

Climate Change on Operational Risk: A Review and Policy Implications for Commercial Banks in Vietnam

Hang Thu Do

Banking Academy of Vietnam

ABSTRACT: This paper examines the impact of climate change on operational risk in Vietnam's commercial banking system from a theoretical review and policy-oriented perspective. It argues that climate-related risks do not constitute a standalone risk category but rather act as an amplifier of traditional banking risks, particularly operational risk. The study identifies primary transmission channels through which climate change affects operational risk: infrastructure and business continuity, IT and cybersecurity, human resources and internal processes, legal and reputational factors, and third-party dependencies. In the context of Vietnam—a highly climate-vulnerable country, the article highlights that commercial banks operate under high levels of climate exposure, while frameworks for managing climate-related operational risk remain at an early stage of development. Based on this assessment, the paper proposes six key policy recommendations, including the integration of climate risk into operational risk management frameworks, the standardization of climate-related data, and the development of a structured roadmap for climate risk disclosure. The findings contribute to the growing literature on climate risk in banking and provide practical implications for regulators and financial institutions in emerging markets.

KEYWORDS: Climate change; Operational risk; Commercial banks; Vietnam; Risk management; Policy implications

1. INTRODUCTION

Climate change is increasingly recognized not only as an environmental or social issue but also as a source of systemic financial risk that may significantly affect the stability and soundness of the banking system. International organizations and financial supervisory authorities have emphasized that climate-related risks do not constitute a distinct category of financial risk; rather, they act as risk drivers that transmit and amplify traditional banking risks, including credit risk, market risk, liquidity risk, and particularly operational risk (BCBS, 2021).

In recent years, most academic studies on climate-related risks in the banking sector have focused on the impacts of climate change on asset quality, credit portfolios, and the valuation of financial assets. However, the implications of climate change for operational risk in banking remain relatively underexplored in a systematic manner, despite the fact that this channel represents a direct transmission mechanism capable of spreading rapidly across the financial system. Extreme climate events may disrupt banking operations, weaken the capacity of financial institutions to deliver services, and amplify spillover risks to the real economy (Financial Stability Board, 2020).

From a supervisory perspective, many regulatory authorities have formally acknowledged the link between climate change and the operational resilience of financial institutions. Guidance issued by the European Central Bank highlights the need to integrate climate-related and environmental risks into

operational risk management frameworks, business continuity planning (BCP), and contingency arrangements (ECB, 2020). Similarly, the Prudential Regulation Authority of the Bank of England notes that climate-related shocks may increase systemic operational risks, particularly through channels such as technological infrastructure, outsourcing arrangements, and financial service supply chains (Prudential Regulation Authority, 2018).

Alongside supervisory expectations, international disclosure frameworks—such as the recommendations of the Task Force on Climate-related Financial Disclosures established by the Financial Stability Board—also encourage financial institutions to enhance transparency regarding how climate-related risks are identified, assessed, and managed across governance structures, business strategies, and risk management processes, including aspects related to internal operations and operational capacity (FSB, 2017).

In this context, developing economies such as Vietnam are considered highly exposed to climate-related risks. Vietnam frequently experiences typhoons, floods, and other extreme weather events that may disrupt economic activities and financial system operations (World Bank, 2020). Although the country has gradually developed policy frameworks on green growth and sustainable finance, the integration of climate-related risks—particularly operational risks—into the risk management frameworks of commercial banks remains at an early stage and has not been sufficiently examined in the academic literature. Therefore, this study

focuses on analyzing operational risks associated with climate change within the Vietnamese commercial banking system, with the aim of clarifying the key transmission channels and identifying existing gaps in current risk management practices.

Overall, while climate-related risks have attracted increasing attention in the finance and banking literature, existing studies largely focus on their implications for credit risk and financial stability. The relationship between climate change and operational risk in banking has not yet been systematically analyzed. This research gap is particularly important given that extreme climate events can directly disrupt banking infrastructure, information technology systems, and financial service supply chains. Addressing this gap, this paper aims to clarify the theoretical foundations of climate risk as a driver of banking risk and to analyze the main transmission channels through which climate change may affect operational risk in commercial banks. In addition, the study proposes several policy implications to strengthen the operational resilience of Vietnam’s banking system in the face of climate-related shocks. By doing so, the paper contributes to expanding the literature on climate-related financial risks in the banking sector, particularly in the context of developing and climate-vulnerable economies such as Vietnam. The remainder of this paper is organized as follows. Section 2 reviews the literature. Section 3 examines the Vietnamese context. Section 4 concludes with policy recommendations.

2. LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1. Climate Risk in the Banking Sector

Recent studies generally agree that climate-related risks do not exist as an independent category of financial risk; rather, they function as risk drivers that amplify the severity of traditional banking risks. This perspective has been emphasized in several foundational reports by the Bank for International Settlements, which indicate that climate risks may simultaneously affect credit risk, market risk, liquidity risk, and operational risk through multiple transmission channels (Bolton et al., 2020; BCBS, 2021).

In recent years, alongside the growing impacts of global climate change, climate-related risks have emerged as a significant concern within the risk management frameworks of the global financial system. Unlike conventional risks, climate risks exhibit systemic characteristics, have wide-ranging impacts, and may simultaneously affect multiple sectors of the economy. As a result, they can influence financial stability both directly and indirectly.

According to the Basel Committee on Banking Supervision (BCBS, 2021) and the Financial Stability Board (FSB, 2020), climate risk refers to financial risks arising from the direct or indirect impacts of climate change on the economy and the financial system. In general, climate-related risks are

classified into two main categories: physical risks and transition risks (FSB, 2020; BCBS, 2021).

First, physical risks arise from the direct impacts of climate-related events. These include (i) acute risks associated with extreme weather events such as storms, floods, droughts, or wildfires, and (ii) chronic risks resulting from long-term climatic changes such as sea-level rise, desertification, and gradual shifts in average temperatures. Such phenomena may increase the likelihood of severe operational risk events and directly affect business continuity in financial institutions (ECB, 2020).

In contrast, transition risks arise from the process of shifting toward a low-carbon economy. These risks may stem from changes in public policies, regulatory frameworks, technological developments, or shifts in consumer preferences and market expectations. For instance, stricter greenhouse gas emission regulations, carbon pricing mechanisms, or increasing pressure from investors regarding environmental, social, and governance (ESG) standards may alter firms’ cost structures, expected profitability, and asset valuations. These changes can subsequently affect credit profiles, financial asset pricing, and the liquidity conditions of financial institutions. For commercial banks, transition risks may increase compliance costs, legal risks, reputational risks, and the complexity of operational processes, thereby raising both the probability and potential severity of operational risk losses (Elderson & Heemskerk, 2020).

Therefore, properly identifying, classifying, and assessing the impacts of these two categories of climate risks is a critical prerequisite for financial institutions—particularly banks—to develop effective strategies for managing and mitigating risks in the context of intensifying climate pressures and increasingly stringent regulatory expectations.

2.2. Operational Risk in Banking and Its Link with Climate Change

According to the approach adopted by international supervisory authorities, climate-related risks affect banks’ operational risk through multiple interconnected transmission channels. Physical and transition risks may not only trigger individual operational risk events but may also weaken the overall operational resilience of banking institutions. Based on the review of existing literature, this study identifies five major transmission channels through which climate change may influence operational risk.

(i) Physical infrastructure and business continuity channel

One of the most direct channels through which climate change affects banks’ operational risk is the disruption of physical infrastructure and business continuity. Extreme weather events such as storms, floods, heatwaves, or large-scale inundation may directly damage banking infrastructure, including headquarters, branches, ATM networks, vault facilities, and data centers (Brei et al., 2019). When these assets are impaired, banks may experience transaction interruptions, delays in payment processing, reduced service

capacity, and increased costs related to recovery and operational adjustments. As a result, climate-related shocks can quickly translate from physical damage into operational risk events that affect the core functioning of banking institutions.

The severity of this channel largely depends on banks' ability to maintain operations under external disruptions. The European Central Bank highlights that climate shocks may significantly weaken Business Continuity Plans (BCP) if disaster and climate scenarios are not adequately incorporated into operational risk management frameworks (ECB, 2020). When climate events occur simultaneously across multiple regions or persist over extended periods, operational disruptions may propagate through payment networks, IT systems, and service supply chains, potentially transforming institution-specific incidents into broader systemic operational risks (Migliorelli & Dessertine, 2020).

(ii) Information technology, data, and cybersecurity channel

Another key transmission channel linking climate change and operational risk in banking relates to information technology infrastructure, data systems, and cybersecurity. As banking activities increasingly depend on digital infrastructure—such as core banking systems, electronic payment platforms, data centers, and digital banking applications—disruptions to technological infrastructure can significantly affect operational continuity. Extreme weather events, including storms, floods, or prolonged heatwaves, may cause power outages, telecommunications disruptions, hardware damage, or reduced operational capacity of data centers. Such disruptions can interrupt transaction processing, payment services, and data management systems, thereby increasing the likelihood of operational risk events related to system failures and technological processes.

In addition to the direct physical impacts on IT infrastructure, the adaptation of banks to climate-related disruptions may also indirectly increase technological risks. To maintain operations during disasters, banks often expand remote working models, rely more heavily on digital platforms, and increase the use of outsourced technology services. While these measures enhance operational flexibility, they may also enlarge the technological attack surface, increasing the risks of cyber incidents, data breaches, or attacks on payment systems. The Bank of England notes that climate-related shocks can expose vulnerabilities in IT governance and outsourced technology services, thereby increasing both the frequency and severity of operational risk events related to systems and data (Prudential Regulation Authority, 2018). This indicates that in the context of rapid digital transformation, climate risks may propagate from physical disruptions into technological and data systems, becoming a significant source of operational risk for banks.

(iii) Human, organizational, and internal process channel

Climate change may also influence operational risk through human, organizational, and internal process factors, which

constitute core elements of operational risk under the Basel framework. Extreme weather events, prolonged heatwaves, natural disasters, or climate-related public health risks may disrupt employees' ability to work, particularly in branches or regions directly affected by such events. These conditions can reduce labor productivity and interrupt the availability of key personnel in critical operational positions, thereby increasing the likelihood of operational errors, delays in transaction processing, and weakened internal control effectiveness.

Beyond human factors, climate change also poses challenges to banks' organizational structures and internal processes. As the risk environment becomes more complex and uncertain due to climate shocks, operational and risk management procedures may become less effective if they fail to incorporate climate-related risks. This may lead to process failures, such as the absence of contingency plans for operational disruptions, inadequate emergency procedures, or insufficient coordination mechanisms among departments during large-scale incidents. According to the Basel Committee on Banking Supervision, banks should integrate climate-related risks into their overall risk management frameworks, including operational risk management and related internal processes (BCBS, 2021). Without such integration, operational risk events may occur more frequently and become harder to control, increasing potential operational losses over time.

(iv) Legal, compliance, and reputational channel

Another important channel through which climate risks affect banks' operational risk is related to legal, compliance, and reputational factors, mainly arising from transition risks associated with the shift toward a low-carbon economy. As governments and financial regulators introduce stricter climate-related regulations, commercial banks face increasing requirements regarding legal compliance, climate risk disclosure, and accountability for environmental and social impacts. New rules related to climate risk reporting, ESG disclosure, and environmental and social risk assessments in lending activities require banks to adjust governance processes, data systems, and internal control mechanisms. Failure to meet these requirements may expose banks to legal risks such as regulatory violations, administrative penalties, or litigation, which can lead to operational risk losses (FSB, 2020).

In addition, reputational risk represents an important transmission channel of climate risk in banking. As expectations from investors, customers, and society regarding sustainable development continue to rise, financing environmentally harmful activities may damage a bank's reputation and undermine market confidence. International climate disclosure frameworks emphasize that financial institutions should transparently report how climate risks are identified and managed within their governance and risk management structures (FSB, 2017). When such disclosures are inadequate or fail to meet stakeholder expectations, banks

may face market pressure and reputational damage, which can indirectly increase operational risks (FSB, 2020).

(v) Third-party dependency and financial service supply chain channel

Another channel through which climate risks affect operational risk in banking relates to third-party dependencies and financial service supply chains. With the expansion of digital banking and technological partnerships, banks increasingly rely on external service providers such as IT infrastructure vendors, fintech firms, cloud service providers, data processing centers, and payment system operators. While such partnerships enhance efficiency and broaden financial service delivery, they also increase banks' vulnerability to external disruptions. Climate-related events such as severe storms, floods, or energy infrastructure disruptions may directly affect these service providers, potentially interrupting financial service supply chains and indirectly transmitting operational risks to banks.

International financial supervisory authorities have highlighted the importance of this transmission channel in climate risk management. The European Central Bank notes that banks should consider climate risks not only within internal operations but also in their relationships with third parties, particularly in outsourced services and critical technological infrastructures (ECB, 2020). Similarly, the Financial Stability Board emphasizes that growing reliance on technology providers and payment infrastructures may increase the financial system's vulnerability to climate shocks, especially when extreme events occur simultaneously across multiple regions (FSB, 2020). This indicates that climate risks may propagate through the network of relationships between financial institutions and service providers, thereby increasing the likelihood of systemic operational risk events.

The above analysis indicates that climate change can affect banks' operational risk through multiple interconnected channels, including physical infrastructure and business continuity, information technology and data systems, human and internal process factors, legal and reputational risks, as well as third-party dependencies and financial service supply chains. These channels do not operate independently; rather, they often interact and reinforce one another, allowing extreme climate events to rapidly translate into severe operational risk incidents. Consequently, climate change does not merely generate isolated disruptions to individual components of banking operations but may also weaken the overall operational resilience of financial institutions in the long run.

3. CURRENT SITUATION OF CLIMATE-RELATED OPERATIONAL RISKS IN VIETNAMESE COMMERCIAL BANKS

Vietnam is considered one of the countries highly exposed to climate-related risks. According to the Global Climate Risk Index 2021 published by Germanwatch, Vietnam ranked 13th

among the countries most affected by extreme weather events in the long term, and in 2020 the country was among those experiencing the most severe losses caused by storms and floods (Germanwatch, 2021). A national report by the World Bank (2020) also indicates that approximately 70% of Vietnam's population and economic assets are concentrated in coastal and low-lying delta areas, which are highly vulnerable to sea-level rise, storms, and flooding. In this context, climate risks do not only affect banks indirectly through borrowers but may also directly influence the operational structure of the commercial banking system.

First, physical risks arising from natural disasters and extreme weather events may disrupt branch networks and the physical infrastructure of banks. According to the Vietnam Disaster Management Authority (2020), natural disasters in 2020 alone caused losses of nearly VND 40 trillion, affecting large areas in Central Vietnam. By 2025, the total damage had increased to more than VND 98.7 trillion, resulting in 468 deaths or missing persons and causing severe destruction to infrastructure and agriculture, reflecting the increasing intensity of climate-related disasters (Vietnam Disaster Management Authority, 2025; Ministry of Agriculture and Environment, 2025). During major floods and storms, many urban and rural areas become isolated, experience power outages, or remain submerged for extended periods. For commercial banks, such conditions may lead to temporary branch closures, damage to equipment, disruptions in face-to-face transactions, and increased operational costs associated with recovery and repair. Although these losses are often recorded as general operational risk events, they are fundamentally direct consequences of climate-related risks.

In addition to physical infrastructure, the increasing reliance on information technology and digital banking has heightened the system's sensitivity to climate-related shocks. According to the State Bank of Vietnam (SBV, 2023), in 2023, the number of transactions conducted through Internet Banking has grown by more than 50% annually, while Mobile Banking transactions have increased by over 60% per year. By the first quarter of 2025, transactions via Internet and mobile banking reached 4.47 billion transactions, with a total value exceeding VND 41.8 quadrillion (SBV, 2025). This reflects the rapid expansion of cashless payments in Vietnam. The interbank electronic payment system processes a massive volume of transactions daily, indicating a high level of dependence on digital infrastructure. Under conditions such as widespread flooding, large-scale power outages, or telecommunications disruptions caused by major storms, the risk of disruptions to data centers, core banking systems, and digital banking channels becomes significant. Guidance from the European Central Bank (2020) emphasizes that climate risks can act as a driver of operational risk through external events that disrupt systems and internal processes. This highlights the need for Vietnamese banks to integrate climate scenarios into their Business Continuity Plans (BCP) and Disaster Recovery Plans (DRP).

Another notable channel of risk transmission is third-party dependency and financial service supply chains. The Banking Sector Digital Transformation Report (SBV, 2023) shows that most commercial banks in Vietnam have expanded cooperation with fintech companies, outsourced IT infrastructure services, and adopted cloud computing technologies. In this context, if technology service providers or payment infrastructure operators are affected by natural disasters, operational risks may be indirectly transmitted to banks. The Financial Stability Board (2020) warns that reliance on third-party service providers may amplify operational risks under extreme climate scenarios, particularly when disasters occur simultaneously across multiple regions. In practice, in Vietnam, the assessment of climate-related risks associated with outsourced partners has not yet become a standardized requirement within operational risk management frameworks.

In addition to tangible operational disruptions, the transition toward a green economy also generates operational risks in the form of legal, compliance, and reputational risks. Vietnam has issued Decision No. 21/2025/QĐ-TTg on the Green Taxonomy, which provides a framework for identifying and certifying green projects. This regulation increases the requirements placed on banks in assessing, classifying, and disclosing information related to environmental and social risks. According to the recommendations of the Task Force on Climate-related Financial Disclosures (FSB, 2017), financial institutions should clearly disclose information on governance, strategy, and climate risk management.

However, the level of disclosure among Vietnamese banks remains uneven, and the integration of climate risks into operational risk management systems is still at an early stage. Errors in the classification of green projects, insufficient transparency regarding climate exposure, or failure to meet the expectations of international investors may give rise to legal and reputational risks—both of which are commonly categorized under operational risk.

Another notable limitation in the current situation is the lack of data systems and measurement tools for operational risks associated with climate-related causes. According to the principles issued by the Basel Committee on Banking Supervision (2021), banks are expected to integrate climate-related risks into their existing risk management frameworks, including the identification, measurement, and monitoring of operational risk. In Vietnam, however, there is currently no publicly available database on operational risk losses categorized by climate-related causes. Stress testing of operational risk linked to disaster scenarios or green transition pathways remains uncommon, and quantitative indicators related to banks' operational resilience to climate shocks have not yet been standardized across the system. This gap reflects the divergence between international policy guidance and domestic risk management practices.

Overall, the current situation indicates that Vietnamese commercial banks operate in an environment with a high

level of climate exposure, while operational risk management frameworks have only begun to incorporate climate-related considerations. The growing dependence on digital infrastructure and third-party service providers increases the system's vulnerability to extreme weather events. At the same time, pressures from the green transition and the demand for greater transparency in climate-related disclosures are creating new challenges in terms of compliance and reputation. These factors suggest that climate-related operational risks are already present in Vietnam, but they have not yet been fully identified or adequately quantified within the risk management frameworks of many banks.

4. CONCLUSION AND RECOMMENDATIONS

From a policy perspective, the synthesis of theoretical insights and empirical observations indicates that the management of climate-related operational risk in Vietnam needs to shift from a reactive and fragmented approach toward a systematic and integrated framework embedded within banks' overall risk governance structures. Current international supervisory recommendations broadly follow this direction. The European Central Bank requires credit institutions to incorporate climate and environmental risks into their business strategies, risk appetite, organizational structures, risk reporting systems, existing risk management frameworks, capital adequacy assessments, operational risk management, stress testing practices, and the disclosure of material information (ECB, 2020). Similarly, the Financial Stability Board recommends that financial institutions structure climate-related governance and disclosures according to four core pillars—governance, strategy, risk management, and metrics and targets—while emphasizing the role of scenario analysis in assessing institutional resilience to climate shocks (FSB, 2017).

First, climate risks should be formally integrated into the operational risk management frameworks of commercial banks. Rather than treating climate risk solely as a component of green finance or ESG management, regulators should clearly recognize it as a transmission factor capable of affecting business continuity, physical infrastructure, information technology systems, third-party dependencies, legal exposure, and reputational risk. According to the ECB, banks are expected to incorporate climate risks into their existing risk management frameworks and to identify and quantify these risks as part of capital adequacy assessments (ECB, 2020). In the Vietnamese context, the State Bank of Vietnam (SBV) could gradually require commercial banks to update their operational risk management frameworks, risk registers, and internal reporting mechanisms to include a specific classification for operational risk events associated with climate-related factors.

Second, governance requirements and executive accountability for climate-related risks should be strengthened. In Vietnam, climate risks are still commonly viewed primarily through the lens of credit risk or corporate

social responsibility. A key policy recommendation is therefore to assign clear responsibilities to Boards of Directors, risk committees, and senior management for overseeing climate risks in relation to operational risk management. In addition, banks should establish dedicated focal points or cross-functional coordination mechanisms involving risk management, information technology, operations, legal compliance, and sustainability units to ensure that climate considerations are systematically incorporated into operational decision-making processes.

Third, the scope of operational risk management should be extended to include third-party relationships, outsourcing arrangements, and critical technological infrastructure. This recommendation is particularly important in Vietnam, where the banking sector is increasingly dependent on information technology providers, cloud service platforms, fintech firms, and payment infrastructure operators. Regulatory policies should therefore require banks to incorporate climate risk considerations into the selection, assessment, and monitoring of third-party service providers; introduce climate exposure criteria into outsourcing contracts; and develop contingency arrangements for critical service providers in the event of climate-related disruptions.

Fourth, there is a need to standardize data systems, indicators, and scenario analysis tools for climate-related risk management. The State Bank of Vietnam should develop a roadmap for establishing a minimum set of climate-related data indicators relevant to banking operations. Such indicators may include information on the geographic location of physical assets, infrastructure exposure to climate hazards, operational disruptions caused by natural disasters, dependence on third-party service providers, and operational losses linked to climate events. Based on these data foundations, banks can gradually implement stress testing or scenario analysis for climate-related operational risks, initially through qualitative approaches and subsequently progressing toward semi-quantitative and fully quantitative methodologies.

Moreover, disclosure requirements and market discipline regarding climate risks should be strengthened. According to the Financial Stability Board, climate-related disclosures should be structured around four pillars—governance, strategy, risk management, and metrics and targets—and integrated into publicly available financial reports or official annual disclosures to enable investors and stakeholders to assess institutions’ climate risk exposures (FSB, 2017). In the Vietnamese context, it may not be necessary to impose a comprehensive mandatory disclosure regime immediately. Instead, a phased implementation roadmap could be adopted based on the maturity of the banking system, initially prioritizing large banks, listed banks, and institutions with high levels of digitalization. Such an approach would align with international practices while simultaneously encouraging banks to improve their data systems, internal

governance structures, and risk assessment capabilities related to climate change.

Finally, from an institutional perspective, policy priorities should shift toward system-level climate risk governance, through the development of a phased but consistent supervisory roadmap. This roadmap should begin with the issuance of guidance on climate risk identification and reporting, followed by the gradual expansion to requirements related to Business Continuity Planning (BCP) and Disaster Recovery Planning (DRP), third-party risk governance, and climate scenario analysis. In the longer term, climate-related risks should be integrated into both microprudential and macroprudential supervisory assessments. Such an approach is essential for strengthening the long-term operational resilience of the banking system against climate-related shocks.

Overall, climate change is increasingly recognized as a source of financial risk capable of directly affecting the functioning of the banking system. Drawing on theoretical frameworks and international policy guidance, this study shows that climate-related risks can be transmitted to banks’ operational risk through multiple channels, including physical infrastructure and business continuity, information technology systems, human factors and internal processes, legal and reputational risks, and dependencies on third-party service providers. These channels are closely interconnected and may reinforce each other, thereby increasing the likelihood of severe operational risk events.

In the case of Vietnam, the analysis indicates that the banking system operates in an environment characterized by high exposure to climate-related risks, while the integration of climate considerations into operational risk management remains at an early stage. The increasing frequency of extreme weather events, together with the transition toward a green economy and the rapid digitalization of the banking sector, is likely to increase the system’s vulnerability to operational disruptions.

Based on these findings, the study proposes several policy directions to strengthen operational risk management in the context of climate change. These include integrating climate risks into operational risk management frameworks, strengthening the oversight role of bank governance bodies, enhancing operational resilience through improved business continuity planning, expanding risk governance over third-party service providers, and developing data systems to support climate scenario analysis. These policy orientations may contribute to improving the long-term resilience of the banking system against climate-related shocks.

However, due to the limited availability of data on operational risks associated with climate change in Vietnam, this study primarily relies on qualitative analysis. Future research may extend this work by developing empirical datasets and applying quantitative methods to more precisely evaluate the impacts of climate-related risks on banking operations.

REFERENCES

1. Basel Committee on Banking Supervision (BCBS). (2021). Climate-related risk drivers and their transmission channels. *Bank for International Settlements*.
2. Bolton, P., Després, M., Pereira da Silva, L., Samama, F., & Svartzman, R. (2020). Green Swans’: central banks in the age of climate-related risks. *Banque de France Bulletin*, 229(8), 1-15
3. Brei, M., Mohan, P., & Strobl, E. (2019). The impact of natural disasters on the banking sector: Evidence from hurricane strikes in the Caribbean. *The Quarterly Review of Economics and Finance*, 72, 232-239.
4. ECB, P. (2020). Guide on Climate-Related and Environmental Risks, Supervisory Expectations Relating to Risk Management and Disclosure. *Guide on climate-related and environmental risks. Supervisory expectations relating to risk management and disclosure*.
5. Elderson, F., & Heemskerk, I. (2020). Guide for Supervisors: Integrating climate-related and environmental risks into prudential supervision. *Network for Greening the Financial System*.
6. Financial Stability Board (FSB) (2017). Recommendations of the task force on climate-related financial disclosures. <https://www.fsb.org/uploads/P290617-5.pdf>
7. Financial Stability Board (FSB) (2020). The Implications of Climate Change for Financial Stability. *Financial stability board*. Financial Stability Board., www.fsb.org/wpcontent/uploads/P231120.pdf.
8. Migliorelli, M., & Dessertine, P. (2020). Sustainability and Financial Risks. *Palgrave Macmillan. Springer International Publishing*. <https://doi.org/10.1007/978-3-030-54530-7>
9. Prudential regulation Authority (2018). Transition in thinking: The impact of climate change on the UK banking sector. *Policy Statement*, <https://www.bankofengland.co.uk/-/media/boe/files/prudentialregulation/report/transition-in-thinking-the-impact-of-climate-change-on-the-ukbankingsector.pdf>.
10. State Bank of Vietnam (SBV). (2023). Annual banking report 2023. Hanoi: SBV Press.
11. State Bank of Vietnam (SBV). (2025). Annual banking report 2025. Hanoi: SBV Press.
12. UNEP, FI. and United Nations Environment Programme-Finance Initiative, 2018. Extending our horizons: Assessing credit risk and opportunity in a changing climate. *Part I: Transition-Related Risks and Opportunities*.