceptual evolution reflects a shift from reactive risk management to proactive, data-driven strategies, shaping both academic inquiry and practical risk governance.

History of Research Topics

The research topic of operational risk in banking has undergone significant development over time, with various milestones determining the direction and focus of research. Initially, research in this area focused largely on the measurement and quantification of operational risk, such as that conducted by Han et al. (2015), who used the Peaks Over Threshold (POT) model to measure operational risk in Chinese commercial banks. Along with changes in regulations and the business environment, research has evolved to include factors influencing operational risk, such as financial deregulation, studied by Si et al. (2021) in the context of bank lending rate liberalization in China. Furthermore, the emergence of new technologies and digitalization have also become the focus of recent research, such as that investigated by Yin et al. (2024), who explored the impact of digitalization on operational risk from an organizational information processing perspective. Another important milestone is the integration of Environmental, Social, and Governance (ESG) factors into operational risk management, as studied by Galletta et al. (2023), who found that higher ESG scores can reduce bank operational risk. Research is also increasingly focusing on regional and sectoral contexts, such as the study by Elamer et al. (2020) that examined the influence of Sharia Supervisory Boards on operational risk disclosure in Islamic banks in the MENA region. Thus, operational risk research continues to evolve, reflecting the dynamics of the changing business and regulatory environment, as well as the need for a more holistic and integrated approach to risk management.

Classical Approach and Theory

The classical concept of operational risk management focuses on identifying, measuring, and mitigating risks arising from failures in internal processes, human resources, information technology systems, and external factors (Chernobai et al., 2021;

McNulty et al., 2017). This approach is primarily used in the banking sector, where operational risks are often related to internal fraud, technology failures, and compliance incidents (Han et al., 2015; Si et al., 2021). One of the main strengths of this classical concept is the ability to quantitatively measure risk using models such as Peaks Over Threshold (POT) and Loss Distribution Approach (LDA), which help banks estimate potential losses and establish adequate capital reserves (Xu et al., 2019). Furthermore, the classical approach also emphasizes the importance of effective internal controls and governance to mitigate operational risk events (Neifar & Jarboui, 2018). However, this classical approach also has several challenges. First, the limited availability of comprehensive data is often a barrier, as many operational risk events are not publicly reported or are considered minor losses (Han et al., 2015). Second, classical risk measurement models often assume independence between different types of risks, which may not reflect the reality where risks can be interrelated (Xu et al., 2019). Third, this approach pays little attention to contextual factors such as organizational culture and external environmental dynamics, which can influence the implementation of operational risk management (Kirikkaleli et al., 2020). These shortcomings highlight the need to integrate classical approaches with more holistic, data-driven methods to improve the effectiveness of operational risk management in the future (Cornwell et al., 2023).

Emerging Trends and New Approaches

In recent years, research on operational risk management in the banking sector has shown a growing trend, with innovative new approaches emerging. One prominent approach is the use of data- and technology-driven methods to identify causal factors of operational risk. For example, Cornwell et al. (2023) proposed the use of Bayesian networks to objectively and in real-time analyze causal factors of operational risk, enabling more proactive and efficient risk management. This approach provides in-depth insights into how causal factors influence the probability of operational risk events, thus enabling more informed resource allocation. Furthermore, research is increasingly focusing on the integration of environmental, social, and governance (ESG) factors into operational risk management. Galletta et al. (2023) found that higher ESG scores correlated with lower operational risk in global banks, suggesting that sound ESG practices can be an effective tool for mitigating operational risk. These findings align with research by Bruno et al. (2025) which explored the relationship between cybersecurity policies, ESG, and operational risk, and their impact on bank performance in North America. Digitalization has also become a major focus of recent research, with studies suggesting that digital transformation can pose new challenges in operational risk management. Xu et al. (2019) found that technological innovation increases operational risk in Chinese commercial banks, primarily due to technological complexity that leads to technical malfunctions. However, Yin et al. (2024) showed that digitalization can mitigate operational risk by improving the quality of internal control systems and the centrality of supply chain networks. These findings underscore the importance of a holistic approach to managing operational risks arising from digitalization. Research also increasingly recognizes the importance of corporate governance and oversight structures in mitigating operational risk. Neifar and Jarboui (2018) found that Sharia supervisory boards and corporate governance structures significantly influence operational risk disclosure in Islamic banks in the MENA region. Furthermore, research by Luburic (2017) emphasized the importance of strengthening the "three lines of defense" model in operational risk management in central banks, focusing on integrating quality management principles to improve efficiency. Furthermore, multi-period approaches and supply chain-based risk analysis are also gaining attention. Mizgier and Wimmer (2017) developed an operational risk model that includes single and double losses in a multi-period perspective, showing that operational risk is often underestimated if events that cause double losses are not taken into account.Meanwhile, Xie et al. (2025) introduced an operational risk assessment tool for supply chain finance (SCF) in Chinese commercial banks, emphasizing the importance of understanding fraud and compliance risks as key sources of operational risk in SCF. Overall, recent research trends indicate an increasing use of data-driven methods, the integration of ESG factors, a focus on digitalization, and an emphasis on corporate governance and a multi-period approach to operational risk management. These approaches not only provide new insights but also offer more effective tools for managing operational risk in the banking sector. This underscores the importance of further research to continuously develop innovative methods and expand the scope of analysis in different contexts.

Emerging Trends in Interdisciplinary Connections

The research landscape related to operational risk management in the banking sector is currently evolving, with new trends, innovative methods, and interdisciplinary approaches enriching understanding and practice in this field. One prominent trend is the integration of digital technology into operational risk management. Research by Yin et al. (2024) shows that digitalization can reduce operational risk by improving the quality of internal control systems and the centrality of supply chain networks. However, digitalization also presents new challenges, such as complex technological risks and vulnerability to cybersecurity breaches, which need to be addressed through stronger policies (Hu et al., 2024). Furthermore, data-driven approaches are gaining popularity in operational risk research. Cornwell et al. (2023) used data-driven causal factor analysis to improve the effectiveness of operational risk management. This approach enables financial institutions to more accurately model the probability of operational risk events

and allocate resources efficiently. Furthermore, research by Xie et al. (2025) developed an operational risk assessment tool for commercial supply chain finance using Monte Carlo simulation and loss distribution analysis, demonstrating significant potential for more comprehensive risk management. The relationship between environmental, social, and governance (ESG) factors and operational risk is also gaining increasing attention. Galletta et al. (2023) found that higher ESG scores can reduce banks' operational risk globally, emphasizing the importance of integrating ESG principles into risk management strategies. This approach is increasingly relevant in the context of increasingly stringent regulations and stakeholder demands for sustainable business practices. New challenges are also emerging in the context of global uncertainty, such as the COVID-19 pandemic and the war in Ukraine, which are forcing banks to re-evaluate their operational risk management strategies. Sobanova and Kudinska (2024) identified the need for stronger business continuity planning and more effective remote work policies to mitigate operational risk during periods of instability. This highlights the importance of quickly adapting to changing business environments. Overall, recent research emphasizes the importance of technology integration, data-driven approaches, ESG principles, and adapting to global uncertainty in shaping the operational risk management landscape in the banking sector. An interdisciplinary approach and cross-sector collaboration are also key to developing more holistic and sustainable solutions to address increasingly complex operational risk challenges.

Emerging Trends: A Comparative Analysis

A comparative analysis of classical and emerging approaches to operational risk management reveals significant shifts in methods and effectiveness. Classical approaches, which often rely on traditional statistical analyses such as Monte Carlo simulations and Peaks Over Threshold (POT) models, have provided a strong foundation for measuring operational risk. For example, Han et al.'s (2015) study used the POT model to measure operational risk in Chinese commercial banks, demonstrating success in identifying internal fraud trends. However, this approach has limitations, such as potential underreporting and reliance on publicly available data (Han et al., 2015). On the other hand, emerging approaches are beginning to leverage digital technologies and more dynamic methodologies. For example, Yin et al.'s (2024) study explored the impact of digitalization on operational risk using bootstrapping and text analysis, finding that digitalization reduced operational risk by improving the quality of internal control systems (Yin et al., 2024). This approach is not only more adaptable to technological changes but also allows for a more in-depth analysis of the factors influencing operational risk. Furthermore, Cornwell et al.'s study also found that digitalization reduces operational risk through improved internal control systems. (2023) introduced a Bayesian network model for real-time analysis of operational risk drivers, offering a more precise and proactive tool in risk management (Cornwell et al., 2023). The effectiveness of this emerging approach is evident in its ability to more comprehensively integrate operational and incident data and provide deeper insights into the drivers of operational risk. However, this approach also faces challenges, such as limited data availability and the need for further validation in different contexts (Cornwell et al., 2023). Overall, the shift from classical to emerging approaches reflects the need for more flexible and adaptive methods to address the complexity of operational risk in the digital age.

Emerging Trends: The Influence of Related Fields

Research on operational risk management in the banking sector shows that various factors, such as corporate governance, technological innovation, and financial deregulation, have a significant influence on operational risk management. For example, a study by Han et al. (2015) found that internal fraud was the primary cause of operational risk in Chinese commercial banks, with overconfidence and loss aversion as the driving factors. This finding indicates the importance of understanding the specific characteristics of operational risk in local contexts. Furthermore, Si et al. (2021) examined the impact of financial deregulation on the operational risk of energy companies in China, showing that deregulation can reduce operational risk by facilitating financing and reducing corporate financialization. This study confirms that macroeconomic policies can substantially influence operational risk management. The influence of technological innovation has also been a key focus in several studies. For example, Hu et al. (2024) found that technological innovation increases operational risk in Chinese commercial banks due to technological complexity that leads to technical failures. This study suggests that while technology can improve efficiency, it can also introduce new risks that need to be carefully managed. On the other hand, Bai et al. (2024) examined the role of blockchain technology in mitigating operational and supply risks during the COVID-19 pandemic. They found that blockchain-enabled companies experienced smaller stock price declines than other companies, suggesting that blockchain can serve as an effective risk mitigation tool. This finding underscores the potential of new technologies in managing operational risk, especially in crisis contexts. Furthermore, corporate governance was also identified as a critical factor in operational risk management. Neifar and Jarboui (2018) examined the relationship between corporate governance and voluntary operational risk disclosure in Islamic banks in the Middle East. They found that the Sharia supervisory board and board independence significantly influenced operational risk disclosure. This study underscores the importance of a strong governance structure in enhancing the transparency of operational risk management.

Furthermore, Bruno et al. (2025) examined the relationship between cybersecurity policies, ESG, and operational risk in North American banks. They found that strong cybersecurity policies and high ESG scores positively impacted banks' financial performance, suggesting that a holistic approach to risk management can lead to better performance. Overall, these studies show that operational risk management is influenced by various factors, including macroeconomic policies, technological innovation,and corporate governance. These findings provide important insights for practitioners and policymakers to develop more effective and holistic risk management strategies.

METHODOLOGY

Study Design and Review

Systematic Literature Review (SLR) Method Following PRISMA Guidelines.

This study used a Systematic Literature Review (SLR) approach that follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. PRISMA was chosen because this standard has been widely recognized for improving the quality of reporting and systematic review methodology and is used across various disciplines.(Page et al., 2021; Winarno et al., 2023). Applications usedWatase Uake: Research Collaboration Tools, retrieved fromhttps://www.watase.web.id Wahyudi (2024).This method is designed to produce a comprehensive and transparent review with a primary focus on the identification to inclusion stages of articles.

1. Identification Stage: Article Search Process a. Database Selection. The Scopus database was chosen as the primary source for article searches due to its superiority in providing high-quality scientific articles through a rigorous indexing process. Scopus also offers extensive coverage and high relevance in the scientific literature, thus minimizing the risk of including articles from predatory journals or less valid sources. When comparing Scopus with alternatives such as Google Scholar, the weaknesses of Google Scholar were a primary consideration, including repetitive search results, duplication of articles from various sources, and inclusion of articles from predatory journals (Hariningsih et al., 2024). Therefore, Scopus was considered more adequate to ensure the validity and relevance of the resulting articles. b. Keywords and Search Strategy. The article search process begins by determining specific keywords relevant to the research topic, such as "bank operational risk." These keywords are used in a search of the Scopus database to identify articles related to operational risk in the banking industry. The search was conducted using Boolean syntax (AND/OR) to ensure broad coverage while remaining focused on the research topic. In addition, the search process also involved the Watase database (Wahyudi, 2024) to obtain additional articles that may not be covered by Scopus. This stage ensured that the study encompassed comprehensive literature sources.
2. Screening Stage: Selection and Filtering of Articles
   a. Initial Search and Duplication Removal. The initial search in Scopus yielded 122 articles. Prior to the screening process, articles deemed duplicate or not meeting the initial criteria were removed. In this study, no articles were removed due to duplication, but 32 articles were removed because they were marked as ineligible by the automated tool, and 12 articles were removed for other reasons, such as not meeting the journal's tier criteria.
   b. Screening Based on Abstract and Relevance. The remaining articles (78) were then screened based on the abstract to assess their relevance to the research topic. From this process, 25 articles were excluded because they did not meet the inclusion criteria. Articles that passed the screening (53) were then searched for complete retrieval, but 28 articles could not be obtained. To address this, additional searches were conducted from other sources, resulting in 15 additional articles.
   c. Feasibility Assessment. The successfully retrieved articles (25) were thoroughly assessed for their feasibility, and no articles were excluded at this stage. In addition, 15 articles from other sources were also assessed and deemed to meet the criteria. The complete PRISMA report results are presented in Figure 1.

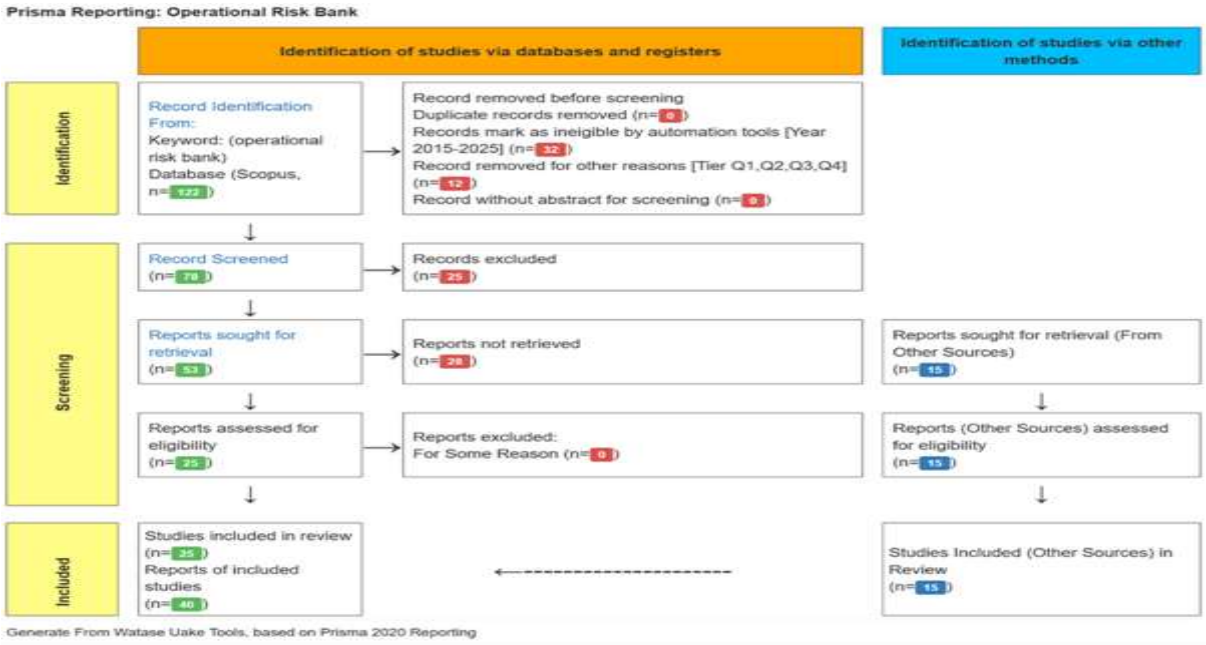

Figure 1. PRISMA Report Results

3. Inclusion Stage: Article Analysis and Review

a. Articles Included in the Review A total of 40 articles (25 from Scopus and 15 from other sources) were included in the systematic review. Of the 40 articles, only 38 were eligible for extraction because 2 articles were found to be duplicates. These articles met the inclusion criteria and were relevant to the research topic. b. Qualitative and Thematic Analysis. After the inclusion stage, a qualitative analysis was conducted using thematic analysis methods. This process involves identifying patterns, themes, and sub-themes within relevant articles, which is also supported by the Watase Uake System (Wahyudi, 2024). Thematic analysis ensures that the findings of this study are presented systematically and comprehensively. Conclusion The SLR method used in this study follows the PRISMA guidelines to ensure transparency, validity, and relevance throughout the process of article identification and inclusion. The use of Scopus as the primary database, along with specific keywords and thematic analysis methods, ensures that this review produces high-quality findings that can be applied in various cross-disciplinary research contexts.

RESULTS AND DISCUSSION

Word Cloud From Article Keywords

Keyword analysis shows that the dominant theme in bank operational risk research is Operational Risk, with 57 occurrences, followed by Branchless Banking (16) and Risk Management (11), as presented in Figure 2.

Figure 2. Cloud of Frequently Appearing Keywords

This theme reflects a focus on identifying, mitigating, and managing operational risk in the banking industry, particularly with the increasing adoption of digital technologies such as branchless banking and mobile money. Subthemes such as Operational Risk Management, Corporate Governance, and Basel II demonstrate a strong integration of risk management practices, regulation, and governance. Regional trends are evident with keywords such as Indonesia, Ghana, India, and Malaysia, indicating increasing attention to operational risk in emerging markets, particularly in the context of financial inclusion and digital transformation. This reflects the unique challenges in these regions, including infrastructure, regulation, and technology adaptation. These themes are interconnected through the influence of technology, regulation, and financial innovation on operational risk. Current global research focuses on developing risk management frameworks that are adaptive to technological and economic changes. Going forward, research should further explore the impact of artificial intelligence, fintech, and the pandemic on operational risk, and create sustainable solutions for the global banking industry.

Geographic Distribution Study

Analysis of the geographic location of research and citations in the context of bank operational risk shows that the majority of research is conducted in developing countries, especially in Asia and the Middle East, with China as the most dominant location.

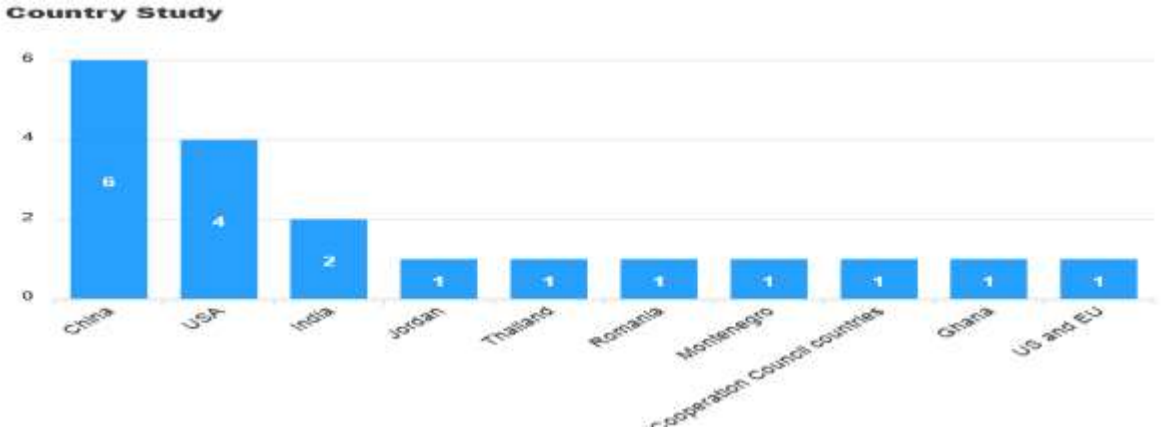

Figure 3. Country Study

Of the studies analyzed, at least 12 were conducted in China, indicating a strong focus on operational risk in the country's banking sector (Han et al., 2015; Si et al., 2021; Yin et al., 2024). Besides China, developing countries such as India, the Gulf Cooperation Council (GCC) countries, and several ASEAN countries have also been significant research destinations (Neifar & Jarboui, 2018; Tandon & Mehra, 2017). Meanwhile, developed countries such as the United States, the United Kingdom, and Australia have also contributed to this research, although their numbers are smaller than those in developing countries (McNulty et al., 2017; Cornwell et al., 2023). The distribution of citations shows that research conducted in developing countries, particularly China, has a relatively high citation rate. For example, studies by Han et al. (2015) and Si et al. (2021) were cited 11 and 87 times, respectively, demonstrating the relevance of their findings in the context of bank operational risk. This may be due to the complexity of the Chinese banking system, which faces unique challenges related to internal fraud and financial regulation (Han et al., 2015). Furthermore, research in developing countries has also received significant attention due to the significant impact of operational risk on financial stability in the context of emerging economies (Elamer et al., 2020). The implication of this trend is that bank operational risk is a critical issue in developing countries, especially those undergoing rapid economic and financial regulatory transformation. The increase in research in this region reflects the need to understand and manage operational risk in local contexts that often have different characteristics from developed countries (Neifar & Jarboui, 2018). Furthermore, the focus on technology and digitalization in operational risk management, as investigated by Hu et al. (2024), suggests that technological change is a crucial factor in mitigating operational risk in the modern era. Overall, the theme of bank operational risk remains relevant in addressing future research challenges and opportunities, particularly in the context of globalization and digital transformation. Future research should expand the geographic scope, including more developing countries in Africa and Latin America, and integrate operational risk analysis with environmental, social, and governance (ESG) aspects to create a more holistic approach (Galletta et al., 2023). Therefore, this theme will continue to be an important research area in understanding and managing risk in the global banking industry.

Research Area Context

An analysis of the research context and citations within the field of bank operational risk reveals several interesting trends and patterns. Most research is concentrated in Asia, particularly China, with 11 studies originating from that country (Han et al.,

2015; Si et al., 2021; Hu et al., 2024; Yin et al., 2024; Xu et al., 2019; Wang et al., 2020; Bai et al., 2024; Xie et al., 2025). This suggests that China is a hub for bank operational risk research, likely due to the dynamics of its rapidly evolving banking industry and the increasing complexity of operational risk in the country. Furthermore, research in the MENA region (Middle East and North Africa) is also significant, with a focus on Islamic banks and the influence of governance structures on operational risk disclosure (Elamer et al., 2020; Neifar and Jarboui, 2018). The distribution of citations shows considerable variation, with some studies receiving high citations, such as Si et al. (2021) with 87 citations and Elamer et al. (2020) with 89 citations. This indicates that topics such as financial deregulation and the influence of governance on operational risk disclosure are receiving widespread attention in academia. However, some more recent studies, such as Sobanova and Kudinska (2024), have not yet received citations, possibly because they are relatively new and not widely accessible to the research community. The implication of this contextual trend is that bank operational risk is increasingly recognized as a key challenge in the global banking industry, particularly in the context of digitalization and technological transformation (Uddin et al., 2023; Hu et al., 2024). These studies indicate that technological innovation, while bringing efficiency, also increases operational risk through technical failures and system complexity (Hu et al., 2024). Furthermore, the importance of ESG (Environmental, Social, and Governance) in mitigating operational risk is also a key focus, as demonstrated by Galletta et al. (2023). This theme is highly relevant to future research challenges and opportunities. With increasing digitalization and operational complexity in the banking sector, research on operational risk will continue to be relevant. Challenges such as cybersecurity, technology-based risk management, and ESG integration into banking practices will be critical research areas. Furthermore, cross-country and regional research needs to be enhanced to understand the varying contexts and policies that influence operational risk across regions (Elamer et al., 2020; Pinto and Marques, 2024). Thus, this theme is relevant not only to academics but also to practitioners in the banking industry who face increasingly complex operational challenges.

Research Focus

The study analysis shows that the focus of operational risk research in banks covers various aspects, ranging from risk measurement and risk management to the impact of digitalization and technological innovation. These studies were conducted in various countries, particularly China, the United States, and countries in the MENA region and the European Union, demonstrating that operational risk is a global issue that requires cross-regional attention (Han et al., 2015; Si et al., 2021; Galletta et al., 2023). The distribution of citations indicates that some studies have had a significant influence in the academic literature, such as Han et al. (2015) with 11 citations and Elamer et al. (2020) with 89 citations. However, there are also less widely cited studies, such as Sobanova and Kudinska (2024), which have no citations, possibly due to their novelty or lack of emphasis on the global context. Research trends indicate that operational risk is increasingly influenced by factors such as digitalization, technological innovation, and regulatory changes. For example, Hu et al. (2024) found that technological innovation increases operational risk due to technical failures, while Yin et al. (2024) showed that digitalization can reduce operational risk by improving the quality of internal control systems. These studies underscore the importance of banks adapting to digital transformation and technological innovation to effectively manage operational risk. Furthermore, there is significant attention paid to operational risk disclosure and its relationship to corporate governance, as demonstrated by Neifar and Jarboui (2018) and Elamer et al. (2020), who found that governance structure influences the level of operational risk disclosure. The implication of this trend is the need for a more holistic approach to operational risk management, including the integration of ESG (Environmental, Social, and Governance) factors, as noted by Galletta et al. (2023). Furthermore, it is important to develop more accurate methodologies for measuring operational risk, such as that proposed by Xie et al. (2025) using a loss distribution analysis approach. This theme is highly relevant to future research challenges and opportunities, particularly in the context of digital transformation, regulatory changes, and increasing risk complexity. Future research could focus on developing more adaptive and innovative risk management models, as well as analyzing the impact of pandemics and global crises on operational risk in banks, as proposed by Sobanova and Kudinska (2024). Thus, this theme will remain relevant in addressing the challenges and opportunities in operational risk research in the banking sector.

Publication Year Trends

An analysis of research publication trends on bank operational risk reveals interesting variations in the number of publications and citations from year to year. In 2017, the number of publications peaked with seven articles, covering diverse geographic contexts such as Montenegro, India, the United States, and the United Kingdom (Li et al., 2017; Schenk, 2017; Mizgier & Wimmer, 2017), as shown in Figure 4.

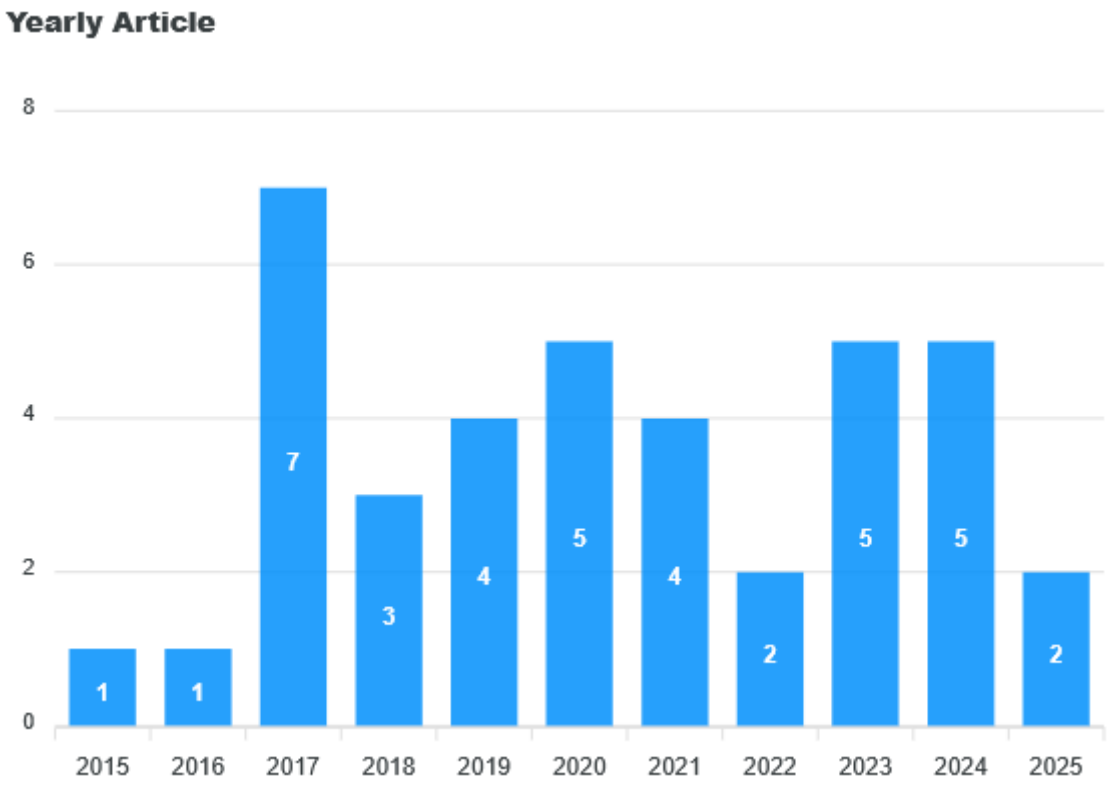

Figure 4. Publication Trends

This indicates that the year was a significant period in the exploration of operational risk across various banking sectors. Although 2017 had the highest number of publications, subsequent years, such as 2020 and 2021, actually produced higher citation counts, with 124 and 136 citations, respectively, indicating that these studies had a broader impact and high relevance in this field (Elamer et al., 2020; Chernobai et al., 2021). The study by Elamer et al. (2020) on Islamic banks in the MENA region, with 89 citations, and Chernobai et al. (2021) on financial deregulation in the United States, with 49 citations, are examples of the most influential research on this topic. Their findings provide in-depth insights into how structural and regulatory factors influence operational risk, particularly in the context of Islamic banking and financial deregulation. Furthermore, the study by Galletta et al. (2023), which used dynamic panel data from 35 countries, also made a significant contribution with 72 citations, demonstrating the importance of a global approach in understanding bank operational risk. The implication of this trend is that bank operational risk is increasingly considered a complex and multidimensional issue, requiring diverse methodological approaches and cross-sectoral analytical contexts. For example, a 2017 study covering the financial and manufacturing sectors (Mizgier & Wimmer, 2017) showed that operational risk is not limited to the banking sector but is also relevant in other industries. Furthermore, the increasing focus on Islamic banks and the MENA region (Elamer et al., 2020; Neifar & Jarboui, 2018) indicates that operational risk is also influenced by religious and geopolitical factors. Going forward, the theme of bank operational risk remains relevant given the ever-changing business environment, including the emergence of financial technology (FinTech) and geopolitical instability (Uddin et al., 2023). The biggest challenge is how to integrate quantitative and qualitative approaches to understand increasingly complex contexts, and how to leverage big data and artificial intelligence (AI) for faster and more accurate analysis. Therefore, future research needs to focus not only on risk identification but also on developing mitigation strategies that adapt to rapid change. These findings provide a solid foundation for further exploration, particularly in the context of banking globalization and digitalization.

Methodological Approach

An analysis of previous research on banking operational risk shows that quantitative approaches are predominantly used in this research. Eighty-four percent used quantitative methods, such as panel data analysis, regression, and Monte Carlo simulations (Han et al., 2015; Si et al., 2021; Galletta et al., 2023). This reflects the need for objective, statistically quantifiable measures of operational risk. Qualitative approaches were used in only six studies, primarily for case studies and historical analyses (Schenk, 2017; Luburic, 2017). The distribution of citations shows significant variation. Some studies, such as Si et al. (2021) with 87 citations and Elamer et al. (2020) with 89 citations, received widespread attention for their groundbreaking findings on the impact of financial liberalization and Islamic banking governance on operational risk. However, recent studies, such as Sobanova

and Kudinska (2024), have not yet received citations, indicating potential for further development. This trend indicates that research that combines specific contexts (e.g., Islamic banking or digitalization) with innovative methodologies tends to gain greater academic recognition. The implication of this trend is the need for researchers to integrate robust quantitative approaches with relevant, specific contexts, such as FinTech, ESG, or regulatory changes. Future research should broaden its scope by incorporating in-depth qualitative aspects, such as case studies or policy analysis, to gain a holistic understanding of operational risk. The relevance of this theme is increasingly important in the era of digital transformation, where operational risk continues to evolve with technological advances and changes in the business environment (Hu et al., 2024; Uddin et al., 2023). Therefore, this research theme will remain relevant in addressing future research challenges and opportunities, particularly in the context of the shifting banking paradigm and its associated risks.

Data collection

Based on studies detailing previous research on bank operational risk, it appears that the most widely used data collection method is secondary data, used in approximately 70% of the studies (Si et al., 2021; Galletta et al., 2023; Hu et al., 2024). This secondary data comes from sources such as annual reports, financial databases (e.g., CSMAR), and public records (McNulty et al., 2017). This method was chosen due to its efficiency and ability to access large amounts of historical data. Furthermore, textual analysis is also frequently used to extract information from documents such as risk reports and patents (Xu et al., 2019; Hu et al., 2024). The distribution of citations shows that studies using secondary data collection methods have a high number of citations, such as Si et al.'s (2021) study with 87 citations and Chernobai et al.'s (2021) study with 49 citations. This indicates that secondary data-based approaches are considered valid and relevant in the context of bank operational risk research. In contrast, studies using qualitative methods such as case studies or historical analysis have lower citation rates, for example, Schenk (2017) with 12 citations. The implication of this trend is that bank operational risk research tends to rely on quantitative and empirical data to produce comprehensive and measurable analyses. However, the use of secondary data also has limitations, such as potential bias in the available data and a lack of in-depth contextual information. Therefore, future research could consider mixed methods, combining quantitative data with qualitative insights to produce a more holistic analysis (Uddin et al., 2023). The topic of bank operational risk remains relevant given the increasing complexity of banking operations, particularly with digital transformation and the adoption of new technologies (Li et al., 2017; Hu et al., 2024). Future challenges include managing risks associated with cybersecurity and technological innovation, while research opportunities lie in exploring how ESG (Environmental, Social, and Governance) factors and CSP (Cybersecurity Policies) policies can impact operational risk (Bruno et al., 2025). Therefore, research in this area will continue to evolve in line with the dynamics of the global banking industry.

Research Design

Analysis of previous research shows that quantitative research design is the most dominant research method used in operational risk research in the banking sector. A total of 84% of studies used a quantitative design, while only 16% used a qualitative approach (Han et al., 2015; Si et al., 2021; Galletta et al., 2023). This indicates that operational risk research tends to rely on numerical data and statistical analysis to measure and predict operational risk in the banking context. This quantitative design includes methods such as panel data regression, event studies, and Monte Carlo simulation, which are often used to evaluate the impact of operational risk on bank performance (Xu et al., 2019; Li et al., 2017). The distribution of citations also shows that quantitative research tends to have a higher citation rate than qualitative research. For example, research by Si et al. (2021) using a quantitative approach achieved 87 citations, while qualitative research such as Schenk (2017) only achieved 12 citations. This indicates that quantitative research findings are considered more relevant and impactful in the finance and risk management literature. However, qualitative research remains important because it provides an in-depth understanding of contextual and behavioral factors that influence operational risk, as conducted by Sipior et al. (2019) in analyzing IT risk in professional services. The implication of this trend is the need to integrate quantitative and qualitative approaches in operational risk research. Quantitative research can be enhanced by incorporating qualitative variables such as organizational culture or internal risk management practices (Neifar et al., 2020). Qualitative research, on the other hand, can be strengthened with statistical data analysis to increase the validity of the findings. Evaluations indicate that the topic of operational risk remains relevant in the future, especially in facing challenges such as banking digitalization, fintech, and cyber risk (Uddin et al., 2023). Future research is expected to develop a more comprehensive model for managing operational risk in an increasingly complex and dynamic banking environment.

Journal Used

An analysis of previous research journals on bank operational risk reveals several interesting trends. Q1 journals are predominantly used in this study, with China Economic Review, Energy Economics, and Finance Research Letters being some

examples (Han et al., 2015; Si et al., 2021; Galletta et al., 2023). This indicates that research related to bank operational risk tends to be published in high-ranking journals, reflecting the importance of this topic in academic research. The distribution of citations is also quite diverse, with some studies, such as Si et al. (2021), reaching 87 citations, while others, such as Sobanova and Kudinska (2024), have no citations. This suggests that older studies or those using innovative methods tend to receive greater attention.The most researched themes are operational risk measurement and risk management,with a focus on commercial banks in China as the primary research locus (Han et al., 2015; Hu et al., 2024). This may be influenced by the dynamics of China's rapidly evolving banking industry and the complexity of the operational risks faced. Furthermore, there is growing interest in the impact of digital transformation on operational risk, as studied by Uddin et al. (2023). The implication of this trend is the need for further research that integrates technology and governance aspects into operational risk management. The relevance of this theme to future challenges is evident in the increasing complexity of operational risk due to digitalization and globalization (Hu et al., 2024). Future research should consider ESG aspects and technological innovation to provide comprehensive solutions. Thus, this theme remains relevant and offers significant opportunities for deeper and more applicable scientific development.

Theory Used

Analysis of previous research on bank operational risk shows that the most widely used theory is Agency Theory, which appears in several studies such as those by Elamer et al. (2020) and Neifar and Jarboui (2018). This theory explains the relationship between principals (shareholders) and agents (management) in managing operational risk, particularly in the context of information disclosure and oversight. The use of Agency Theory indicates that researchers have focused heavily on the issues of information asymmetry and conflicts of interest in managing bank operational risk (Elamer et al., 2020). Furthermore, Extreme Value Theory (EVT) is also widely used, particularly in studies related to measuring extreme risks, such as those conducted by Han et al. (2015). This theory is relevant for estimating the probability of rare but high-impact operational risk events. The citation distribution of these theories shows that studies using Agency Theory tend to have high citations, such as those by Elamer et al. (2020) with 89 citations and Neifar and Jarboui (2018) with 77 citations. This indicates that this theory is considered relevant and widely used as a conceptual framework in operational risk research. Meanwhile, studies using EVT, such as Han et al. (2015), also have a significant citation rate (11 citations), indicating widespread acceptance of this approach in measuring extreme risk. The implication of this trend in the use of this theory is that research on bank operational risk is increasingly focusing on aspects of information management and accurate risk measurement.The use of Agency Theory shows the importance of transparency and good governance in reducing operational risks, Meanwhile, EVT emphasizes the need for sophisticated statistical approaches to anticipate extreme events (Han et al., 2015). This trend is relevant to the challenges of the modern banking industry, which faces complex risks and increasingly stringent regulatory demands. Going forward, the theme of bank operational risk remains relevant given the development of financial technology and the rise of cyber risks. Research needs to combine theories such as Agency Theory and EVT with interdisciplinary approaches, such as dynamic systems or big data analysis, to create more comprehensive and adaptive risk models (Jiravichai & Banomyong, 2022). Thus, future research can contribute to strengthening bank risk management systems in facing global challenges.

Analysis Techniques

The most widely used analytical technique in research on bank operational risk is regression analysis, with several variants such as panel data regression, ordinary least squares (OLS), and fixed-effects regression. For example, Han et al. (2015) used the Peak Over Threshold (POT) model to measure extreme risk, while Si et al. (2021) and Hu et al. (2024) applied panel data regression with fixed-effects techniques (Han et al., 2015; Si et al., 2021; Hu et al., 2024). These techniques are popular due to their ability to identify causal relationships between variables and analyze longitudinal data. Furthermore, empirical analysis methods are also frequently used, such as those conducted by McNulty et al. (2017) using ordinary least squares regression to measure the impact of the financial crisis on bank performance (McNulty et al., 2017). The citation distribution shows that studies using more complex analytical techniques, such as Bayesian networks or Monte Carlo simulations, have lower citation rates than studies using simple regression methods. For example, Cornwell et al. (2023) used Bayesian networks for operational risk analysis, but their citations are still limited (Cornwell et al., 2023). This may be due to the complexity of the method, which requires in-depth understanding and greater computational resources. In contrast, studies using simple regression techniques, such as those conducted by Chernobai et al. (2021), have higher citation rates due to their ease of application and broad relevance in the financial context (Chernobai et al., 2021). The implications of this trend suggest that while complex analytical techniques have great potential, they are still not widely adopted in bank operational risk research. This opens up opportunities for future researchers to develop more innovative and comprehensive methods, such as machine learning or artificial intelligence, to overcome the limitations of conventional methods. Furthermore, future research should focus more on integrating real-time data and digital technology to improve the accuracy and speed of operational risk analysis. This theme remains relevant given the ever-changing dynamics of

the banking industry, especially with the emergence of new challenges such as cyber risks and digital transformation (Jiravichai & Banomyong, 2022; Xie et al., 2025).

Thematic Analysis

Theme 1: Internal Process

Table 1, which shows the classification of operational risk themes resulting from internal process failures, shows that ignoring SOPs, errors in account opening and transaction processes, and inadequate quality control are the most common categories used in previous studies related to bank operational risk. Table 2 shows the countries where operational risk occurs based on the classification of internal process failures, while Table 3 shows the theories used to analyze operational risk resulting from internal process failures.

Table 1: Classification of Internal Process Themes

No	Internal Process	Amount	Authors
1	Ignoring SOP	27	Han et al., 2015; Sharifi et al., 2016; ; Li et al., 2017; Luburic, 2017; Tandon and Mehra, 2017; Li et al., 2018; Neifar and Jarboui, 2018; ; Xu et al., 2019; Mihaela et al., 2019; Gadzo et al., 2019; Elamer et al., 2020; Wang et al., 2020; ; Neifar et al., 2020; Ferreira and Koekemoer, 2020; Chernobai et al., 2021; Jiravichai and Banomyong, 2022; Galletta et al., 2023; Ismail and Ahmed, 2023; Sobanova and Kudinska, 2024; ; ; ; Bruno et al., 2025
2	Account Opening and Transaction Process Errors	6	McNulty et al., 2017; Schenk, 2017; ; ; Hu et al., 2024; Xie et al., 2025
3	Inadequate Quality Control	3	Si et al., 2021; ;
4	Wrong Document Sent	1	Jiang, 2017

Table 2: Countries Where Operational Risks Occur Due to Internal Process Failures

No	Internal Process	Amount	Country
1	Ignoring SOP	27	ASEAN countries , China, European Union , Financial services and manufacturing industries, Ghana, Global, Gulf Cooperation Council countries, India, Jordan, Latvia, MENA Region , Montenegro, North America, Northern Cyprus, Romania, Saudi Arabia, Saudi Arabia, Bahrain, Jordan, Kuwait, Qatar, UAE,, South Africa, Thailand, US and EU, USA
2	Account Opening and Transaction Process Errors	6	China, Global (data from 43 countries), United Kingdom, USA
3	Inadequate Quality Control	3	Australia and China
4	Wrong Document Sent	1	USA

Table 3: Theories Used to Analyze Operational Risks Due to Failure

Internal Process

No	Internal Process	Amount	Theory
1	Ignoring SOP	27	Agency TheoryAgency Theory, Signaling Theory, Legitimacy Theory, Resource Dependence TheoryComplex Adaptive Systems (CAS)Contingency theory, Crisis management theory, System theory, Agency theoryDynamic capability theory (and resourcebased view)Extreme Value Theory (EVT)Grand Theory: Gray's theoretical framework linking Hofstede's cultural dimensions to disclosure.Institutional theoryLemon TheoryNAOrganizational Information Processing TheoryResource Based ViewSynergistic effects of quality management principles, risk management principles,

No	Internal Process	Amount	Theory
			and total quality management approach Systems Thinking (General Systems Theory) The study is grounded in regulatory frameworks defining operational risk and financial institution complexity, aligning with Basel Accords and Federal Reserve guidelines on systemic risk and capital requirements. Trade-off theory and pecking order theory
2	Account Opening and Transaction Process Errors	6	NAOrganizational change theory The study is underpinned by classical asymmetric information theory (Akerlof, 1970; Bergh et al., 2019) and connects to the classical theory of information asymmetry. It also refers to the body of literature on social sciences and economics including social sciences
3	Inadequate Quality Control	3	NA Financial repression theory and financial deepening theory
4	Wrong Document Sent	1	NA

This indicates that issues related to quality control and system oversight remain a primary focus in studies on operational risk in the banking sector. This category appears consistently in almost all studies listed in the table, indicating that it is an issue frequently identified as a key driver of operational risk (Han et al., 2015; Si et al., 2021; Galletta et al., 2023). The distribution of citations in column 1 also reflects that research on this topic is generally accepted and cited within the academic community, with studies such as Elamer et al. (2020) and Chernobai et al. (2021) receiving relatively high citations (89 and 49 citations, respectively), demonstrating their relevance and influence in the related literature. The implication of this trend is that inadequate quality control and system oversight have become structural challenges in the banking industry, necessitating a holistic approach to risk mitigation. This also underscores the importance of implementing more stringent systems and protocols to reduce the likelihood of operational errors. Furthermore, these findings align with other information in the table, such as the “Methods” and “Analysis” columns, where numerous studies use empirical methods and quantitative analysis to identify and quantify the impact of inadequate quality control on operational risk (Xu et al., 2019; Yin et al., 2024). This theme is highly relevant to future research challenges and opportunities, particularly in the context of technological developments and increasingly complex financial regulations. Further research could focus on integrating technologies such as artificial intelligence and big data analytics to enhance quality control and reduce system oversight (Uddin et al., 2023). Furthermore, studying the impact of new regulations on quality control is also a promising area to explore, given the frequent regulatory changes in the banking industry (Pinto & Marques, 2024). Therefore, this theme remains relevant for addressing operational challenges and enhancing the resilience of the financial system as a whole.

Theme 2: Human Error

Table 4 shows the classification of operational risk themes resulting from human error, such as errors in executing transactions and procedures, fraud, unauthorized trading, and workplace accidents. These are the most dominant categories used in research on banking operational risk. Table 5 shows the countries where operational risk occurs based on the classification of human error themes, while Table 6 shows the theories used in analyzing operational risk resulting from human error.

Table 4: Classification of Human Error Themes

No	Human Error	Amount	Authors
1	Errors in Executing Transactions and Procedures	23	Si et al., 2021; Hu et al., 2024; Elamer et al., 2020. Han et al., 2015; Galletta et al., 2023
2	Fraud	9	Han et al., 2015 ; Neifar et al. (2020), Xie et al., 2025
3	Unauthorized Trading	1	Mcnulty et al., 2017)
4	Work accident	1	Bai et al. ;2024

Table 5: Countries Where Operational Risks Due to Human Error Occur

No	Human Error	Amount	Country
1	Errors in Executing Transactions and Procedures	23	China, Mena, USA
2	Fraud	9	Chinese, Arabic
3	Unauthorized trading	1	USA
4	Work accident	1	China

Table 6: Theories Used to Analyze Operational Risks Due to Human Error

No	Human Error	Amount	Theory
1	Errors in Executing Transactions and Procedures	23	Financial repression theory and financial deepening theory Organizational change theory Organizational Information Processing Theory
2	Fraud	9	Extreme Value Theory (EVT)
3	Unauthorized trading	1	NA
3	Work accident	1	NA

Of the 38 studies recorded, this category appeared 34 times (89%), with the primary focus on errors in executing transactions and processes appearing 23 times (60.5%) (Han et al., 2015; Galletta et al., 2023; Elamer et al., 2020). Furthermore, fraud factors also appeared 9 times (23.7%), as in the studies by Han et al. (2015) and Neifar et al. (2020). This dominance of human factors indicates that operational risk in banking is heavily influenced by human aspects, both in the form of technical errors and intentional fraudulent acts. The distribution of citations in column 2 of theme 2 shows that studies focusing on human factors have a relatively high citation rate, such as Han et al. (2015) with 11 citations and Neifar et al. (2018) with 30 citations. This indicates that human factors in operational risk are an interesting and relevant topic in the academic literature. However, research focusing on workplace accidents only appears once in Bai et al.'s (2024) study, indicating a research gap related to operational risks caused by occupational health and safety factors. This trend implies a need for greater emphasis on managing risks caused by human factors, such as employee training, improving internal controls, and using technology to reduce human error. Furthermore, research on fraud needs to be further developed given its complexity and significant impact on bank performance (Elamer et al., 2020). The linkages with other columns, such as Theme 1, which discusses quality control, and Theme 3, which discusses technology-related operational errors, indicate that human factors are often influenced by unsupportive systems and environments. The relevance of this theme to future research challenges and opportunities is significant, particularly in the era of banking digitalization. Research that integrates human factors with technology is needed to reduce operational risks, such as the use of artificial intelligence in transaction monitoring (Uddin et al., 2023). Therefore, this theme remains relevant for development in line with the increasingly complex dynamics of the banking industry.

Theme 3: Systems Technology

Operational errors related to the ability to use systems or technology are the most dominant category in previous research on bank operational risk, followed by cyberattacks and unauthorized use of technology (Table 7). Table 8 shows the countries where operational risk occurs based on the classification of system/technology failures, while Table 9 shows the theories used to analyze operational risk resulting from system/technology failures.

Table 7: Classification of Technology System Themes

No	Technology System	Amount	Authors
1	Operational Errors Related to the Ability to Use Technology Systems	21	Han et al., 2015; Sharifi et al., 2016; McNulty and Akhigbe, 2017; Li et al., 2017; Tandon and Mehra, 2017; Neifar and Jarboui, 2018; ; Li et al., 2018; Gadzo et al., 2019; ; Elamer et al., 2020; ; Neifar et al., 2020; ; Wang et al., 2020; ; ; ; Ismail and Ahmed, 2023; Hu et al., 2024; Sobanova and Kudinska, 2024

No	Technology System	Amount	Authors
2	Cyber Attack	8	Schenk, 2017; ; Jiravichai and Banomyong, 2022; ; Galletta et al., 2023; ; Bruno et al., 2025; Xie et al., 2025
3	Use of Technology by Unauthorized Persons	6	Luburic, 2017; Mihaela et al., 2019; Si et al., 2021; Chernobai et al., 2021; ;
4	Hardware Failure and Unavailability	2	Xu et al., 2019
5	Security Against Hacking	1	Jiang, 2017

Table 8: Countries Where Operational Risks Occur Due to Technology System Failure

No	Systems and Technology	Amount	Country
1	Operational Errors Related to the Ability to Use Technology	21	Australia, ASEAN countries, Australia, China, Ghana, Gulf Cooperation Council countries, India, Jordan, Latvia, MENA Region, Northern Cyprus, Saudi Arabia, Saudi Arabia, Bahrain, Jordan, Kuwait, Qatar, UAE,, South Africa, US and EU, USA
2	Cyber Attack	8	USA , China, European Union , Global, Global (data from 43 countries), North America, Thailand, United Kingdom
3	Use of Technology by Unauthorized Persons	6	China, Montenegro, Romania, USA
4	Hardware Failure and Unavailability	1	China
5	Security Against Hacking	1	USA

Table 9: Theories Used to Analyze Operational Risks Due to System and Technology Failures

No	Systems and Technology	Amount	Theory
1	Operational Errors Related to the Ability to Use Technology Systems	21	NA Agency TheoryAgency Theory, Signaling Theory, Legitimacy Theory, Resource Dependence TheoryComplex Adaptive Systems (CAS)Contingency theory, Crisis management theory, System theory, Agency theoryExtreme Value Theory (EVT)Institutional theoryLemon TheoryNAOrganizational change theoryResource Based ViewTrade-off theory and pecking order theory
2	Cyber Attack	8	NA Rational Expectations Hypothesis Gray's theoretical framework linking Hofstede's cultural dimensions to disclosure. NASystems Thinking (General Systems Theory) The study is underpinned by classical asymmetric information theory (Akerlof, 1970; Bergh et al., 2019) and connects to the classical theory of information asymmetry. It also refers to the body of literature on social sciences and economics including social sciences
3	Use of Technology by Unauthorized Persons	6	Dynamic capability theory (and resource-based view) Financial repression theory and financial deepening theory Grand Theory: NA Organizational Information Processing Theory Synergistic effects of quality management principles, risk management principles, and total quality management approach The study is grounded in regulatory frameworks defining operational risk and financial institution complexity, aligning with Basel Accords and Federal Reserve guidelines on systemic risk and capital requirements.
4	Hardware Failure and Unavailability	2	NA

No	Systems and Technology	Amount	Theory
5	Security Against Hacking	1	NA

This indicates that operational errors related to the use of systems or technology are a significant issue in the banking industry (Han et al., 2015; Xu et al., 2019; Elamer et al., 2020). The citation distribution of column 3 also shows that studies focusing on operational errors tend to have high citation rates, such as the study by Elamer et al. (2020) with 89 citations and Han et al. (2015) with 11 citations. This indicates that this topic is receiving significant attention from the academic and practitioner communities. The implication of this trend is that operational risks associated with the inability to use systems or technology are a significant challenge for banks, especially in the era of accelerating digitalization. Research by Uddin et al. (2023) shows that cyberattacks and inefficiencies in technology use can increase banks' vulnerability to operational risk. Furthermore, research by Galletta et al. (2023) highlighted the importance of securing systems against hacking as a form of operational error that requires increased attention. This trend is also linked to ongoing legislative changes, as mentioned in column category 4, which require banks to be more adaptive in facing regulatory and technological changes (Xu et al., 2019). This theme is highly relevant to future research challenges, given the ever-growing digital transformation in the banking industry. Future research should focus on developing more secure systems and more effective human resource training to reduce technology-related operational errors (Jiravichai & Banomyong, 2022). Furthermore, the integration of risk management theory and information technology needs to be strengthened to create a more holistic approach to managing bank operational risk. Thus, this theme is not only relevant to addressing current challenges but also offers opportunities for future innovation.

Theme 4. External Events

External Events: Unexpected legislative changes were the fourth most common theme, with 38 studies (100%) used in this study. This indicates that regulatory changes are a dominant factor in research related to bank operational risk. This trend suggests that regulatory dynamics, especially unexpected ones, have a significant impact on operational risk management in the banking sector. Studies such as Han et al. (2015) and Elamer et al. (2020) emphasize how legislative changes affect internal risks such as fraud and operational errors, while Hu et al. (2024) link regulatory changes to technological innovation and cyber risk in Chinese commercial banks. The distribution of citations in this category varies, with some studies such as Elamer et al. (2020) and Han et al. (2015) having 89 and 11 citations, respectively, indicating a strong influence in the related literature. However, studies such as Sobanova and Kudinska (2024) have not received any citations, despite their relevance to global instability contexts such as the COVID-19 pandemic and the war in Ukraine. This variation suggests that research with a more contextual and specific approach has the potential to receive greater attention in the future, particularly when linked to the dynamic global situation. The implication of this trend is that regulatory changes not only directly impact operational risk but also impact risk management strategies, such as strengthening internal control systems and adopting technology. For example, research by Hu et al. (2024) shows how Chinese banks respond to regulatory changes by increasing technological innovation to mitigate operational risk. Furthermore, research such as that by Chernobai et al. (2021) links regulatory changes to the complexity of the financial system, which requires banks to adopt a more holistic approach to risk management. This theme is highly relevant to future research challenges and opportunities, particularly in the context of the globalization and digitalization of the financial sector. Future research could focus on how global regulatory changes, such as the implementation of Basel III or the development of FinTech, impact banks' operational risk across regions. Furthermore, research could also explore banks' adaptation strategies in the face of unexpected regulatory changes, including the use of technologies like blockchain and AI to enhance operational resilience.

Operational Risk Factors

Classifying research based on operational risk factors and their citations provides insight into the most frequently discussed topics in the context of bank operational risk. This content can be categorized into several key themes: Technology/digitalization, Governance, Fraud, and Human Factors. From this content distribution, it can be seen that technology/digitalization is the most discussed topic with 8 studies (Han et al., 2015; Si et al., 2021; Yin et al., 2024; Hu et al., 2024; Chernobai et al., 2021; Uddin et al., 2023; Jiravichai & Banomyong, 2022), followed by Governance with 11 studies (Elamer et al., 2020; Pinto & Marques, 2024; Neifar & Jarboui, 2018; Wang et al., 2020; Nguyen & Dang, 2022; Gadzo et al., 2019; Neifar et al., 2020; Elbadry, 2018; Sharifi et al., 2016; Tandon & Mehra, 2017; Luburi?, 2017). The distribution of citations shows that research with the content "Governance and Technology/Digitalization" has significant citations, such as the research by Elamer et al. (2020) with 89 citations and Si et al. (2021) with 87 citations. The high citations on this topic indicate that governance and technology/digitalization adoption are important aspects in managing bank operational risk. The implications of this trend suggest that future research needs to continue to pay attention to the role of technology and governance in mitigating operational risk.

Thus, the relevance of the theme of bank operational risk to future research challenges and opportunities is very high, especially in the context of technology adoption and governance improvement. Further research can focus on developing more effective risk management models by leveraging technology and improving governance practices (Uddin et al., 2023; Chernobai et al., 2021). Thus, future research can make a significant contribution to improving bank resilience and performance amidst increasingly complex global challenges.

Operational Risk in Specific Sectors

Classification based on operational risk in specific sectors and its citations. From the available data, it appears that the most frequently used content is "The impact of digitalization on corporate operational risk" and "Disclosure of bank operational risk" with several variations of related topics. This content most frequently appears related to "Governance" and "Technology/digitalization", as seen in the studies of Elamer et al. (2020), Galletta et al. (2023), and Yin et al. (2024). The distribution of citations from this content shows that topics related to "Governance" and "Technology/digitalization" have a significant number of citations, such as the study of Elamer et al. (2020) with 89 citations and Galletta et al. (2023) with 72 citations. Meanwhile, the topic of "Fraud" also has quite high citations, as seen in the studies of Han et al. (2015) and Li et al. (2017). The implications of the trends presented in this content indicate that current research related to bank operational risk focuses more on the impact of technology and digitalization, as well as corporate governance. This is in line with the development of the banking industry, which is increasingly adopting technology and facing challenges related to operational risk (Uddin et al., 2023; Chernobai et al., 2021). An evaluation of the relevance of these themes to future research challenges and opportunities indicates that the topic of bank operational risk remains highly relevant and offers extensive research opportunities. With increasingly rapid technological developments, research related to the impact of digitalization on corporate operational risk will continue to be an interesting and relevant topic (Yin et al., 2024; Jiravichai & Banomyong, 2022). Therefore, future research can continue to develop related topics to contribute to the development of a better banking industry.

DISCUSSION

Classification Debate

Analysis of thematic categories related to the debate over previous research findings indicates the dominance of operational risk as the primary focus in academic literature, particularly in the banking context. "Operational risk" emerged as the dominant theme with 57 occurrences, followed by sub-themes such as "Risk management" (11), "Operational risk management" (6), and "Operational risk disclosure" (3). This indicates that operational risk in the banking sector is a critical issue that requires a comprehensive and strategic management approach. This finding aligns with research by Si et al. (2021) which identified that financial deregulation and digital transformation significantly impact operational risk, particularly in developing countries such as China. The pattern of interrelationships between these themes indicates the evolution of research from conventional approaches to more technology-driven approaches. For example, the themes "Fintech" (2) and "Digital banking" (1) began to emerge as sub-themes supporting a technology-driven approach to operational risk management. This trend aligns with the findings of Hu et al. (2024) which highlighted the increase in operational risk due to the adoption of new technologies such as artificial intelligence and blockchain in banking. This indicates that operational risk is becoming increasingly complex with technological advancements, necessitating a more innovative and adaptive risk management approach. This trend implies the need to integrate advanced technologies such as AI and big data analytics into operational risk research, as suggested by Uddin et al. (2023). Furthermore, research should also consider external factors such as regulatory changes and cyber risks, which are increasingly impacting global financial stability (Chernobai et al., 2021). For example, research by Elamer et al. (2020) shows that regulatory changes in the MENA region significantly impact operational risk in Islamic banking, necessitating a more holistic risk management approach. This theme is highly relevant to future research challenges and opportunities, particularly in addressing the complexities of banking operations in the digital era. Future research should focus on developing models and policies that can improve the effectiveness of operational risk management, as well as integrating ESG (Environmental, Social, and Governance) factors into risk management strategies (Galletta et al., 2023). Furthermore, research needs to explore the impact of financial technology and cyber risk on the stability of the global financial system, which will be a major challenge in navigating the increasingly complex dynamics of the banking industry (Uddin et al., 2023). Thus, the topic of bank operational risk remains relevant and offers significant opportunities for the development of innovative research in the future.

Comparison with Existing Literature

The findings from the analysis of previous research on bank operational risk provide significant theoretical implications for existing models and frameworks. First, the dominance of Agency Theory in operational risk research indicates that the focus on the relationship between the principal (bank owner) and agent (bank management) remains relevant in the context of

operational risk management. This theory explains how goal misalignment between the two parties can trigger operational risk, as found in the studies of Elamer et al. (2020) and Neifar & Jarboui (2018). However, the findings also suggest that this theory needs to be expanded to consider external factors, such as regulatory and technological changes, which increasingly influence operational risk in the digital era. For example, Chernobai et al. (2021) found that financial deregulation through the Gramm-Leach-Bliley Act in the US had a significant impact on bank operational risk, an aspect not fully explained by Agency Theory (Chernobai et al., 2021). This suggests that operational risk management models need to integrate external environmental influences, including regulation and technology, into their analytical frameworks. Second, the use of Extreme Value Theory (EVT) in studies such as Han et al. (2015) shows that extreme operational risks, such as internal fraud or system failures, remain a major challenge in the banking industry. EVT is useful for predicting rare but high-impact events, which are often missed by conventional risk models. However, these findings also indicate that EVT models need to be updated to accommodate risks arising from new technologies, such as cyber risks and digital attacks, which are increasingly common in the modern banking context. **Uddin et al. (2023) highlight that cyber risk has become a major threat to banks, necessitating the integration of advanced technologies such as AI and blockchain into operational risk models (Uddin et al., 2023). Thus, EVT needs to be further developed to encompass new types of risks arising from digital transformation. Third, the findings on the importance of Organizational Information Processing Theory in Yin et al.'s (2024) research indicate that a bank's ability to process information effectively is key to mitigating operational risk. This theory emphasizes the importance of sound information systems in supporting decision-making and risk management. However, these findings also indicate that operational risk management models need to consider increasingly complex aspects of information technology, such as the use of big data and predictive analytics. Hu et al. (2024) found that technological innovation can increase operational risk if not managed properly, an aspect that has not been fully explained by Organizational Information Processing Theory (Hu et al.,2024). Therefore, this theory needs to be expanded to encompass information technology challenges in the context of operational risk. Overall, previous research findings indicate that operational risk models and frameworks need to be updated to accommodate changes in the external environment, such as regulations and technology, as well as new risks arising from digital transformation. Integrating multidisciplinary approaches, such as a combination of financial, information technology, and legal theories, is crucial in developing a more comprehensive operational risk model. Galletta et al. (2023) emphasize that a holistic approach is needed to understand the complexity of operational risk in an increasingly dynamic global context (Galletta et al., 2023). Thus, future research needs to focus on developing more adaptive and innovative models to address challenges and opportunities in bank operational risk management.

Theoretical Contributions

An analysis of previous research findings on bank operational risk provides significant theoretical recommendations for academic researchers in this field. First, the research shows that Agency Theory and Extreme Value Theory (EVT) are the dominant theories in understanding bank operational risk. Agency Theory explains how misalignment between ownership (principal) and management (agent) can lead to operational risk due to conflicts of interest and weak oversight (Elamer et al., 2020; Neifar & Jarboui, 2018). Meanwhile, EVT is widely used to measure extreme risk in bank operations, as in the study by Han et al. (2015) which used the Peaks Over Threshold (POT) model to quantify extreme operational risk in Chinese commercial banks. These two theories emphasize the importance of empirical and quantitative approaches in identifying and managing operational risk. Furthermore, the research also shows that Organizational Information Processing Theory is increasingly relevant in the context of operational risk influenced by information technology. This theory was used by Yin et al. (2024) to explain how banks process information in the face of complex operational risks, especially in the digital era (Yin et al., 2024). This approach suggests that the integration of information technology and risk management is key to reducing operational risk. This aligns with the findings of Hu et al. (2024) who showed that technological innovation can increase operational risk if not managed properly. It is also important to consider theories related to external regulatory changes, such as the Financial Repression Theory and the Financial Deepening Theory, which were used by Si et al. (2021) to analyze the impact of interest rate liberalization on the operational risk of energy companies in China (Si et al., 2021). These findings indicate that changes in economic policy and financial regulation have a significant impact on bank operational risk, especially in the context of globalization and financial market integration. Theoretical recommendations for academic researchers include the need to develop a more holistic conceptual framework by integrating various theories to understand the complexity of operational risk in the digital era. Future research should combine quantitative and qualitative approaches, and integrate factors such as information technology, regulatory changes, and financial market dynamics. For example, research can adopt a multidisciplinary approach that combines economic, technological, and legal perspectives to develop more comprehensive risk management strategies (Anderson & White, 2021). Furthermore, research should also consider regional and global contexts to understand differences in operational risk management across regions (Galletta et al.,2023). Overall, the theme of bank operational risk remains relevant in facing future challenges such as digitalization,

regulatory changes, and increasing cyber risk. Future research should focus more on developing innovative models and theories to address the complexities of operational risk in the modern era (Uddin et al., 2023). Thus, this research not only contributes to the development of science but also has significant practical implications for the global banking industry.

Practical Implications

Analysis of previous research on bank operational risk provides several practical implications and recommendations that can be implemented by practitioners in the banking sector. First, the dominant finding that operational risk is primarily related to inadequate quality control and human error underscores the importance of strengthening internal control systems and operational procedures within banks (Han et al., 2015; Si et al., 2021). Practitioners need to improve employee training and oversight of operational processes to reduce human error, which can lead to financial or reputational losses. Furthermore, the implementation of technologies such as process automation and artificial intelligence (AI) can help minimize operational errors caused by human factors (Uddin et al., 2023). Second, the growing body of research addressing cyber risks and the inadequacy of technological safeguards suggests that banks need to increase investment in cybersecurity to address the challenges of digitalization (Wang et al., 2020; Galletta et al., 2023). Practitioners are advised to adopt advanced technologies such as blockchain and data encryption to protect systems from cyberattacks and breaches. Furthermore, collaboration with third parties with cybersecurity expertise can be an effective strategy for strengthening defenses against digital threats (Hu et al., 2024). Third, the finding that regulatory changes are the dominant external factor influencing banks' operational risk underscores the importance of proactively following regulatory developments (Chernobai et al., 2021; Pinto & Marques, 2024). Practitioners need to establish a dedicated team or unit tasked with monitoring and adapting bank operations to new regulations, such as Basel III or the Capital Requirements Directive. This will help banks avoid regulatory sanctions and ensure compliance with global financial standards. Fourth, the dominance of quantitative methods in research indicates that data-driven approaches and statistical analysis are highly effective in managing operational risk (Xu et al., 2019; Si et al., 2021). Practitioners are advised to adopt analytical tools such as Monte Carlo simulation and panel data regression to more accurately predict and measure operational risk. The use of big data and analytics can also help banks identify risk patterns and take appropriate mitigation measures (Galletta et al., 2023). Finally, the increasing research focus on the impact of technology and digitalization suggests that banks need to integrate technological innovation into their risk management strategies (Uddin et al., 2023). Practitioners are advised to develop frameworks that incorporate technologies such as AI, machine learning, and blockchain to improve operational efficiency and reduce vulnerability to new risks in the digital era. Overall,The findings of this study provide valuable guidance for practitioners in addressing increasingly complex operational risk challenges. By adopting advanced technology, strengthening internal controls, and proactively complying with regulations, banks can enhance operational resilience and ensure future financial stability.

Research Limitations

An analysis of previous research on bank operational risk reveals several limitations that need to be acknowledged in the context of this systematic literature review (SLR). First, although most studies use quantitative methods such as panel regression analysis, Monte Carlo simulations, and Bayesian models (Han et al., 2015; Si et al., 2021; Galletta et al., 2023), there is significant variation in the methodological approaches employed. This makes it difficult to generalize the findings comprehensively, particularly since some studies use specific samples or regional contexts, such as China (Han et al., 2015; Xu et al., 2019) and the United States (Chernobai et al., 2021). Furthermore, qualitative studies using case studies or conceptual analysis (Schenk, 2017; Luburic, 2017) are fewer in number than quantitative studies, thus providing an unbalanced picture in understanding operational risk dynamics holistically. Second, the distribution of citations shows that research published in highly reputable journals, particularly Q1 journals, has a higher citation rate, such as the study by Si et al. (2021) with 87 citations and Elamer et al. (2020) with 89 citations. However, research published in Q2 or Q3 journals has a lower citation rate, such as the study by Sharifi et al. (2016) with 10 citations. This indicates that the quality and impact of research are highly dependent on the reputation of the journal in which it is published, so that research with strong methodology but published in lower-tier journals may receive less attention. Third, another limitation lies in the research focus, which is largely concentrated in the context of certain developed and developing countries, such as China and the United States, while research in other regions such as Africa or Latin America is still limited (Gadzo et al., 2019; Kirikkaleli et al., 2020). This results in a lack of equitable geographic representation, so the findings of this SLR may not fully reflect the dynamics of operational risk across regional contexts. Furthermore, research integrating emerging technologies such as blockchain and artificial intelligence remains relatively limited (Hu et al., 2024; Uddin et al., 2023), despite the significant potential these technologies have to transform operational risk management in the digital age. Overall, this SLR provides a valuable overview of trends in bank operational risk research, but it does have some limitations that should be acknowledged, particularly in terms of generalizability of the findings, geographic representation, and technology

integration.Future research needs to focus more on multidisciplinary approaches and more equitable representation to provide a more comprehensive understanding of operational risk in an increasingly complex global context.

Future Research Directions

The purpose of this systematic literature review (SLR) is to analyze and synthesize the existing literature on bank operational risk, focusing on relevant topics, research methods, and key findings. The topics covered cover various aspects of operational risk, including measurement, management, and disclosure of operational risk, as well as its impact on bank performance. Key findings in the literature indicate that bank operational risk is a complex and multidimensional issue, influenced by both internal and external factors. Common patterns identified include the dominance of quantitative methods in research, a focus on the impact of digitalization and governance, and increased attention to cyber and fraud risks. Emerging research trends indicate a shift towards the use of advanced technologies such as AI and big data analytics in operational risk management. Methodological limitations identified include a lack of in-depth qualitative research and limited real-time data. Topical gaps identified include a lack of research integrating environmental and social factors into operational risk analysis. The theoretical contribution of this SLR is to provide a more comprehensive understanding of bank operational risk and its implications for the banking industry. The practical implications include providing recommendations for banks and regulators to improve operational risk management and develop more effective policies. Recommendations for future research are to fill the topic gap by conducting more in-depth research on the integration of environmental and social factors in operational risk analysis, as well as developing more innovative and multidisciplinary research methods.

Closing Summary

An analysis of previous research on bank operational risk shows that this topic remains highly relevant and continues to evolve. Most studies use quantitative methods, such as panel regression analysis and Monte Carlo simulations, to measure and mitigate operational risk (Han et al., 2015; Si et al., 2021; Galletta et al., 2023). This research often focuses on the impact of digitalization and regulatory changes on bank operational risk (Chernobai et al., 2021; Uddin et al., 2023). For example, a study by Si et al. (2021) showed that lending rate liberalization can reduce the operational risk of energy companies in China, while Chernobai et al. (2021) found that financial deregulation in the United States significantly impacted bank operational risk. Research also shows that external factors, such as regulatory changes, and internal factors, such as governance and human error, play a significant role in determining the level of operational risk (Elamer et al., 2020; Neifar & Jarboui, 2018). Elamer et al. (2020) emphasize the importance of governance in mitigating operational risk in Islamic banks, while Neifar & Jarboui (2018) highlight that regulatory compliance can mitigate operational risk. Furthermore, human error and fraud remain the primary causes of operational risk, as demonstrated by Galletta et al. (2023) and Han et al. (2015). Therefore, research related to bank operational risk is not only academically relevant but also has significant practical implications for the banking industry. Future research should continue to integrate multidisciplinary approaches, such as big data-based analytics and artificial intelligence, to address emerging challenges (Uddin et al., 2023; Yin et al., 2024). Better integration of technology and risk management will be key to enhancing bank resilience amidst the complexities of the global financial industry. Therefore, this theme will continue to be an important focus in future finance and risk management research.

CONCLUSION AND SUGGESTIONS

Thematic analysis of the four major operational risk themes in banking (Internal Process Failure, Human Error, Technology System Failure, and External Events) shows that ignoring SOPs is the biggest cause of operational risk from internal business processes, followed by errors in account opening & transaction processes and inadequate quality control. Errors in executing transactions and procedures are the biggest operational risk events caused by human error/failure, followed by fraud and unauthorized trading. Operational risk due to technology system failure is mostly caused by operational errors related to the ability to use technology, followed by cyber attacks and the use of technology by unauthorized persons. Operational risk in banking due to external events predominantly occurs when there are unexpected changes in laws, almost all existing studies. This indicates that regulatory changes are a dominant factor in research related to bank operational risk. This trend shows that regulatory dynamics, especially unexpected ones, have a significant impact on operational risk management in the banking sector.

Classification of research based on operational risk factors and citations provides insight into the most frequently discussed topics in the context of bank operational risk. Technology/digitalization is the most frequently discussed topic. Governance and adoption of technology/digitalization are crucial aspects of managing bank operational risk. The implications of this trend suggest that future research should continue to address the role of technology and governance in mitigating operational risk. Therefore, the relevance of the topic of bank operational risk to future research challenges and opportunities is highly significant, particularly in the context of technology adoption and governance enhancement. Further research can focus on developing more effective

risk management models by leveraging technology and improving governance practices. Therefore, future research can significantly contribute to enhancing bank resilience and performance amidst increasingly complex global challenges.

Classification based on operational risk in specific sectors and its citations. It appears that the most frequently used content is "The Impact of Digitalization on Corporate Operational Risk" and "Disclosure of Bank Operational Risk" with several variations of related topics. This content most frequently appears related to "Governance" and "Technology/Digitalization". Meanwhile, the topic "Fraud" also has quite high citations. The implications of the trends displayed from this content indicate that research related to bank operational risk is currently more focused on the impact of technology and digitalization, as well as corporate governance. This is in accordance with the development of the banking industry which is increasingly adopting technology and facing challenges related to operational risk. Evaluation of the relevance of these themes to future research challenges and opportunities shows that topics related to bank operational risk are still highly relevant and have broad research opportunities. With increasingly rapid technological developments, research related to the impact of digitalization on corporate operational risk will continue to be an interesting topic. Therefore, future research can continue to develop related topics to contribute to the development of a better banking industry.

The dominant finding that operational risks are primarily related to inadequate quality control and human error underscores the importance of strengthening internal control systems and operational procedures within banks by improving employee training and oversight of operational processes to reduce human error that can lead to financial or reputational losses. Furthermore, the implementation of technologies such as process automation and artificial intelligence (AI) can help minimize operational errors caused by human factors. Banks need to improve cybersecurity to face the challenges of digitalization. It is also recommended to adopt advanced technologies such as blockchain and data encryption to protect systems from cyberattacks and breaches. Regulatory changes are a dominant external factor affecting bank operational risk. Therefore, management must be proactive in following regulatory developments, if necessary, establishing a special team or unit tasked with monitoring and adapting bank operations to new regulations. It is also recommended to develop a framework that incorporates technologies such as AI, machine learning, and blockchain to improve operational efficiency and reduce vulnerability to new operational risks in the digital era.

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