

Green Finance Business Model Innovation in Indonesian State-Owned Banks toward Net Zero Emission 2060: A Triple Layered Business Model Canvas Approach

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ABSTRACT

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Purpose—This study examines how Indonesian state-owned banks organize economic, environmental, and social value creation through green finance in the context of Indonesia's Net Zero Emissions (NZE) 2060 agenda.

Method—A qualitative multiple-case study investigated Bank Rakyat Indonesia (BRI), Bank Mandiri, Bank Negara Indonesia (BNI), and Bank Tabungan Negara (BTN). Eight purposively selected informants, two per bank, were interviewed. Sustainability reports identified in the source manuscript as 2024 reports and institutional documents supplemented the interviews. Framework Analysis used the 27 components of the Triple Layered Business Model Canvas (TLBMC), with NVivo supporting data organization and cross-case comparison.

Findings—The accounts indicate different emphases: inclusive micro, small, and medium enterprise financing at BRI; corporate and infrastructure financing at Mandiri; ESG governance at BNI; and housing finance at BTN. Sustainability commitments coexist with reported gaps in impact measurement and strategic–operational alignment. These patterns describe business orientations rather than a validated ranking of sustainability maturity.

Conclusion and Implications—Green finance integration remains uneven. Banks should strengthen outcome measurement, organizational capabilities, and alignment across the three value layers. The findings identify potential support for the NZE agenda; they do not establish attributable emissions reductions or achievement of the national target.

Originality/Value—The study adapts TLBMC to compare four banking cases and proposes an untested integration framework linking economic, environmental, and social value through governance and digital transformation.

Purpose—This study examines how Indonesian state-owned banks organize economic, environmental, and social value creation through green finance in the context of Indonesia's Net Zero Emissions (NZE) 2060 agenda.

Keywords : *green finance; sustainable banking; business models; triple layered business model canvas; state-owned banks; net zero emissions.*



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INTRODUCTION

Climate change affects environmental sustainability and economic and social stability. More frequent climate-related events create risks for businesses, communities, and financial institutions. International climate cooperation and Indonesia's commitment to Net Zero Emissions (NZE) by 2060 or sooner provide the context for examining how banks direct capital toward low-carbon activities (Santoso et al., 2025; Setiawan et al., 2021).

Achieving the national NZE agenda requires structural transformation across energy, transportation, industry, and forestry (Rahman et al., 2024). Net zero involves balancing residual anthropogenic greenhouse gas emissions with removals, while prioritizing substantial emissions reductions. Financial institutions can support this transition through capital allocation and engagement with financed businesses, although financing activity alone does not demonstrate a measurable climate outcome (Shahzad et al., 2024).

The financial sector can support a low-carbon transition by directing capital toward environmentally beneficial activities. Green finance encompasses services and investment that address environmental objectives, including mitigation and resource efficiency (Pratama & Firmansyah, 2024; ICMA, 2020). International experience provides context, while the present study focuses on how Indonesian state-owned banks organize the relevant financing and business processes.

Indonesia has substantial renewable energy potential, but realizing it requires sustained investment in low-carbon infrastructure (Santoso et al., 2025). The Financial Services Authority (OJK) provides an institutional context through the Sustainable Finance Roadmap and the Indonesian Sustainable Finance Taxonomy (TKBI). These instruments guide sustainable finance implementation, while the environmental contribution of individual financing activities still requires project-level classification and outcome evidence (OJK, 2021; Setiawan et al., 2021).

Within Indonesia's financial system, state-owned banks hold a strategic position due to their dominant share of national banking assets, credit distribution, and extensive service networks (OJK, 2021). Through green bonds, green credit, sustainability-linked loans, and ESG-based financing, state-owned banks are expected to play a leading role in financing renewable energy projects and supporting the national decarbonization agenda (Sutrisno et al., 2024). Previous studies have shown that green finance contributes not only to environmental sustainability but also to long-term bank profitability and financial stability (Riyanti et al., 2025). Green credit has been found to strengthen financial resilience while expanding sustainable investment portfolios (Sutrisno et al., 2024). Nevertheless, significant differences remain in the implementation strategies among Bank Mandiri, BRI, BNI, and BTN, particularly regarding target sectors, financing mechanisms, and sustainability integration within their business operations.

Despite the growing adoption of green finance, limited studies have examined how state-owned banks integrate economic, environmental, and social value creation within their business models. Most existing studies focus on financing instruments, regulatory frameworks, or financial performance rather than business model transformation (Lyons & White, 2025). Furthermore, the role of green finance in accelerating Indonesia's energy transition remains highly dependent on financing governance and institutional collaboration (Massagony et al., 2025). Therefore, this study aims to analyze the business models of Indonesian state-owned banks in implementing green finance to support the Net Zero Emissions 2060 target using the Triple Layered Business Model Canvas (TLBMC) framework. TLBMC extends the traditional Business Model Canvas by incorporating environmental and social dimensions alongside economic value creation (Joyce & Paquin, 2016). Through this approach, the study seeks to identify how state-owned banks create sustainable value and contribute to Indonesia's transition toward a low-carbon economy.

The gap addressed here concerns how economic, environmental, and social value are organized and aligned within the business models of four state-owned banks. Prior work cited in this manuscript addresses banking profitability and stability (Sutrisno et al., 2024; Riyanti et al., 2025), multiple forms of value in green banking (Lyons & White, 2025), and the institutional conditions of Indonesia's energy transition (Massagony et al., 2025). This study brings those concerns into a comparative, component-level analysis of banking business models. Its novelty is contextual and analytical: it applies and adapts TLBMC across four cases rather than claiming to introduce a new sustainability theory.

The study asks: (1) How do the four banks organize green finance activities across the economic, environmental, and social layers? (2) What similarities, differences, and integration gaps emerge across cases? (3) What conceptual integration mechanisms can be proposed from these patterns? The analysis treats NZE 2060 as a policy context and does not measure each bank's attributable contribution to national emissions reductions.

LITERATURE REVIEW AND PROPOSITION DEVELOPMENT

Sustainable Finance and Green Finance

Sustainable finance refers to the mobilization and allocation of financial resources to support sustainable economic development while considering environmental, social, and governance (ESG) factors in financial decision-making. Sustainable finance aims to ensure long-term economic growth without compromising environmental quality and social welfare (Sommer, 2020). According to Ryszawska (2016), sustainable finance integrates economic, environmental, and social dimensions into financial activities to support sustainable development. Similarly, the International Capital Market Association defines sustainable finance as financial activities that combine climate, green, and social finance while considering long-term economic sustainability and financial system stability (ICMA, 2020).

The United Nations Environment Programme emphasizes that sustainable finance supports inclusive and sustainable economic development by addressing environmental, social, and economic challenges simultaneously (UNEP, 2017). In the Indonesian context, sustainable finance has become an important framework for directing capital allocation toward renewable energy, energy efficiency, sustainable agriculture, and responsible natural resource management (Setiawan et al., 2021). Furthermore, the integration of ESG principles into financial practices contributes to long-term financial stability and sustainable value creation for stakeholders (Jeucken, 2010). Therefore, sustainable finance serves as a foundation for green finance implementation and supports the achievement of national climate objectives, including Net Zero Emissions targets.

Green finance refers to financial activities that support environmental sustainability, climate change mitigation, and efficient resource utilization. It aims to achieve economic growth while reducing pollution, greenhouse gas emissions, and environmental degradation (ICMA, 2020). Green finance includes financial instruments and investment mechanisms designed to support environmentally sustainable projects and activities.

According to Hühne et al. (2012), green finance encompasses financing for climate mitigation and adaptation activities, including investments in renewable energy, energy efficiency, sustainable transportation, and environmental conservation. Ahmad et al. (2025) further define green finance as a mechanism that mobilizes financial resources to support climate-resilient and low-carbon economic development while integrating ESG considerations into financial decision-making processes.

Green loans and green bonds finance eligible environmentally beneficial activities, whereas sustainability-linked financing connects financial terms to specified sustainability performance (Loan Market Association, 2025). These instruments should not be treated as environmentally equivalent without examining their criteria and implementation. Similarly, lending to MSMEs or housing can generate social value without necessarily qualifying as green finance. In this study, social inclusion, green financing activities, and environmental outcomes are therefore distinguished (ICMA, 2020).

Business Model Innovation and Stakeholder Perspectives

Business Model Innovation Theory explains how organizations create, deliver, and capture value through innovative business structures and processes. According to Osterwalder and Pigneur (2010), a business model describes the rationale of how an organization creates, delivers, and captures value. Business model innovation occurs when organizations redesign fundamental elements of their business models to respond to changing market conditions and emerging sustainability challenges (Osterwalder & Pigneur, 2010).

Amit and Zott (2012) argue that business model innovation involves redesigning the relationships among key business activities, governance structures, and value creation mechanisms. Competitive advantage is no longer derived solely from products and services but

also from an organization's ability to develop innovative and sustainable business models. Within the banking sector, business model innovation is increasingly important in supporting sustainable finance initiatives and maintaining long-term competitiveness (Simangunsong & Rahadian, 2025). Consequently, the integration of sustainability principles into banking business models has become essential for supporting green finance implementation and climate transition strategies.

Stakeholder Theory suggests that organizational success depends not only on financial performance but also on the ability to address the interests and expectations of stakeholders. Freeman and McVea (2001) define stakeholders as individuals or groups that can affect or be affected by organizational activities. This perspective emphasizes that organizations must balance economic objectives with social and environmental responsibilities.

The Global Impact Investing Rating System explains that stakeholders include all parties who experience positive or negative impacts from organizational decisions. According to UNEP (2017), stakeholder engagement contributes to risk management, organizational learning, and strategic value creation. In the banking industry, stakeholder engagement involves collaboration with regulators, customers, investors, employees, communities, and environmental organizations. Effective stakeholder management is particularly important for state-owned banks because green finance initiatives require cooperation among multiple actors to support climate mitigation and sustainable development objectives.

Business model innovation directs attention to changes in the way banks create, deliver, and capture value; the presence of a sustainability product alone does not establish such a change. Stakeholder Theory helps interpret how banks distribute benefits and responsibilities among customers, employees, communities, investors, and regulators. These perspectives complement sustainable finance by explaining organizational choices and stakeholder implications rather than supplying three separate lists of definitions.

Green Finance and the Net Zero Emissions Agenda

Net Zero Emissions refers to a condition in which greenhouse gas emissions generated by human activities are balanced by greenhouse gas removals from the atmosphere. According to the Intergovernmental Panel on Climate Change, net zero is achieved when anthropogenic emissions are balanced by anthropogenic removals over a specified period (IPCC, 2018). This concept has become a central objective in global climate policy due to its importance in limiting global warming and reducing climate-related risks.

Green finance plays a crucial role in achieving Net Zero Emissions targets because it provides the financial resources required to support low-carbon economic transformation. Large-scale investments are needed to develop renewable energy systems, improve energy efficiency, modernize transportation infrastructure, and promote sustainable industrial practices. Green finance facilitates these investments by directing capital toward

environmentally sustainable projects and reducing financial barriers to climate action (OECD, 2017).

Research demonstrates that green finance contributes significantly to carbon emission reduction through increased green investment and improved capital allocation efficiency (Zhang et al., 2023). Green finance also accelerates technological innovation and supports the development of clean energy solutions that are necessary for long-term decarbonization (Zhang et al., 2023). Furthermore, green financing mechanisms such as green bonds and green loans have been identified as essential instruments for supporting energy transition and achieving climate goals (Ali et al., 2023). Therefore, green finance functions not only as a source of funding but also as a strategic driver of sustainable economic transformation and Net Zero Emissions achievement.

The connection between green finance and NZE requires several analytical steps: allocation of finance, implementation of eligible activities, environmental outcomes, and contribution to an emissions trajectory. The present study examines the first two primarily through organizational accounts. It does not estimate counterfactual emissions, additionality, or a national decarbonization pathway. Claims about climate impact are accordingly interpreted as reported or expected contributions unless supported by outcome measurements.

Adapting the Triple Layered Business Model Canvas to Banking

This study utilized the Triple Layered Business Model Canvas (TLBMC) developed by Joyce and Paquin (2016) as the primary analytical framework. TLBMC extends the traditional Business Model Canvas by incorporating environmental and social dimensions alongside economic value creation. The framework enables a holistic evaluation of how organizations create, deliver, and capture value while addressing sustainability challenges.

The economic layer consists of nine components: customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure. These components were used to analyze how green finance contributes to business performance and value creation within state-owned banks.

The environmental layer examines the environmental implications of banking activities through nine dimensions, including supplies and outsourcing, production, materials, functional value, distribution, use phase, end-of-life considerations, environmental benefits, and environmental impacts. These dimensions provide insights into how banks contribute to environmental sustainability through financing policies, operational efficiency, and climate-related initiatives.

The social layer evaluates social value creation through local communities, governance, employees, social value, societal culture, scale of outreach, end-users, social impacts, and social benefits. This layer facilitates understanding of how green finance initiatives contribute to social welfare, financial inclusion, stakeholder engagement, and sustainable development objectives.

The economic layer maps value creation, delivery, and capture. The environmental layer distinguishes the bank's service operations from the activities it finances, while the social layer maps stakeholder relationships and benefits. Table 1 specifies the analytical adaptation used to interpret the existing findings. No life cycle assessment was conducted.

METHOD

Research Design

This study employed a qualitative research approach using a multiple-case study design to explore how Indonesian state-owned banks implement green finance and integrate sustainability principles into their business models to support the Net Zero Emissions (NZE) 2060 target. Qualitative research was selected because it enables a comprehensive understanding of organizational strategies, decision-making processes, and sustainability practices within their natural settings (Creswell & Poth, 2018). The study adopted a post-positivist paradigm, which assumes that social reality can be understood through empirical observation while recognizing the influence of contextual interpretation in explaining organizational phenomena (Lincoln & Guba, 1985).

The study has a descriptive qualitative purpose and uses a multiple-case design. The analysis combines a deductive framework based on TLBMC with interpretation of themes emerging from the interviews and documents. This is more accurately described as a framework-guided, deductive–inductive process than as wholly inductive reasoning. The study explores reported organizational practices rather than testing causal hypotheses or estimating climate impact.

The multiple-case study strategy was selected because it allows comparison across different organizational contexts while maintaining analytical depth. Four Indonesian state-owned conventional banks—Bank Rakyat Indonesia (BRI), Bank Mandiri, Bank Negara Indonesia (BNI), and Bank Tabungan Negara (BTN)—were chosen as research cases. These institutions represent the largest banking entities in Indonesia and play a strategic role in implementing sustainable finance policies established by the Financial Services Authority (OJK). Moreover, all four banks have publicly declared commitments to sustainability, ESG integration, and green financing initiatives, making them suitable cases for investigating sustainable banking business models.

The unit of analysis in this study was the organization. Each bank was treated as an independent case, while comparisons across cases were conducted to identify similarities, differences, and common patterns in green finance implementation. The study was conducted under non-contrived settings, meaning that data were collected without manipulating organizational activities or influencing ongoing business operations. Furthermore, a cross-sectional time horizon was adopted, whereby data collection occurred during a specific period and reflected the current state of green finance implementation within the participating banks.

Case and Informant Selection

The population of this study consisted of all state-owned commercial banks operating in Indonesia. Based on official records from the Financial Services Authority (OJK), four state-owned conventional banks meet the criteria for inclusion: Bank Rakyat Indonesia (BRI), Bank Mandiri, Bank Negara Indonesia (BNI), and Bank Tabungan Negara (BTN). These banks collectively dominate the Indonesian banking industry in terms of assets, lending portfolios, and market influence, making them highly relevant to the study of green finance implementation.

Purposive sampling was employed to select research participants. This technique was chosen because qualitative research requires informants who possess specific knowledge, experience, and involvement related to the research topic (Sugiyono, 2019). Participants were selected based on the following criteria: (1) employed by a state-owned conventional bank; (2) involved in sustainability, ESG, green finance, corporate planning, or strategic management functions; (3) holding strategic or implementation-level positions related to sustainability initiatives; (4) having at least one year of organizational experience; and (5) possessing direct involvement in green finance programs or sustainable banking activities.

A total of eight informants participated in the study, consisting of two representatives from each bank. One participant represented the strategic level, such as sustainability executives or corporate planning managers, while the other represented the implementation level, such as ESG managers, green lending officers, or sustainability specialists. This structure enabled the study to capture both strategic perspectives and operational experiences regarding green finance implementation.

Case selection and informant selection operate at different levels. The four banks constitute the organizational cases, while two informants per bank provide situated accounts. The designation “strategic” refers to the level assigned in the original study and does not establish that each informant had equivalent authority over bank-wide policy. Variations in role, organizational level, and access to information are treated as limitations of cross-case inference.

Data Collection and Documentary Sources

The study employed both primary and secondary data sources. Primary data were collected through semi-structured in-depth interviews. This method allows researchers to explore participants’ experiences, interpretations, and perspectives while maintaining flexibility to investigate emerging themes during the interview process (Creswell & Poth, 2018).

Interview questions were developed based on the 27 elements of the Triple Layered Business Model Canvas. The interview protocol was reviewed through expert judgment to ensure alignment with the study objectives and theoretical framework. Interviews focused on understanding how banks create economic, environmental, and social value through green finance initiatives, ESG integration, sustainability governance, and climate-related financial strategies.

Secondary data were collected from sustainability reports, annual reports, ESG disclosures, regulatory documents, OJK publications, government policies, and academic literature. These

documents provided contextual information and facilitated triangulation of interview findings. Combining primary and secondary data strengthened the validity of the research by enabling cross-verification of information obtained from different sources.

The source manuscript identifies sustainability reports as 2024 reports and labels the processed findings as 2026 research data. The interview period and the reports' reporting and publication years require clarification. The temporal boundary must therefore be confirmed before comparisons are interpreted as contemporaneous. Corporate disclosures provide contextual evidence but may reflect selective self-reporting; they should be examined alongside interview accounts rather than assumed to provide independent verification of every claim.

Data Analysis

Data analysis was conducted using Framework Analysis supported by NVivo software. Framework Analysis is particularly suitable for policy-oriented and organizational research because it provides a systematic approach for identifying, organizing, and interpreting qualitative data (Ritchie & Spencer, 2003). The analytical process followed five sequential stages. The first stage, familiarization, involved repeatedly reviewing interview transcripts, sustainability reports, and supporting documents to gain a comprehensive understanding of the data. During this stage, preliminary ideas and patterns related to green finance and sustainability practices were identified.

The second stage, identifying a thematic framework, involved developing coding categories based on the three layers of the Triple Layered Business Model Canvas. Themes were derived from both theoretical constructs and emerging empirical findings. The third stage, indexing, consisted of coding data according to the established framework. Interview excerpts and documentary evidence were assigned to relevant categories using NVivo. Analytical memos were simultaneously created to document insights and emerging relationships among themes.

The fourth stage, charting, involved organizing coded data into thematic matrices that facilitated within-case and cross-case comparisons. NVivo matrix coding queries were used to identify similarities and differences among banks regarding green finance implementation, ESG integration, and sustainability value creation. The final stage, mapping and interpretation, focused on synthesizing findings and identifying relationships among economic, environmental, and social dimensions. Through this process, conceptual patterns were developed to explain how state-owned banks integrate green finance into their business models and contribute to Indonesia's Net Zero Emissions 2060 agenda. The resulting analysis provides both organization-specific insights and broader conceptual implications regarding sustainable banking business models in emerging economies.

The 27 TLBMC components form the initial coding structure. Cross-case interpretation examines differences in financing orientation, ESG governance, and reported integration gaps. Orientation categories are descriptive and may overlap; they do not assign banks to mutually exclusive maturity stages. NVivo supports organization and comparison of evidence, but the credibility of an interpretation depends on the underlying excerpts, documentary references, and analytical decisions.

Trustworthiness and Researcher Reflexivity

To ensure research rigor, the study adopted the trustworthiness criteria proposed by Lincoln and Guba (1985), consisting of credibility, transferability, dependability, and confirmability. Credibility was established through source triangulation and method triangulation. Source triangulation involved comparing information obtained from different informants across banks and managerial levels. Method triangulation involved comparing interview findings with sustainability reports, ESG disclosures, and institutional documents. Member checking was also conducted by sharing interpretations with selected participants to confirm the accuracy of findings.

Transferability was enhanced by providing detailed descriptions of organizational contexts, sustainability practices, regulatory environments, and green finance strategies within each bank. Such contextual information enables readers to assess the applicability of findings to other settings. Dependability was ensured through maintaining an audit trail that documented all stages of data collection, coding, analysis, and interpretation. Research procedures, interview guides, coding structures, and analytical decisions were systematically recorded to facilitate transparency and replication.

Confirmability was achieved through reflexive practices, documentation of evidence, and the use of triangulation techniques. All findings were grounded in empirical data rather than researcher assumptions, ensuring that interpretations accurately reflected participant perspectives and documentary evidence.

The procedures described above are reported in the original manuscript. Their implementation should be made assessable through examples of corroboration, disagreement, and member-checking feedback. Where interviews and disclosures diverge, both accounts should be retained and interpreted. The researcher's relationship to participating institutions and potential assumptions about sustainability should also be disclosed.

Ethical Considerations

Informants are identified by codes N1–N8 in this manuscript. Initials have been omitted to reduce identification risk. Bank and role information remain analytically relevant but require confirmation that their disclosure is consistent with participant consent and any institutional restrictions.

RESULTS AND DISCUSSION

A. RESULTS

Informant Characteristics and Scope of the Findings

This study involved eight informants representing four Indonesian state-owned banks, namely Bank Rakyat Indonesia (BRI), Bank Mandiri, Bank Negara Indonesia (BNI), and Bank Tabungan Negara (BTN). Informants were selected using purposive sampling based on their involvement in sustainability initiatives, Environmental, Social, and Governance (ESG) programs, and green finance implementation within their respective institutions. To obtain

comprehensive information, informants were drawn from two organizational levels, namely the strategic level and the implementation level, allowing the study to capture both policy formulation and operational execution perspectives.

Eight informants contributed accounts from different business functions. The diversity offers complementary perspectives but does not establish equal access to bank-wide strategy. Table 2 retains the reported roles while separating them from claims of organizational representativeness.

Table 2 Characteristics of Informants

Code	Bank	Reported position	Assigned level
N1	BRI	Micro and Retail Risk and Compliance Manager	Strategic
N2	BRI	Individual Relationship Manager	Implementation
N3	Mandiri	Branch Manager	Strategic
N4	Mandiri	Sales Generalist Promotion	Implementation
N5	BNI	ESG Management Officer	Strategic
N6	BNI	Micro Relationship Manager	Implementation
N7	BTN	ESG Division Data and Reporting	Strategic
N8	BTN	SME Relationship Manager	Implementation

Note. Levels follow the original study classification. Branch-level strategic responsibility is not equivalent to bank-wide strategic authority. Informant initials have been removed.

The following findings summarize reported activities and interpretations. Expected benefits are distinguished from measured outcomes. Direct quotations and document-page references remain necessary to substantiate the main themes; the descriptive matrices should not be read as independent verification of every activity or its impact.

Green Finance Business Model of BRI

Based on interviews with informants N1 and N2, supported by sustainability reports and related corporate documents, Bank Rakyat Indonesia (BRI) has integrated green finance into its business strategy as part of its commitment to sustainable finance and Indonesia's Net Zero Emissions (NZE) 2060 agenda. The implementation of green finance at BRI is not only reflected in financing allocation toward environmentally friendly sectors but also in the integration of Environmental, Social, and Governance (ESG) principles into business processes, risk management, customer engagement, and operational activities.

From the strategic perspective, informant N1 explained that BRI has adopted sustainable finance principles through internal policies that align with the Sustainable Finance Roadmap issued by the Financial Services Authority (OJK). Green finance implementation is integrated into risk assessment processes, financing policies, and portfolio management. According to the informant, sustainability considerations have increasingly become part of financing decisions, particularly for sectors related to renewable energy, sustainable agriculture, waste management, energy efficiency, and environmentally friendly infrastructure.

Meanwhile, informant N2 explained that at the implementation level, green finance is primarily reflected through financing distribution to individual and micro-segment customers who conduct environmentally responsible business activities. The informant emphasized that financing assessments increasingly consider environmental aspects and business sustainability, particularly for customers operating in sectors that support sustainable development. This indicates that green finance implementation at BRI is not limited to policy formulation but has also been operationalized in financing activities at the customer level.

Table 3 summarizes the economic layer of the reported BRI model.

TLBMC component	Reported practice or interpretation
Key partnerships	OJK, Bank Indonesia, government ministries, ESG consultants, renewable energy developers, and sustainability institutions
Key activities	Green financing, ESG risk assessment, reporting, customer education, and portfolio management
Key resources	Financial capital, ESG policies, sustainability teams, digital systems, and risk infrastructure
Value proposition	Financing intended to support environmental sustainability alongside business growth
Customer relationships	Long-term partnerships, advisory services, education, and financing assistance
Channels	Branches, digital and mobile banking, relationship managers, and business networks
Customer segments	MSMEs, retail customers, renewable energy businesses, sustainable agriculture, and environmentally oriented projects
Cost structure	ESG implementation, reporting, training, technology, and monitoring
Revenue streams	Financing income, sustainable investment returns, and banking services

Note. Author synthesis of the reported interviews and documentary analysis. Benefits described as expected are not quantified outcomes.

Table 4 Environmental Layer of the BRI Green Finance Business Model

TLBMC component	Reported practice or interpretation
Supplies and outsourcing	Preference for environmentally responsible procurement and suppliers
Production	Paperless initiatives, energy efficiency, and digital banking
Materials	Reduced paper use and environmentally oriented office equipment
Functional value	Financing of renewable energy and environmentally oriented businesses
Distribution	Digital service delivery intended to reduce physical resource use
Use phase	Expected environmental benefits of financed activities
End-of-life	Project monitoring is reported; closure and asset end-of-life evidence are not specified
Environmental impacts	Operational footprint and environmental effects are described, without comparable outcome estimates
Environmental benefits	Expected contributions to energy efficiency, emissions reduction, and conservation

Note. Author synthesis of the reported interviews and documentary analysis. Benefits described as expected are not quantified outcomes.

Table 5 Social Layer of the BRI Green Finance Business Model

TLBMC component	Reported practice or interpretation
Local communities	Local economic development and MSME empowerment
Governance	ESG governance and sustainable finance policies
Employees	ESG training and awareness
Social value	Financial inclusion and community empowerment
Societal culture	Sustainability culture within the organization
Scale of outreach	Nationwide branch-network coverage
End users	MSMEs, communities, retail customers, and green business actors
Social impacts	Reported or expected improvements in financial access and opportunities
Social benefits	Expected economic resilience and community welfare

Note. Author synthesis of the reported interviews and documentary analysis. Benefits described as expected are not quantified outcomes.

Based on Table 3, BRI's green finance business model demonstrates a strong orientation toward sustainable financing while maintaining its role as a commercial banking institution. One important characteristic identified during the interviews is BRI's emphasis on the MSME sector. This reflects the bank's strategic objective to integrate financial inclusion and sustainability simultaneously.

The findings further indicate that BRI perceives green finance not merely as regulatory compliance but as a business opportunity capable of generating long-term economic value. Financing environmentally responsible businesses is considered capable of reducing future credit risk, improving portfolio quality, and strengthening the bank's competitiveness in the evolving sustainable finance landscape.

Informants describe digital banking and paperless practices as resource-efficiency initiatives. Their environmental effect was not quantified in the reported analysis. BRI's emphasis on MSMEs connects financial access with opportunities to encourage environmentally responsible practices, but MSME financing is not automatically classified as green and its environmental outcomes require separate evidence.

Green Finance Business Model of Bank Mandiri

Based on interviews with informants N3 and N4, Bank Mandiri has positioned green finance as an integral component of its long-term business transformation strategy. The implementation of green finance is embedded within the bank's sustainable finance framework, which aligns with national policies, including the Sustainable Finance Roadmap, Indonesia Sustainable Finance Taxonomy (TKBI), and the Net Zero Emissions (NZE) 2060 target. Unlike BRI, which emphasizes financial inclusion and microfinance, Bank Mandiri demonstrates a stronger focus on financing large-scale projects, corporate sustainability initiatives, infrastructure development, and renewable energy investments.

Informant N3 explained that sustainability considerations have increasingly become part of strategic decision-making processes. Environmental and social risk assessments are incorporated into financing decisions, particularly for large corporate customers. The bank evaluates not only financial feasibility but also ESG performance and climate-related risks associated with proposed projects. This approach reflects a transition from conventional banking practices toward a sustainability-oriented business model.

At the implementation level, informant N4 stated that green finance is increasingly promoted through customer engagement, product marketing, and financing advisory services. The bank actively introduces sustainable financing products to corporate, commercial, and SME customers that seek funding for renewable energy projects, energy efficiency improvements, sustainable buildings, and environmentally responsible business activities. This indicates that sustainability objectives are not only reflected in strategic planning but also translated into customer-facing business activities.

Table 6 Economic Layer of the Mandiri Green Finance Business Model

TLBMC component	Reported practice or interpretation
Key partnerships	OJK, Bank Indonesia, Ministry of SOEs, international financial institutions, consultants, and renewable energy developers
Key activities	Sustainable financing, ESG integration, green bond management, reporting, and climate risk assessment
Key resources	Capital, ESG governance, sustainability expertise, digital infrastructure, and corporate network
Value proposition	Financing solutions combining business growth with intended environmental benefits
Customer relationships	Long-term partnerships, sustainability consultation, and relationship management
Channels	Corporate banking units, branches, digital platforms, and relationship managers
Customer segments	Corporates, infrastructure developers, renewable energy companies, SMEs, and institutional customers
Cost structure	ESG implementation, technology, reporting, and risk-management systems
Revenue streams	Interest income, financing services, portfolio returns, and green investment products

Note. Author synthesis of the reported interviews and documentary analysis. Benefits described as expected are not quantified outcomes.

Table 7 Environmental Layer of the Mandiri Green Finance Business Model

TLBMC component	Reported practice or interpretation
Supplies and outsourcing	Sustainability criteria in procurement and vendor selection
Production	Green office initiatives, energy efficiency, and digital transformation
Materials	Reduced paper use and operational resource requirements
Functional value	Financing renewable energy and sustainable infrastructure
Distribution	Digital banking delivery
Use phase	Expected environmental benefits of financed projects
End-of-life	Environmental monitoring is reported; end-of-life treatment is not established
Environmental impacts	Operational and financed-project impacts are discussed without comparable outcome estimates
Environmental benefits	Expected renewable energy, energy-efficiency, and emissions benefits

Note. Author synthesis of the reported interviews and documentary analysis. Benefits described as expected are not quantified outcomes.

Table 8 Social Layer of the Mandiri Green Finance Business Model

TLBMC component	Reported practice or interpretation
Local communities	Community development and sustainable economic programs
Governance	ESG governance within corporate management
Employees	Sustainability training and competency development
Social value	Support for business development and employment opportunities
Societal culture	Sustainability culture across organizational levels
Scale of outreach	National banking reach
End users	Corporations, SMEs, communities, and infrastructure beneficiaries
Social impacts	Expected employment, development, and business-resilience effects
Social benefits	Expected socioeconomic welfare benefits

Note. Author synthesis of the reported interviews and documentary analysis. Benefits described as expected are not quantified outcomes.

The findings indicate that Bank Mandiri's economic value creation is strongly driven by large-scale financing activities. Green finance is viewed as a strategic growth opportunity that enables the bank to expand into emerging sustainable sectors while managing long-term risks. Compared with BRI, Bank Mandiri demonstrates greater emphasis on corporate financing and infrastructure-related projects that contribute directly to energy transition efforts.

The informants highlighted that sustainable financing has become increasingly important due to growing customer demand, regulatory requirements, and investor expectations regarding ESG performance. Consequently, green finance contributes not only to revenue generation but also to strengthening the bank's reputation and competitiveness within the financial sector.

Informants emphasized that environmental considerations are incorporated into project evaluation processes. Large-scale projects financed by Bank Mandiri are increasingly assessed using environmental risk criteria and sustainability indicators. Projects with significant environmental impacts require additional assessments before financing approval is granted.

Furthermore, the bank has implemented internal initiatives to reduce operational environmental impacts through paperless banking systems, digital transactions, energy-efficient buildings, and waste reduction programs. These efforts demonstrate that environmental sustainability is pursued both internally and externally through financing activities.

The reported orientation connects corporate and infrastructure financing with potential environmental and social benefits. The scale of a financing portfolio is not itself evidence of larger emissions reductions. Because the two informants occupy branch and promotion roles, bank-wide claims require support from relevant documentary evidence or additional knowledgeable informants.

Green Finance Business Model of BNI

The accounts from N5 and N6 describe BNI's emphasis on ESG governance, financing, risk management, and reporting. These accounts indicate organizational attention to sustainability but do not establish a validated maturity position relative to the other banks.

Informant N5 explained that ESG has become an integral component of BNI's corporate strategy. The bank has established policies and governance structures that ensure sustainability considerations are embedded in strategic planning, business operations, financing decisions, and stakeholder engagement. Sustainability initiatives are regularly monitored and evaluated through ESG performance indicators, sustainability reporting mechanisms, and alignment with national and international sustainability frameworks.

At the operational level, informant N6 stated that green finance implementation is reflected in financing activities directed toward environmentally responsible business sectors. The bank prioritizes financing projects that contribute to renewable energy development, energy efficiency improvements, sustainable agriculture, and environmentally sustainable business operations. Environmental and social considerations are also incorporated into customer assessment processes before financing approval is granted.

Table 9 Economic Layer of the BNI Green Finance Business Model

TLBMC component	Reported practice or interpretation
Key partnerships	OJK, Bank Indonesia, international financial institutions, ESG organizations, government agencies, and corporate partners
Key activities	Sustainable financing, ESG implementation, reporting, green investment management, and stakeholder engagement
Key resources	ESG governance, sustainability expertise, capital, information systems, and corporate network
Value proposition	Financial solutions intended to generate economic and environmental value
Customer relationships	Strategic partnerships, sustainability advisory services, and ESG engagement
Channels	Corporate units, branches, digital platforms, and relationship managers
Customer segments	Corporates, SMEs, renewable energy companies, and environmentally oriented businesses
Cost structure	ESG implementation, monitoring, reporting systems, and training
Revenue streams	Sustainable financing income, banking services, green investment returns, and portfolio

TLBMC component	Reported practice or interpretation
growth	

Note. Author synthesis of the reported interviews and documentary analysis. Benefits described as expected are not quantified outcomes.

Table 10 Environmental Layer of the BNI Green Finance Business Model

TLBMC component	Reported practice or interpretation
Supplies and outsourcing	Procurement incorporating environmental considerations
Production	Energy-efficient operations, paperless systems, and digital transformation
Materials	Reduced paper use and responsible resource management
Functional value	Financing environmentally oriented projects and businesses
Distribution	Digital banking and electronic transactions
Use phase	Expected benefits from financed activities
End-of-life	Project monitoring is reported; end-of-life treatment is not established
Environmental impacts	Environmental risk and low-carbon development considerations
Environmental benefits	Expected contribution to emissions reduction and environmental sustainability

Note. Author synthesis of the reported interviews and documentary analysis. Benefits described as expected are not quantified outcomes.

Table 11 Social Layer of the BNI Green Finance Business Model

TLBMC component	Reported practice or interpretation
Local communities	Community development and economic empowerment
Governance	ESG governance and sustainability oversight
Employees	Capacity building, training, and engagement
Social value	Inclusive financial access and stakeholder benefits
Societal culture	Sustainability-oriented organizational culture
Scale of outreach	Nationwide banking network
End users	Corporate customers, SMEs, communities, and sustainable business actors
Social impacts	Reported awareness and expected economic opportunities
Social benefits	Expected welfare and inclusive development benefits

Note. Author synthesis of the reported interviews and documentary analysis. Benefits described as expected are not quantified outcomes.

The findings indicate that BNI's economic value creation is strongly associated with ESG integration. Informants emphasized that sustainability considerations are no longer viewed as separate initiatives but rather as strategic business drivers that influence investment decisions, financing allocation, and long-term organizational performance.

Unlike BRI, which emphasizes financial inclusion, and Bank Mandiri, which focuses heavily on large-scale infrastructure financing, BNI adopts a balanced approach by integrating sustainability considerations into both business growth strategies and risk management systems. This approach allows the bank to pursue profitability while simultaneously enhancing environmental and social outcomes.

Informants highlighted that environmental risk assessment has become increasingly important within financing evaluation processes. Businesses seeking financing are assessed not

only on their financial performance but also on their environmental practices and sustainability commitments.

Furthermore, BNI has implemented various internal environmental initiatives, including digital banking expansion, paperless operations, and energy conservation programs. These initiatives contribute to reducing operational environmental impacts while supporting broader sustainability objectives.

The social findings indicate that BNI places significant emphasis on governance and stakeholder engagement. Informants explained that sustainability initiatives are supported by clear governance structures that facilitate accountability, transparency, and continuous performance improvement.

In addition, employee participation plays a critical role in achieving sustainability objectives. Training programs and ESG awareness initiatives have been implemented to strengthen employee understanding of sustainable finance principles and their application within daily banking activities.

These accounts emphasize governance and stakeholder engagement. They do not establish superiority in environmental performance or a verified maturity ranking. Reported interest in sustainability measurement should be distinguished from implementation coverage and demonstrated outcomes.

Green Finance Business Model of BTN

Based on interviews with informants N7 and N8, Bank Tabungan Negara (BTN) demonstrates a unique approach to green finance implementation compared with the other state-owned banks. As a bank with a strong focus on the housing sector, BTN integrates green finance primarily through sustainable housing financing, environmentally friendly property development, and ESG-based business practices. Green finance at BTN is positioned not only as a sustainability initiative but also as a strategic instrument to support the transition toward sustainable urban development and Indonesia's Net Zero Emissions (NZE) 2060 target.

Informant N7 explained that ESG principles have been incorporated into BTN's sustainability strategy through various initiatives, including sustainable finance governance, ESG reporting, climate-related risk management, and environmentally responsible financing policies. The bank continuously develops sustainability indicators to monitor environmental and social performance while ensuring alignment with regulatory requirements and stakeholder expectations.

Meanwhile, informant N8 highlighted that green finance implementation at the operational level is largely reflected in financing activities for housing projects and SMEs that adopt environmentally responsible practices. Customers are increasingly encouraged to implement energy-efficient technologies, environmentally friendly building materials, and sustainable construction methods. As a result, sustainability principles are gradually becoming part of financing assessment and customer engagement processes.

Table 12 Economic Layer of the BTN Green Finance Business Model

TLBMC component	Reported practice or interpretation
Key partnerships	OJK, housing-related government institutions, developers, ESG consultants, and government agencies
Key activities	Sustainable housing financing, ESG implementation, reporting, and green property financing
Key resources	Housing finance expertise, ESG framework, data systems, and capital
Value proposition	Affordable financing intended to support sustainable housing development
Customer relationships	Long-term engagement, financing advice, and sustainability education
Channels	Branches, digital platforms, and developer partnerships
Customer segments	Property developers, homebuyers, SMEs, and sustainable construction businesses
Cost structure	Implementation, reporting, and environmental assessment
Revenue streams	Housing financing income, mortgage services, and sustainable financing products

Note. Author synthesis of the reported interviews and documentary analysis. Benefits described as expected are not quantified outcomes.

Table 13 Environmental Layer of the BTN Green Finance Business Model

TLBMC component	Reported practice or interpretation
Supplies and outsourcing	Encouragement of environmentally responsible suppliers and developers
Production	Green office initiatives, resource efficiency, and digital transformation
Materials	Environmentally oriented construction materials in financed housing; distinct from bank materials
Functional value	Financing sustainable housing and green buildings
Distribution	Digital banking and paperless delivery
Use phase	Expected housing energy-efficiency and environmental benefits
End-of-life	Project monitoring is reported; asset end-of-life treatment is not established
Environmental impacts	Potential effects on housing emissions and urban resource use
Environmental benefits	Expected efficiency and emissions benefits from housing projects

Note. Author synthesis of the reported interviews and documentary analysis. Benefits described as expected are not quantified outcomes.

Table 14 Social Layer of the BTN Green Finance Business Model

TLBMC component	Reported practice or interpretation
Local communities	Housing accessibility and community development
Governance	ESG governance in sustainability management
Employees	Awareness and capacity building
Social value	Access to affordable and sustainable housing
Societal culture	Sustainability values among staff and customers
Scale of outreach	National housing-finance coverage
End users	Homebuyers, communities, developers, and SMEs
Social impacts	Expected access and living-condition improvements
Social benefits	Expected community welfare and inclusion benefits

Note. Author synthesis of the reported interviews and documentary analysis. Benefits described as expected are not quantified outcomes.

The findings reveal that BTN's economic value creation is strongly linked to its specialization in housing finance. Green finance initiatives are primarily directed toward supporting sustainable property development and environmentally friendly housing projects. Informants indicated that sustainability considerations increasingly influence financing decisions, particularly for large-scale residential developments.

Informants explained that environmental value creation within BTN is closely associated with sustainable property development. Green housing projects financed by the bank are expected to incorporate energy-saving technologies, water conservation systems, and environmentally friendly construction practices.

The findings also indicate that environmental considerations are increasingly integrated into project evaluations. Property developers seeking financing are encouraged to adopt sustainability principles that minimize environmental impacts throughout the project lifecycle. Consequently, BTN contributes to environmental sustainability not only through internal operational improvements but also through influencing sustainable practices within the housing sector.

BTN's housing specialization offers a context in which affordability and environmental objectives can be considered together. Affordable housing does not automatically meet green criteria, and expected improvements in efficiency or welfare must be distinguished from measured effects. The available accounts identify opportunities for integration rather than quantified housing-portfolio emissions reductions.

Cross-Case Comparison

The findings indicate that all four state-owned banks have incorporated green finance into their business strategies. However, each institution demonstrates a different emphasis depending on its core business orientation, customer segments, strategic priorities, and sustainability objectives. While BRI focuses on financial inclusion and MSME empowerment, Bank Mandiri prioritizes large-scale infrastructure and renewable energy financing. BNI emphasizes ESG governance and sustainability integration, whereas BTN concentrates on sustainable housing finance and environmentally responsible urban development.

Table 15 compares the reported orientations using common descriptive dimensions. These orientations are overlapping emphases, not mutually exclusive types or stages of maturity. Financing orientation, degree of integration, and maturity require distinct criteria and are not interchangeable classification dimensions.

Table 15 Comparison of Reported Green Finance Orientations

Dimension	BRI	Mandiri	BNI	BTN
Financing emphasis	MSMEs and inclusion	Corporate, infrastructure, and renewable energy	Corporate finance and ESG integration	Housing and property

Dimension	BRI	Mandiri	BNI	BTN
Customer emphasis	MSMEs and retail	Corporate and institutional	Corporate, commercial, and SME	Developers and homebuyers
Organizational emphasis	Reach and customer access	Financing capacity	ESG governance	Housing expertise
Environmental pathway	Financed business practices and operations	Financed infrastructure and operations	Screening, governance, and operations	Housing efficiency and operations
Social pathway	Inclusion and empowerment	Expected investment and employment benefits	Stakeholder engagement	Housing access and welfare
Comparative limit	Green eligibility and outcomes need evidence	Bank-wide strategy exceeds informants' role scope	Governance does not establish superior outcomes	Affordability does not establish green eligibility

Note. Descriptive synthesis of available accounts. No comparable maturity score or attributable emissions estimate is reported.

Across cases, core business orientation appears to shape where sustainability-related activities are concentrated. Financial inclusion, infrastructure investment, governance, and housing finance represent different potential pathways rather than evidence that one bank is superior. The accounts suggest both strategic interest in sustainability and continuing implementation gaps; these observations can coexist because declared commitments and operational integration are different levels of analysis.

Potential complementarity across the four banks is an interpretation of their different orientations. The study does not establish that a coordinated interbank green finance system operates in practice. Coordination, joint targets, or shared implementation would require separate evidence.

B. DISCUSSION

Interpreting Strategy and Implementation

Nevertheless, the study reveals varying levels of economic integration among the banks. BRI demonstrates strong economic value creation through MSME financing and financial inclusion initiatives. Bank Mandiri emphasizes large-scale sustainable financing for infrastructure and renewable energy projects. BNI integrates sustainability into its corporate financing and ESG governance framework, while BTN focuses on sustainable housing finance. These differences indicate that green finance implementation is strongly influenced by each bank's business orientation and market specialization. Rather than adopting identical approaches, the banks develop complementary business models that collectively contribute to national climate objectives.

The central finding is uneven integration rather than either complete transformation or exclusive regulatory compliance. The accounts describe business opportunities and strategic

commitments, while also reporting weaknesses in impact measurement, capabilities, and operational alignment. A bank may pursue green finance commercially while parts of its implementation remain compliance-oriented. This distinction explains how strategic sustainability objectives can coexist with incomplete integration into core banking processes.

Business Model Innovation Theory helps interpret potential changes in value propositions, activities, and partnerships (Osterwalder & Pigneur, 2010). However, the cross-sectional evidence maps current reported practices; it does not document a before-and-after redesign of each bank's model. The findings therefore support analysis of sustainability-oriented business models and possible transformation mechanisms, rather than a demonstrated innovation trajectory.

Stakeholder Theory explains why customer access, employee capabilities, governance, and community benefits matter alongside financing returns (Freeman & McVea, 2001). The comparison is consistent with the multiple-value perspective discussed by Lyons and White (2025), while also showing why intentions, activities, and outcomes must remain distinct. Social benefits attributed to inclusion or housing require evidence that goes beyond a bank's sectoral specialization.

Measurement and Integration Gaps

One of the most prominent challenges identified is the limited measurement and monitoring of environmental impacts generated through green finance activities. While all participating banks have established green financing portfolios and sustainability initiatives, only a limited number have implemented comprehensive systems for measuring financed emissions and quantifying environmental outcomes. The findings indicate that environmental performance is often assessed through financing allocation rather than actual environmental results. As a consequence, banks may face difficulties in demonstrating the direct contribution of their financing activities to carbon emission reductions and climate mitigation efforts.

This finding is consistent with Shahzad et al. (2024), who argue that achieving Net Zero Emissions requires not only increased green investment but also robust mechanisms for measuring environmental outcomes. Without standardized measurement systems, banks may struggle to evaluate whether financed projects genuinely contribute to climate objectives. Furthermore, inconsistencies in environmental reporting may reduce transparency and limit stakeholders' ability to assess the effectiveness of green finance initiatives.

Another challenge relates to organizational capacity and ESG competency. The findings reveal that sustainability expertise remains concentrated within specific divisions, particularly ESG, sustainability, and risk management units. At the operational level, many employees continue to perceive green finance as a specialized function rather than a core component of banking activities. This situation creates disparities in sustainability understanding across organizational levels and may hinder the integration of ESG considerations into daily decision-making processes.

The interviews suggest that continuous capacity-building programs are necessary to strengthen sustainability literacy throughout the organization. Employees involved in customer

engagement, financing assessment, and portfolio management require a comprehensive understanding of sustainability principles and climate-related risks. This observation supports previous findings that human capital and organizational learning are essential factors in successful sustainable finance implementation (Rahadian, 2025).

The study also identifies limitations in green finance product diversification. Although banks have introduced various sustainable finance instruments, including green loans, sustainability-linked financing, and green bonds, product innovation remains relatively limited compared to the rapidly evolving sustainability finance landscape. Many green financing products continue to focus on traditional lending structures, while innovative instruments such as transition finance, blended finance, carbon-related financing, and sustainability-linked investment products are still developing.

This limitation may reduce the ability of banks to address the diverse financing needs associated with Indonesia's climate transition. Considering the substantial investment required to achieve Net Zero Emissions 2060, financial institutions must continuously develop innovative financing solutions capable of supporting emerging low-carbon sectors and technologies. The findings therefore suggest that product innovation remains an important area for future development.

A further challenge concerns the alignment between strategic sustainability commitments and operational implementation. The results reveal that sustainability objectives are generally well articulated within corporate strategies, sustainability reports, and ESG frameworks. However, implementation practices often vary across business units and operational levels. In some cases, sustainability targets are not fully translated into measurable operational indicators or integrated performance evaluation systems.

This finding highlights the importance of strengthening internal governance mechanisms and communication processes. Effective sustainability implementation requires not only top-management commitment but also organizational alignment across departments, branches, and operational units. The gap between strategy and implementation identified in this study reflects challenges commonly encountered during organizational transformation toward sustainability-oriented business models.

Stakeholder awareness and market readiness also emerge as significant challenges. Informants noted that not all customers fully understand the benefits of green finance products or recognize sustainability as an important factor in financing decisions. Many customers continue to prioritize financial considerations over environmental performance when seeking financing. As a result, demand for green finance products may remain lower than expected despite increasing sustainability commitments within the banking sector.

This challenge suggests that banks must play a more active role in educating customers and promoting sustainability awareness. Financial institutions are not only providers of capital but also important agents of change capable of influencing business practices and stakeholder behavior. Increasing customer awareness regarding environmental and social sustainability may contribute to broader adoption of green finance across economic sectors.

The study further identifies challenges associated with regulatory development and standardization. Although Indonesia has established various sustainable finance regulations, informants indicated that sustainability reporting standards, ESG assessment methodologies, and environmental performance metrics continue to evolve. Frequent regulatory developments require banks to continuously adapt their systems, processes, and reporting mechanisms. While regulatory progress is generally viewed positively, the transition process may create implementation complexities and additional compliance costs.

In addition, the findings reveal that social value generated through green finance is often less visible and less systematically documented than economic performance. Indicators such as financing growth, profitability, and portfolio expansion are relatively easy to measure, whereas social outcomes such as community empowerment, stakeholder welfare, sustainability awareness, and quality-of-life improvements are more difficult to quantify. This limitation may result in an underestimation of the broader societal benefits generated by green finance initiatives.

These findings support Lyons and White (2025), who argue that conventional performance evaluation systems frequently fail to capture the full range of environmental and social value created by green banking institutions. Consequently, organizations may overlook important sustainability contributions that extend beyond financial performance indicators.

Claims of financed-emissions measurement, quantified green-bond benefits, or reductions in housing-portfolio emissions require exact source pages, methods, periods, and coverage. In their absence, the analysis does not rank BNI or BTN above BRI or Mandiri on measurement maturity. Operational emissions, financed emissions, avoided emissions, and actual emissions reductions represent different quantities and should not be conflated. PCAF-based accounting, where verified, does not by itself prove that a bank has caused emissions reductions.

Integration should also be examined through trade-offs. Environmental screening and verification may add costs that smaller borrowers find difficult to absorb. Efficient housing features may create affordability tensions. These are analytical possibilities for subsequent investigation, not additional empirical findings from the present interviews. Identifying such tensions would strengthen the framework beyond an assumption that all three value layers always reinforce one another.

Proposed Integration Framework

Based on the Triple Layered Business Model Canvas (TLBMC) analysis, this study proposes an integrated green finance business model that combines the strengths identified across the four state-owned banks. The proposed model is designed to strengthen the alignment between sustainability objectives and banking operations while maximizing the contribution of financial institutions toward climate mitigation and sustainable development. The model emphasizes the integration of the economic, environmental, and social layers as interconnected components rather than separate sustainability initiatives.

At the economic layer, the proposed model emphasizes the mobilization of capital toward sectors that contribute directly to decarbonization and sustainable development. These sectors

include renewable energy, sustainable infrastructure, energy efficiency, green manufacturing, environmentally responsible agriculture, sustainable transportation, and green housing. Financing allocation should be supported by innovative financial instruments such as green loans, green bonds, sustainability-linked loans, blended finance mechanisms, and transition finance products. By diversifying sustainable finance instruments, banks can increase their capacity to address varying financing needs associated with Indonesia's low-carbon transition.

The findings indicate that economic value creation should not be limited to profitability and financing growth alone. Instead, sustainable financial performance should incorporate long-term risk reduction, resilience enhancement, and climate-related opportunity creation. This perspective aligns with Sustainable Finance Theory, which argues that financial institutions can simultaneously achieve economic performance and sustainability objectives through responsible capital allocation. Consequently, the proposed model positions green finance as a core business strategy rather than a supplementary sustainability initiative.

At the environmental layer, the proposed model highlights the importance of strengthening environmental impact measurement systems. The findings reveal that financing allocation alone is insufficient to demonstrate environmental performance. Therefore, banks should adopt standardized methodologies for measuring financed emissions, carbon reductions, energy savings, and environmental outcomes generated by financed projects. Frameworks such as the Partnership for Carbon Accounting Financials (PCAF) and climate-related disclosure standards can support the development of more transparent and consistent environmental reporting systems.

In addition, environmental considerations should be integrated throughout the financing lifecycle, including project assessment, approval, monitoring, and evaluation processes. Banks should expand environmental risk assessments and climate scenario analyses to ensure that financing decisions support long-term sustainability objectives. The proposed model therefore encourages a transition from activity-based measurement toward impact-based measurement, enabling financial institutions to evaluate the actual environmental contributions of their financing portfolios.

The social layer emphasizes the importance of ensuring that the transition toward a low-carbon economy remains inclusive and equitable. The findings demonstrate that green finance generates significant social value through financial inclusion, housing accessibility, employment creation, community development, and stakeholder engagement. However, these social contributions are often less visible than financial performance indicators. The proposed model therefore recommends the development of more comprehensive social performance measurement systems capable of capturing the broader societal benefits generated by sustainable finance initiatives.

Furthermore, stakeholder engagement should become a central component of green finance implementation. Banks should strengthen collaboration with regulators, government agencies, investors, businesses, local communities, academic institutions, and environmental organizations. Such collaboration can facilitate knowledge sharing, improve sustainability

awareness, and accelerate the adoption of environmentally responsible practices across economic sectors. This approach is consistent with Stakeholder Theory, which emphasizes that long-term organizational success depends on the creation of value for multiple stakeholder groups.

The findings also suggest that governance functions as a critical enabler connecting the three TLBMC layers. Strong ESG governance supports organizational alignment, accountability, transparency, and sustainability integration. Therefore, the proposed model recommends strengthening ESG governance structures through dedicated sustainability units, enhanced board oversight, sustainability-linked performance indicators, and comprehensive ESG reporting systems. Governance mechanisms should ensure that sustainability objectives are consistently translated into operational practices across all organizational levels.

Another important component of the proposed model is digital transformation. Informants emphasized that digital technologies can support green finance implementation through improved data management, sustainability monitoring, environmental reporting, and customer engagement. Digital banking platforms can reduce operational emissions while expanding access to sustainable finance products. Furthermore, technological innovation can improve the efficiency and transparency of sustainability performance measurement. As a result, digitalization should be viewed as a strategic enabler that strengthens economic, environmental, and social value creation simultaneously.

Figure 1 organizes the proposed mechanisms. Economic activities mobilize finance; environmental assessment and monitoring identify intended climate-related outcomes; social evaluation examines access and distribution of benefits. Governance and digital systems may help align objectives, data, and accountability across the three layers. The arrows represent proposed relationships for future evaluation and do not indicate tested causal effects.

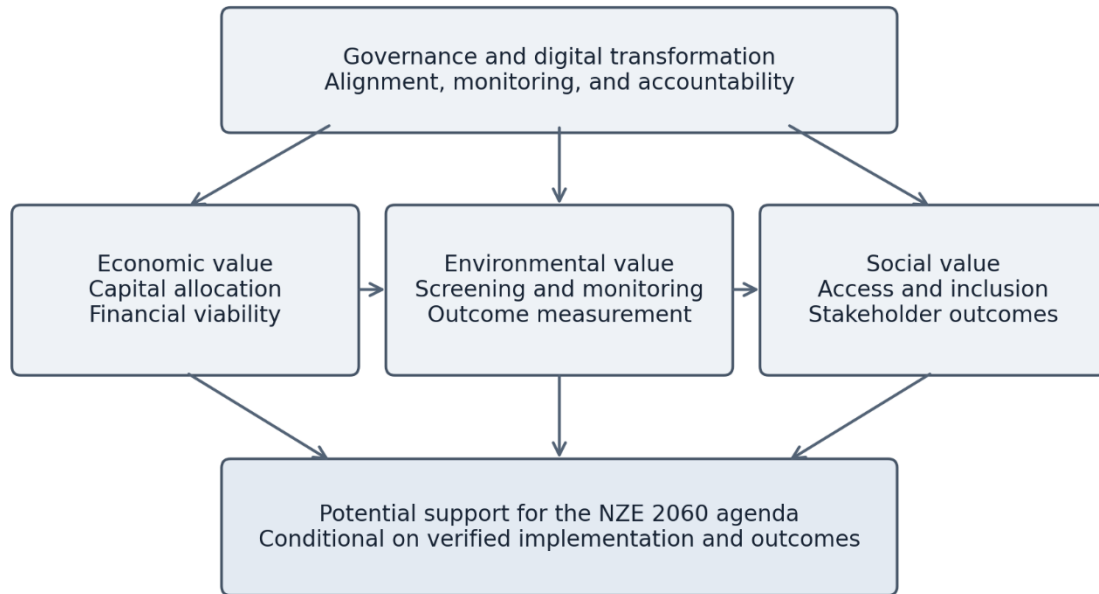


Figure 1 Proposed TLBMC Based Green Finance Integration Framework

Note. Author-developed conceptual synthesis. Relationships are proposed, not empirically tested. NZE = Net Zero Emissions.

The framework is intended as an organizing model adaptable to individual banks and as a basis for considering ecosystem complementarity. It does not require every bank to reproduce all four sectoral specializations. Sector choices remain contingent on mandate, capabilities, and customer base. Empirical validation should examine whether governance and digital systems improve cross-layer alignment and whether that alignment produces verifiable outcomes.

Theoretical and Practical Contributions

The contribution is the contextual application and transparent adaptation of TLBMC to four banking cases, together with a proposed integration framework. It distinguishes financing orientation from sustainability maturity and recognizes that internal operations and financed activities have different environmental boundaries. The study does not establish a new theory or prove that TLBMC is effective in predicting environmental performance. Its value lies in organizing questions about alignment, evidence, and stakeholder implications.

Based on the findings and limitations of this study, several recommendations are proposed for state-owned banks, regulators, and future researchers. For state-owned banks, greater efforts are required to strengthen the transformation of green finance business models toward fully integrated sustainable business models. ESG principles should be embedded throughout all business processes, including strategic planning, financing activities, risk management,

operational decision-making, and performance evaluation systems. In addition, banks should enhance the differentiation of green finance products and services to develop clearer value propositions and strengthen their competitive positioning within the sustainable finance market.

State-owned banks should also improve environmental and social impact measurement systems by adopting internationally recognized frameworks such as the Partnership for Carbon Accounting Financials (PCAF), Social Return on Investment (SROI), and climate risk assessment methodologies. The implementation of standardized measurement systems would enable banks to evaluate, monitor, and communicate their contributions toward the Net Zero Emissions 2060 target more objectively and transparently. Furthermore, stronger environmental and social impact reporting may enhance stakeholder confidence and support more effective sustainability governance.

For regulators, the findings support clearer classification, comparable disclosures, and guidance on environmental and social measurement. Proposals for liquidity, tax, or risk-weight incentives should be treated as policy options requiring separate legal, prudential, and empirical assessment rather than recommendations established by this qualitative study. For banks, priorities should reflect documented gaps in the relevant units rather than an unsupported ranking of institutions.

Boundary Conditions and Alternative Explanations

The evidence is bounded by four state-owned conventional banks, two informants per institution, and documentary sources whose exact temporal coverage requires confirmation. Different roles may partly explain the emphasis on inclusion, infrastructure, governance, or housing. Corporate disclosures and employee accounts may favor positive descriptions of sustainability. Consequently, the findings offer analytical insights into reported practices and should not be generalized statistically to all Indonesian banks.

Cross-sectional observations cannot establish the sequence of organizational change or causal effects on profitability, credit risk, customer welfare, or emissions. The lack of comparable project-level outcome evidence also limits environmental comparisons. These limitations constrain the proposed framework to a conceptual synthesis pending further verification and testing.

CONCLUSION

This study examined green finance business models in BRI, Bank Mandiri, BNI, and BTN through the economic, environmental, and social layers of TLBMC. The reported accounts show different emphases associated with each bank's business orientation: MSME inclusion, corporate and infrastructure financing, ESG governance, and housing finance. They also describe continuing gaps in impact measurement, organizational capacity, product development, stakeholder awareness, and strategic–operational alignment. Strategic interest

and compliance-related implementation therefore coexist, with integration remaining uneven across contexts.

The study proposes a conceptual framework in which governance and digital transformation support alignment among economic viability, environmental assessment, and social inclusion. This framework identifies potential pathways for supporting the NZE 2060 agenda; it does not demonstrate attributable emissions reductions or validate a maturity ranking. Its contribution is a comparative adaptation of TLBMC to banking and an explicit distinction between reported activities and verified outcomes.

Limitations include unequal informant roles, the small and context-specific information base, reliance on organizational disclosures, incomplete reporting of the temporal boundary, and absence of comparable impact measures. Future studies should use functionally comparable informants, traceable documentary evidence, longitudinal designs, and verified financing and outcome data. The inclusion of private, Islamic, and regional development banks could clarify the framework's boundary conditions, while mixed-methods designs could test its proposed mechanisms.

DECLARATION ON THE USE OF AI-ASSISTED TECHNOLOGIES

ChatGPT was used to assist with language editing, organization of the revision, adaptation to the journal template, and visualization of the proposed conceptual framework. It was not used to generate interview data or perform additional empirical analysis. The authors are responsible for verifying all revised text, references, interpretations, and declarations before submission.

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