

Climate Change Risk Internalization on Providing Financing Evaluation Principle's

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Abstract: Climate change has become global concern, including to the business and commercial sector. This phenomenon occurs due to direct impact to financial institutions, especially banks. The risks could be categorized mainly into two forms, namely physical and transition. Banks have a significant role in financing economic activities because the debt portion is generally greater than equity. Banks need to consider the risk of climate change when evaluating financing. Banks can anticipate this from the start in the financing evaluation phase, where one of the approaches used is the 5C principle. This research aims to answer how climate change risks can be internalized in the principal stage of financing evaluation. The method used is desk study research using secondary data sourced from literature and benchmarks conducted by banks. The result of this research shows potential risks arise on climate change that affect the 5C principles, including the financial risk of climate change which results in rising sea levels can affect the value of assets that are collateral for debtors and decrease the debtor's capacity in fulfilling its obligation to the bank. Banks need to prepare their capacity to internalize climate change risks into bank risk management so that financial risks from a commercial perspective are well managed.

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INTRODUCTION

Currently, the world is facing major climate change that causes extreme temperature. Over five decades ago, global temperature in average has risen by 0.2°C every ten years (Kozarcanin et al, 2019). Temperature in 2021 even reached 1.11°C and adapting to global climate change is urgent (Sun et al, 2023). The primary cause of climate change is global warming, increasing concentrations of carbon emissions, especially from fossil fuels (Rodriguez et al, 2023). The continuous increase in greenhouse gas emissions is caused by several things such as previous unequal contributions, uneven energy use sustainability, land use changes, lifestyle and consumption patterns of society, and production between regions and even within countries and between countries (IPCC, 2023).

Climate change has become one of the main reasons causing physical risks in the form of natural disasters, exacerbating new risk impact on either nature and human as well the impacts of climate-influenced disasters, such as sea level rise, or even hurricanes, and worsening droughts due to climate change, occur over multiple time scales and are becoming more frequent, having far-reaching consequences (Tseng, 2019). Climate change will greatly affect living things because of extreme rain and prolonged drought which have implications for poverty and inequality in society (Ajeng & Rosalina, 2022;). Phenomena such as mudflows, wind, floods, or other natural disasters occur frequently that affect society significantly, which is of international concern (Wei, 2018). The increase in extreme weather events, which are expected to increase because of climate change, poses major challenges for nature and environmental management (Visoiu & Whinam, 2014).

Indonesia is a country prone to disasters caused by climate change, so resilience efforts are needed at both local and national levels (Abdillah et al., 2023). Indonesia is faced with various significant climate changes that affect various aspects of life (Worldbank, 2021). According to Pratiwi et al. (2022), climate change is also acknowledged to potential increase in health problems, which is up to 1.8% of Indonesia's national Gross Domestic Product (GDP). Indonesia's climate change circumstances could be measured by the extreme temperature changes and rainfall patterns as main indicators (Suryadi, et al, 2018). Climate change is also predicted to affect rice production in Indonesia through changes in rainfall (Khairulbahri, 2020).

According to the Bank for International Settlements (2021), financial risks affected by climate-change-related are divided into two main categories: physical risks, and transition risks. Physical risks are losses caused by events related to climate change such as floods, storms, heat waves, increases in average temperature, and/or other events. On the other hand, transition risk is a risk triggered by policies aimed at encouraging a net-zero carbon economy to fulfill the commitment to Green House Gas (GHG) emissions reduction as agreed in the Paris Agreement.

The economic and commercial impacts caused by climate change could cause huge future losses on financial institutions that affect essential global dilemma (Stela & Sajin, 2022). the economic well-being of almost all countries long-term growth and prosperity will also be disturbed by this climate change threat. Extreme event costs of US\$ 143 billion per year are incurred due to climate change (Newman & Noy, 2023). Climate change has also brought broad impact, even reaching the level of small-scale industries and households (Narayan et al, 2023). Moreover, climate change also affects the financial risk of the banking sector because climate risk can endanger financial stability by reducing the quality of bank loans (Zhang, 2024). The banking industry is starting to understand that climate change would have an impact on banking operations, procedures, and policies, by adopting the Green Banking model (Bukhari et al., 2020). Real climate change will also result in disruption to business, decreased productivity, damage to assets and infrastructure, and rising commodity prices. Therefore, the Financial Services Industry/Industri Jasa Keuangan (IJK) will be significantly impacted by climate change.

Climate change also gradually worsens corporate liquidity due to decline capital sources as well as reduced profitability which causes higher default rates that can disrupt the financial sector (Defermos et al, 2018). The debt profile in the areas affected by natural disasters have a higher probability of default or an increase in Non-Performance Loans (NPL) (Chen et al, 2022). Consequently, banks will try to limit their credit allocation to disaster-prone areas (Furukawa et al, 2020). If a disaster occurs, insurance payments are not enough to protect bank loans from financial difficulties so the possibility of NPLs remains (Noth & Schüwer, 2018). The damaging impact of carbon emissions, especially as a driver of global climate change, has triggered banks to reposition their lending strategies, including to refrain from lending to companies that have a bad ecological footprint such as causing pollution and other environmental hazards (Odeku, 2017).

The increasing frequency of hydrometeorological disasters in Indonesia, as linked to climate change, emphasizes the importance of adaptation and mitigation strategies (Putra et al, 2021). In a high environmental risk position, banks can refuse loans or carry out mitigation, including compensating in the form of increased interest rates. Financial institutions assess disasters related to climate change as a long-term risk that will affect interest rates for long-term loans (Nguyen et al., 2022). Interest is determined at the credit evaluation stage and one of the methods used is the 5C principle. The 5 C principles, which include Character, Capacity, Capital, Collateral, and Condition, are principles used to assess the suitability of a debtor to receive financing (Sembirin & Jannah, 2022).

The 5 C principles are very useful in making decisions about granting credit and can reduce non-performing loans (Kabir, 2022). The increasing frequency and impact of environmental risks mean banks can include environmental risks in providing financing evaluation analysis through the 5C principles. This research will study how environmental risks can be internalized into the 5C principles.

Internalizing environmental risk into financing evaluation principles means banks have an important role in mitigating environmental risk because when financing an economic activity, the portion of bank financing is generally the majority, namely 70% -80%.

According to the preceding discussion, it is evident that the relationship between climate change and financial stability has indeed been addressed in prior studies. However, existing literature tends to focus on the macro-financial implications of climate-related risks, including their impact on banking stability, non-performing loans, asset valuation, and climate stress testing (Dafermos et al., 2018; BIS, 2021; Zhang et al., 2024). Other studies emphasize green banking practices, ESG implementation, and sustainable finance as institutional responses to climate change (Bukhari et al., 2020; Ahmad et al., 2023). Despite those studies, the primary focus remains limited to understanding on how technical aspect risks and climate transition risks can be operationally integrated into the credit assessment process, especially within the conventional 5C financing evaluation framework used by lenders.

The existing studies generally treat climate risk management and credit assessment as two separate areas. As a result, there is still a conceptual and practical gap regarding how climate risk considerations should affect each dimension of the 5C principles, namely Character, Capacity, Capital, Collateral, and Economic Conditions. With increasing financial regulatory requirements asking banks to also integrate climate-related financial risks into corporate risk management and supervisory frameworks, there is a need to translate these regulatory expectations into operational lending practices. However, the existing literature has not yet provided a comprehensive framework that explains the interaction between climate related risks and each financing evaluation principle.

This study addresses a gap in prior research by proposing a conceptual framework to internalize climate change risks into the "5C" principles of financing evaluation. Unlike previous studies that largely examined climate risks from portfolio, regulatory, or macroprudential perspectives, this research focuses on the financing assessment process at the borrower level, the stage where initial lending decisions are made. Accordingly, this study extends the conventional 5C framework by incorporating climate-related physical (technical) and transition risks into each evaluation component, thereby offering a more comprehensive approach to credit risk assessment in a climate uncertainty context.

The proposed framework offers several contributions. Theoretically, it enriches the credit risk assessment literature by integrating climate-related financial risks into the classic "5Cs" lending framework, thereby bridging sustainable finance and conventional banking risk assessment. Practically, the findings provide guidance for banks in designing climate-sensitive credit assessment procedures, strengthening climate risk governance, supporting the implementation of climate stress testing, and aligning lending practices with the latest international standards issued by the Basel Committee on Banking Supervision (BCBS), the Task Force on Climate-related Financial Disclosures (TCFD), the International Sustainability Standards Board (ISSB), and Indonesia's Financial Services Authority (OJK). Consequently, integrating climate risk into financing evaluations is expected to enhance banking resilience while supporting the transition toward a sustainable financial system.

RESEARCH METHOD

The research approach is using qualitative by carrying out descriptive analysis. The research method that will be used in this research is the desk research study method based on a literature review, where the researcher will use secondary data related to the philosophy of the 5 C principles and the risks of climate change that impact the 5C principles. This research was conducted from November 2023 to January 2024 in Jakarta Province. This research uses secondary data sourced from books, journals, and literature related to the 5C principles and the risks of climate change both nationally and globally. The steps for this research were carried out as follows (1) Analysis of the philosophy of each 5C principle, (2) Analysis of climate change risks associated with each 5C principle, (3) Analysis of the impact on climate change risks that consider 5C principle, (4) Identify things that

need to be done by banks to internalize climate change risks into the financing evaluation process. All research steps will be discussed in each subsection of the 5 C principles.

This study employed a qualitative approach through a structured literature review based on narrative literature review. The method was selected because the research objective is to develop a conceptual framework explaining how climate risks can be internalized into the 5C credit evaluation principles, rather than to empirically test causal relationships. This approach enables the integration of multidisciplinary knowledge spanning climate science, banking risk management, sustainable finance, and credit assessment literature.

The literature review was conducted systematically through four stages: identification, screening, eligibility assessment, and synthesis. Scholarly publications were sourced from various internationally recognized databases such as Scopus, Web of Science, Google Scholar, Orchid and others. Additionally, policy documents and supervisory guidelines issued by international and national regulatory bodies, such as the Intergovernmental Panel on Climate Change (IPCC), the Basel Committee on Banking Supervision (BCBS), the Bank for International Settlements (BIS), the Network for Greening the Financial System (NGFS), the International Sustainability Standards Board (ISSB), the Task Force on Climate-related Financial Disclosures (TCFD), the World Bank, and the Financial Services Authority (OJK)—were included, as these institutions establish internationally accepted standards regarding climate-related financial risks.

RESULTS AND DISCUSSION

The risk of climate change is very strong both in terms of incidence and impact, so the financial services industry needs to detect it from the early stages of financing. Climate change phenomena will lead to an emergence of prudential risks in the banking sector (OJK, 2023). According to the Bank for International Settlements (2021), the banking system will be exposed to financial risks caused by climate change. These financial risks are (1) Credit risk, banks may be exposed to the risk of borrowers failing to repay their loans due to exposure to climate change risk, (2) Market risk, banks may be exposed to the risk of declining assets due to the impact of climate change, (3) Liquidity risk, banks may be disrupted in meeting their maturing obligations due to cash flows and liquid assets being exposed to climate change risks, (4) Operational risk, banks may have their operations disrupted due to exposure to climate change risks, (5) Reputation risk, market or customer sentiment due to negative perceptions of activities banks that are considered to cause climate change. The strong correlation between climate change and commercial risk becomes main consideration for internalizing the climate change impact to the 5C principles of lending.

The findings show that climate change should not be viewed as a separate or standalone category of banking risk. Instead, the technical or physical risks, and transition risks act as underlying risk drivers that spread into conventional financial risks, including credit, market, liquidity, operational, and reputational risks. Physical risks can arise from acute events, such as floods, storms, fires, and heatwaves as well as gradual changes, such as rising temperatures, sea level rise, and shifting precipitation patterns. Meanwhile, transition risks stem from changes in climate policy, technology, consumer preferences, market structures, and legal liabilities associated with the transition to a low carbon economy.

From the perspective of financial intermediation theory, banks or financing institutions transform short-term liabilities into longer-term financing while managing information asymmetry and borrower default risk. Climate change exacerbates this intermediation challenge because historical financial data may no longer adequately reflect a borrower's future risk profile. Borrowers who previously demonstrated stable financial performance may experience declining cash flows, assets losing economic value ("stranded assets"), rising operating costs, or weakened market access when exposed to physical or transition risks. Consequently, internalizing climate risk requires banks to

expand conventional, retrospective credit analysis into prospective assessments based on scenarios, geographic exposure, sectoral vulnerabilities, and adaptive capacity.

This interpretation aligns with Dafermos et al., (2018), who state that climate change can undermine corporate liquidity and financial stability, and with Zhang et al. (2024), who show that exposure to climate risk may reduce bank loan quality. There is also evidence that natural disasters increase non-performing loans, indicating that climate events are not merely environmental issues but directly impact the likelihood of borrower default and banks' expected credit losses (Chen et al., 2022). Thus, while the 5C framework remains useful, each of its components needs to be reconsidered to account for the unpredictable, long-term, and non-linear nature of climate-related financial risks.

The conceptual contribution of this study goes beyond merely adding environmental indicators to the existing 5C assessment. Instead, it aims to reposition the 5C principles as an integrated transmission framework through which climate-related risks affect borrower quality, loan performance, collateral recovery, and portfolio resilience.

1. Character

Banks need to look at the character of the prospective debtor to ensure that the loan given can be paid by the debtor. According to Sembirin & Jannah (2022), in general character due diligence is carried out through BI Checking and direct interviews. In the context of due diligence related to climate change risks, character checks cannot be carried out through systems within the financial services authority. The character of prospective debtors in carrying out risk management related to climate change risks is very important. Two aspects influence the character of implementing management related to climate change or ESG, namely:

- a. Track record of prospective debtor companies in implementing environmental risk management or implementing Environmental and Social Governance (ESG). There is a correlation between the implementation of risk management related to the environment or ESG. Several studies have validated the application of risk management related to the environment or ESG, namely (1) The application of ESG has an important role related to the environmental and economic impact of an organization (Ahmad et al, 2023), (2) ESG also put a positive yet significant impact on the corporate financial performance (Fu and Li, 2023), (3) The ESG performance of a company will have a positive effect on Financial Reporting Quality (Seker & Şengür, 2021).
- b. Top leader or top management of the prospective debtor. Former studies have validated the relationship between top leaders and ESG implementation performance and/or risk management, including (1) The CEO's character influences ESG implementation (Lazareva, 2022), (2) Transformational leadership will deliver a positive influence on ESG performance and innovative action in an organizations (Zhu and Huang, 2023), (3) Company leaders who pay attention to ESG implementation and make it an important part of their strategy can strengthen their financial performance (Fu & Li, 2023).

Banks can include these two approaches in the character principal evaluation section or part of the Know Your Customer (KYC) process. The more prospective debtors have a track record in including environmental, social, and risk management aspects in their business processes, the smaller the risk of climate change they will be exposed to. The highest policy in an organization is in the hands of the top leader, considering that risk management on climate change requires commitment of resources, the track record of the top leader is one of the keys.

2. Capacity

Regarding the capacity principle, banks need to ensure their prospective debtors' capability in fulfilling their obligations during the credit period. If the prospective debtor's financial performance is good, the better the credit quality will be. The risk of climate change is becoming increasingly real with the chances of its occurrence and impact also increasing. Physical climate and transition risks could increase levels of non-performing loans (NPL) that significantly affect financial stability. Climate risks can reduce bank loans quality that will endanger financial stability in long term (Zhang et al, 2024).

Banks need to pay attention to two risks related to climate change, which are physical risks and transition risks from business activities that will be financed by banks.

Physical risks are potential risks resulting from climate impacts such as floods, hurricanes, high temperatures, fires, rising sea levels, etc., which result in economic and financial losses (OJK, 2022). Physical risks can harm physical and non-physical assets as well as have an impact on environmental changes. Physical risks are closely related to ecosystem damage which ultimately affects economic activities (Bebbington et al., 2020). For example, increasing carbon in the atmosphere has the potential to increase crop failure due to rising temperatures. Indonesia, the world's largest archipelagic country, is very sensitive to long-term climate change.

Transition risk to climate change is a risk that occurs due to policy changes, technological improvements, and social dynamics that influence economic aspects and impact reputation, business, and asset values. Transition risk is a driver of financial risk consisting of credit risk, liquidity risk, market risk, and operational and reputation risk (OJK, 2023). Transition risk triggers are policies that support a net zero carbon economy in fulfillment of the Paris Agreement commitment to reduce greenhouse gases, such as an emissions trading system or carbon tax. Understanding transition risks is needed by economic sectors such as debtors operating along with the sector's sensitivity to adapting to a low-carbon economy (OJK, 2022).

Based on the capacity principle, banks need to integrate risk on climate change which include physical risks and transition risks into their risks data aggregation, then need to prepare in-depth stress testing and due diligence so that it does not affect banking financial risks deeply or can even result in systemic risks in one of the portfolios. financing provided by the bank. Banks must increase awareness and integrate physical risk analysis into their business strategies.

3. Capital

When financing a project, there is a certain composition for comparing debt and equity, known as the debt-equity ratio (DER). The equity portion is issued by investors as capital. For banks in financing, the greater the capital paid in, the more comfortable the bank is in providing loans. In general, the return on paid-in capital will be greater than the interest rate so it will ultimately affect the financial performance of the prospective debtor. Banks need to ensure the assumed amount of return on paid-in capital so that projects proposed for financing can remain viable and able to repay the loans provided. Like banks, investors will set high returns if the risk is high, and vice versa. There is also a correlation between climate change risk and the required return expected by investors, which can be represented through the cost of equity.

Several researchers have validated the relationship between cost of equity and climate change risk, including: (1) Companies with high levels of environmental and social performance (Ahmed et al, 2019), (2) Investors will make decisions based on risk information and environmental performance (Eriandani et al, 2019), (3) Climate vulnerability will affect the cost of equity (Kling et al, 2021). In terms of capital principles, banks need to ensure environmental risk management is carried out by prospective debtors so that they can ensure that climate change risks can be controlled, and the cost of capital can be lower. Thus, project costs will be lower and loan repayment rates can be better.

4. Collateral

Collateral is a guarantee that the bank asks for from prospective debtors regarding the proposed loan. Collateral will be valued by the bank to determine the value of the assets pledged as collateral and is one of the considerations when carrying out financing. Banks need to ensure that collateralized assets do not depreciate or even become stranded assets due to climate change risks. The value of an asset itself is also greatly influenced by physical risks and transition risks. Assets that are permanently exposed to physical risk will reduce the value of the asset, such as a factory that is permanently exposed to flooding during the rainy season, the value of which has the potential to decrease continuously. Meanwhile, assets that are exposed to transition risk can reduce their asset value or become trended assets. For example, when financing is carried out for a coal power plant and there is

a policy to stop power plants that use coal as fuel, the value of the power plant assets can decrease drastically.

The relationship between risk on climate change and asset value, have also informed in various studies, including (1) Climate change results in the loss of part or even all of the asset value (Colgan et al, 2020), (2) Asset prices can fall when climate change occurs (Furukawa, et al, 2020), (3) Assets recorded on bank balance sheets may be threatened by increased risk due to climate change (Mongeli et al, 2022). Banks need to carry out stress testing and scenario analysis of the assets they own to avoid exposure to market risk.

5. Condition of Economy

Economic conditions will affect company performance and people's purchasing power which is correlated with the loan repayment ability of prospective debtors. Banks need to consider future economic conditions. Economic conditions are influenced by global risks. According to WEC (2023), global risks ranked by severity for 2 years and 10 years from 2023 are dominated by environmental and social risks, where eight out of ten global risks originate from environmental and social risks. This risk dominance has an impact on global economic conditions being exposed to environmental and social risks. Other studies have validated the correlation between risk on climate change that affect economic conditions, namely (1) Environmental damage can hamper economic growth (Acheampong & Opoku, 2023), (2) Changes in environmental quality and increased pollution harm economic growth (Wang & Su, 2023), (3) Good economic growth will be in line with the quality of the environment (Wafiq & Suryanto, 2021). Environmental risks caused by climate change can affect economic conditions, making banks need to carry out scenario analysis and stress testing on loan portfolios and assets owned using environmental risk variables and economic conditions.

Overall, these findings indicate that the internalization of climate risk transforms the 5C framework traditionally dominated by historical data into a forward looking, scenario-based credit risk framework. These five principles should not be applied in isolation, as climate related deterioration in one dimension can impact the others. Weak climate governance can diminish adaptive capacity, low capacity can erode capital, declining capital can increase the likelihood of default; and a single climate event can simultaneously impair collateral recovery. Therefore, effective climate risk management requires an integrated assessment that links borrower level due diligence with portfolio-level scenario analysis, risk appetite, pricing, monitoring, and capital planning.

CONCLUSION

Environmental risks dominated by climate change greatly influence financing principles, especially the financing principles approach through the 5C approach which includes Character, Capacity, Capital, Collateral, and Condition of the economy. The increasing risk of climate change correlates with the 5C principles so it can affect the capacity of prospective debtors in fulfilling their loans repayment. Based on the character principle, banks can use a top leader profile approach and the track record of prospective debtors in managing the environment. Based on the capacity principle, banks can use the business vulnerability profile, including the prospective debtor's income, to climate change risks in assessing the prospective debtor's capacity to repay the loan. In terms of capital principles, banks can use a profile approach to the capital vulnerability of prospective debtors to climate change risks because financing in Indonesia generally comes from debt and equity. In terms of collateral principles, climate change risks either in the form of physical and/or transition risks could affect the existence of collateral value itself that potential debtors pledge to lenders. Environmental and social risks influenced by climate change are the dominant risks in global risk, making banks need to precisely consider the impact of climate change risks to economic conditions that can affect the loan repayment ability of prospective debtors.

The increasing real risk of climate change means banks needs to internalize this risk in the financing evaluation process. Banks need to make the following preparations (1) prepare tools to carry

out stress testing and scenario analysis to carry out financing evaluations, (2) Prepare time series data regarding climate change risks in each of their operational areas, (3) Prepare human resources within the organization to carry out evaluate climate change risks in the financing evaluation process.

This study demonstrates that climate-related physical and transition risks affect all dimensions of the "5Cs" financing evaluation framework. Climate risks should not be treated merely as an additional environmental checklist item, but rather as fundamental factors underlying conventional financial risks, influencing both the likelihood of borrower default and the potential losses a bank might incur in the event of default. The study's key contribution is the development of a conceptual framework that expands the 5Cs: Character to encompass climate governance and management credibility; Capacity to include climate adjusted cash flow resilience; Capital to cover loss absorption capacity and transition financing; Collateral to account for physical damage risks and stranded assets; and Conditions of Economy to include climate-sensitive macroeconomic, sectoral, geographic, and regulatory factors.

These findings also indicate that the five aspects are interconnected. Weak climate governance can diminish adaptive capacity, impair future cash flows, erode capital, and reduce collateral value. Consequently, climate change can simultaneously impact both primary repayment sources and secondary sources of repayment. This integrated interpretation broadens the scope of conventional credit risk analysis by linking sustainable finance considerations with borrower-level financing assessments. For the banking industry, climate risk needs to be incorporated into due diligence, internal rating processes, cash flow projection analysis, collateral valuation, pricing, covenants, monitoring, loss provisioning, and portfolio stress testing. Banks should implement differentiated responses based on levels of exposure, vulnerability, adaptive capacity, and residual risk, rather than relying solely on policies that single out specific sectors. For regulators, these findings underscore the need for standardized climate risk indicators, data disclosure requirements, scenario assumptions, supervisory guidelines, and proportionate implementation standards.

This study has limitations, as it relies on desk-based research design and secondary literature. The proposed framework has not yet been empirically validated, and the availability and comparability of borrower-level climate data remain limited. Furthermore, the study does not quantify the relative importance of climate variables within each of the "5C" dimensions, nor does it comprehensively differentiate between sectors, borrower scales, loan types, and maturities.

Future research should empirically test this framework using primary data sources from banks and borrowers, climate hazard indicators, and credit performance metrics. Follow-up studies could examine whether climate-adjusted 5C indicators improve the accuracy of predictions regarding probability of default, loss given default, non-performing loans, collateral value, and credit pricing. Research in Indonesia should also integrate regional hazard maps, sectoral emissions data, OJK stress-test scenarios, and qualitative evidence from banks, regulators, and borrowers.

Thus, integrating climate-related risks into the 5C framework can transform conventional credit evaluation, which has historically relied heavily on historical data into a banking risk management approach that is more forward looking, scenario based, and climate sensitive.

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