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## DEVELOPMENT OF GREEN BONDS FOR SUSTAINABLE FINANCE IN ASEAN



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### Abstract

This research aims to analyze the development, effectiveness, and implementation challenges of green bonds as a sustainable financing instrument in the ASEAN region, specifically in Indonesia, Singapore, Malaysia, Thailand, and Vietnam. The research uses a qualitative method with a meta-analysis, meta-synthesis, and gap analysis approach on various previous studies, regulations, and green bond issuance data in ASEAN countries. The results of the meta-analysis show that 58% of the studies found a positive influence of green bonds on sustainable financial development, while the other 42% showed varied and inconsistent results. The meta-synthesis reveals that the successful implementation of green bonds is significantly influenced by regulatory strength, government incentives, institutional capacity, and investor awareness levels. This confirms that regulatory harmonization, increased investor literacy, and strengthening the green project portfolio are strategic steps needed to accelerate the growth of green bonds in ASEAN.

**Keywords:** Green Bonds, Sustainable Finance, ASEAN, Meta-Analysis

## INTRODUCTION

Climate change, environmental degradation, and uncontrolled exploitation of natural resources have become global issues affecting various sectors of life. The impacts of climate change, such as increased intensity of natural disasters, rising sea levels, and ecosystem degradation, necessitate global efforts to accelerate the transition toward sustainable development. This condition has led to the emergence of various innovative financial instruments, including green bonds, as a means of financing projects that provide environmental benefits. Green bonds are becoming increasingly important as public attention to environmental risks grows and the need to finance renewable energy projects, energy efficiency, waste management, and other climate change mitigation programs becomes more urgent (OECD, 2017; ICMA, 2021).

Green bonds are debt instruments that require the funds raised to be allocated exclusively to environmentally friendly projects. This instrument has key principles governed by the Green Bond Principles, which include fund use, project evaluation and selection processes, fund management, and periodic reporting to ensure transparency and accountability (ICMA, 2021). Thus, green bonds not only serve as financial instruments but also as a signal of the issuer's commitment to sustainability to investors (Flammer, 2020). Investor awareness of Environmental, Social, and Governance (ESG) principles has also driven increased demand for these instruments in global financial markets. The Global Sustainable Investment Alliance (2019) noted significant growth in sustainability-based assets, indicating that ESG dimensions have become an important consideration in modern investment.

In the ASEAN region, the development of green bonds has shown a fairly rapid growth trend in recent years. Each country implements various policies to promote green financing. Data from Asian Bonds Online (2022) shows that Singapore leads with the largest green bond market size, at USD 9.46 billion, strongly supported by the Green Bond Grant Scheme policy issued by the Monetary Authority of Singapore (MAS, 2021). Indonesia holds the second position with the issuance of large-scale green sukuk, which received a positive response from international investors, especially from the Middle East and Europe (Ministry of Finance of the Republic of Indonesia, 2021). Malaysia is also strengthening its financial market thru the Sustainable and Responsible Investment (SRI) Sukuk Framework, designed to support Shariah-compliant financing for environmentally friendly projects (Securities Commission Malaysia, 2021).

Thailand and Vietnam are also starting to show significant development. Thailand is developing sustainability bonds thru the Securities and Exchange Commission (SEC Thailand, 2021), with a focus on financing low-emission transportation and renewable energy. Meanwhile, Vietnam, a relatively new market for green bonds, has begun to adopt policy frameworks supporting green investment to fund clean energy projects (State Bank of Vietnam, 2021). This development shows that ASEAN countries are increasingly understanding the importance of green financing integration to promote more sustainable and resilient economic development against environmental risks.

However, despite the significant market potential, ASEAN countries still face a number of structural and regulatory challenges in implementing green bonds. In Indonesia, the main obstacles lie in the lack of investor literacy regarding green instruments, the limited

number of green projects that meet international standards, and the still-developing supporting infrastructure for the financial market (MDPI, 2023). Singapore faces challenges related to the need to harmonize reporting standards and transparency in the use of funds, which are key demands of global investors (IIGF, 2023). Malaysia faces a gap in understanding among institutional and retail investors, leading to green bonds often being perceived as having higher risks compared to conventional bonds (UNDP, 2021). Thailand faces a shortage of viable green projects and low demand from local investors (ScienceDirect, 2023). Meanwhile, Vietnam faces challenges of immature regulations and limited technical capacity of financial institutions in assessing environmental risks (PT SMI, 2023).

Beside policy developments and market dynamics in the ASEAN region, previous research also indicates that the implementation of green bonds plays a strategic role while also facing several obstacles that need to be considered. Several studies confirm that green bonds can make a significant contribution to financing sustainable projects, particularly in the renewable energy and energy efficiency sectors. The Climate Bonds Initiative (2018) states that the green bond market in ASEAN has high growth potential, especially in Indonesia, Malaysia, and Singapore, although adoption in some countries is still in its early stages. This aligns with the findings of Jain et al. (2022), which highlight that the potential for green bond development is significant, but is still hampered by a lack of mature institutional structures and an underdeveloped domestic bond market.

In the Indonesian context, Cendekiawan and Firmansyah (2024) found that the implementation of green bonds has not been optimal due to institutional design weaknesses and limited capacity of financial institutions, despite the government releasing a sustainable finance regulatory framework. Additionally, research by Aini et al. (2023) indicates that investor interest in green bonds is increasing, but higher risk perceptions compared to conventional bonds are a barrier in the domestic market. Similar findings were also reported in Youngho's (2019) study on Singapore, which indicated that the main challenges for green finance development are greenwashing practices and the need for increased reporting transparency. These findings indicate that despite the optimism surrounding green bonds, the ASEAN market still needs standardization and accountability enforcement.

Furthermore, several studies have also highlighted the role of green bonds in supporting sustainable development in ASEAN. Sudan (2023) and Ahmed et al. (2022) show that green bonds have a positive impact on reducing carbon emissions and increasing investment in renewable energy. Sadiq et al. (2023) emphasize that green finance, environmental innovation, and creativity significantly contribute to achieving the Sustainable Development Goals (SDGs), making increased issuance of green bonds a strategic necessity. This aligns with the research findings of Putra and Oktora (2024), which emphasize the importance of financial inclusion and economic integration in supporting green growth in the ASEAN region.

Various research shows that the successful implementation of green bonds depends on a combination of a strong regulatory framework, government incentives, the readiness of financial institutions, and the interest of domestic and international investors (UNEP, 2021; ADB, 2021). This highlights the need for a comprehensive study on how ASEAN countries manage these challenges. Among ASEAN countries, there is significant variation in strategies, institutional capacity, and the effectiveness of implemented policies. This inequality also creates a research gap regarding how green bond implementation strategies

are executed, what factors determine their success, and to what extent this instrument can consistently support sustainable development in the region. Given this dynamic, it is important to conduct an in-depth analysis of the implementation of green bonds in ASEAN countries to identify policy patterns, challenges faced, and strategic opportunities that can be leveraged. This research is relevant because green bonds have significant potential to accelerate the achievement of regional sustainability agendas, including supporting carbon emission reduction targets and clean energy development. Additionally, this research is important for assessing the contributions of the banking sector, investors, and international financial institutions in strengthening the green financing ecosystem in ASEAN.

## **REVIEW OF LITERATURE**

### **Signaling Theory**

Signaling theory explains how the party with more information, generally companies or governments, sends signals to the party with less information, namely investors. Spence (1973) asserted that signals serve to reduce information asymmetry and increase trust. In the context of green bonds, issuing green bonds is seen as a signal of credibility in commitment to environmental sustainability. Flammer (2020) states that green bonds strengthen investors' positive perceptions because these instruments demonstrate a real commitment to environmental goals. This finding aligns with Tang & Zhang (2020), who confirm that signals through green bonds enhance transparency and reduce investor perceived risk.

### **Green Bonds**

Green bonds are debt instruments that require the use of funds for green projects. OECD (2017) emphasizes that this instrument aims to support projects focused on mitigating climate change. Since their first issuance by the European Investment Bank in 2007, green bonds have grown rapidly and become a key instrument in the Sustainable Development Goals (SDGs) agenda. Climate Bonds Initiative (2021) reported that global issuance has surpassed USD 1 trillion.

### **Sustainable Finance**

Sustainable finance emphasizes the integration of ESG factors into investment decisions. Schoenmaker & Schramade (2019) state that sustainable finance focuses not only on financial returns but also on social and environmental balance. UNEP FI (2016) emphasizes that instruments like green bonds play a crucial role in achieving the SDGs.

## **RESEARCH METHOD**

### **Research Design**

This research employs a descriptive qualitative research design aimed at providing a comprehensive overview of the implementation of green bonds as a sustainable financing instrument in the ASEAN region. The descriptive approach was chosen because this study does not focus on testing hypotheses, but rather on describing, interpreting, and analyzing policy phenomena, market dynamics, and the role of stakeholders in the development of green bonds. According to Creswell's (2020) view, a qualitative descriptive design allows researchers to examine phenomena in depth within their natural context through the study of diverse data sources.

### **Population and Sample**

The unit of analysis in this study includes ASEAN member states, but the sample focus is directed toward five countries with significant activity in green bond issuance, namely Indonesia, Singapore, Malaysia, Thailand, and Vietnam. The selection of these five countries was done thru purposive sampling techniques, considering the existence of sustainable finance policy frameworks, the volume of green bond issuance, and the availability of relevant literature. In addition to countries, the research sample also consisted of 25 scientific articles, policy reports, and academic publications discussing the development and implementation of green bonds in ASEAN. The broader population included stakeholders such as governments, regulators, financial institutions, institutional investors, academics, and non-governmental organizations involved in overseeing and developing the green bond market.

### **Types and Sources of Data**

Research data was obtained thru a combination of secondary and primary data. Secondary data included journal articles, reports from international organizations, policy documents, and academic publications relevant to sustainable finance. Meanwhile, primary data was collected thru in-depth interviews with stakeholders who understand the development of green bond policies and market dynamics. Data collection was conducted systematically thru literature review techniques to assess previous findings, identify research gaps, and develop a strong theoretical framework. This literature review process refers to the principles of critical analysis as explained by Kraus et al. (2021), which is to assess the suitability of the theory, methodology, and context of each study. Additionally, empirical analysis is also used to strengthen understanding of real-world conditions thru observation of quantitative data and policies available in official reports.

### **Data Collection Techniques**

This research also utilizes gap analysis to identify the differences between the ideal conditions for issuing green bonds and the actual conditions that exist in each country. This technique refers to Garvin's view, which explains that gap analysis is important for understanding performance discrepancies and formulating appropriate improvement strategies. Additionally, to enrich the findings, the study utilizes a meta-analysis approach as proposed by Glass (1976) to integrate the results of various previous studies, thereby providing a broader empirical overview of the effectiveness and challenges of green bonds in ASEAN.

### **Data Analysis Techniques**

Data analysis was conducted thematically, following the Miles and Huberman (1994) data analysis process, which includes data reduction, data presentation, and conclusion drawing. The themes developed focus on implementation strategies, factors influencing the adoption of green bonds, structural challenges, strategic steps by governments and financial institutions, and the role of international organizations in strengthening the green financing ecosystem in the ASEAN region. The analysis process was conducted comparatively to assess differences and similarities in practices across countries, as well as to identify best practices that can be replicated.

## RESULT AND DISCUSSION

### Implementation of Green Bonds in ASEAN

The implementation of green bonds in the ASEAN region shows rapid development as member countries increase their commitment to supporting the sustainable development agenda. The five major countries of Indonesia, Singapore, Malaysia, Thailand, and Vietnam showcase different but complementary approaches in building the green bond market ecosystem in the region.

Indonesia is a pioneer with the issuance of the world's first sharia-based green sukuk, managed within the state budget framework thru the Green Bond & Green Sukuk Framework. Studies by Muslim Cendekiawan and Firmansyah (2024) and Aini et al. (2023) show that the existence of green sukuk provides Indonesia with a strategic advantage in attracting global sharia investors. However, challenges such as institutional capacity and governance still limit the effectiveness of implementation. Additionally, the Asian Development Bank's report (2022) emphasizes the importance of increased transparency and market education to strengthen investor confidence, with POJK 60/2017 serving as the main regulatory foundation.

Singapore is pursuing a more structured strategy thru incentive policies, green taxonomies, and enhanced ESG reporting platforms developed by the Monetary Authority of Singapore. Initiatives like the Green Bond Grant Scheme and the Green Finance Action Plan position Singapore as a regional green finance hub. Based on the findings of Kapoor et al. (2021) and Fadhillah and Wahyu (2024), the transparency and efficiency of the reporting system are the country's main strengths. Additionally, Osangthammanont (2018) noted Singapore's high achievement in the SDGs, reinforcing its role in harmonizing international green financial standards.

Malaysia stands out thru the development of SRI Sukuk by the Securities Commission Malaysia, which integrates Islamic financial principles with sustainability. This approach broadens the base of global and domestic investors (Asmadi Naim, 2019). Studies by Azhgaliyeva et al. (2020) and Kapoor et al. (2021) indicate that Malaysia has good regulatory and market infrastructure readiness, although it still faces limitations in the availability of viable private green projects.

Thailand is implementing a collaborative approach with regulatory bodies thru the Green Bond Notification, which regulates project classification and impact reporting. According to Pongsiri et al. (2020), synergy between ministries and capital market authorities is a key factor in the development of green bonds in Thailand. Climate Bonds Initiative (2018) notes Thailand's focus on the sustainable transportation sector and efforts to build a domestic green bond index to strengthen the secondary market.

Vietnam, although still in its early stages, is demonstrating a progressive policy direction thru the development of Green Bond Guidelines and the integration of green financing into the National Green Growth Strategy. Nguyen et al. (2022) highlight the challenges of low green financial literacy and the absence of independent rating agencies. However, Azhgaliyeva et al. (2020) and Nepal et al. (2021) show that political commitment and multilateral support are important foundations for Vietnam in strengthening the green bond market.

Overall, the implementation of green bonds in ASEAN is developing thru a combination of Sharia instruments, policy incentives, and regulatory strengthening, with

each country exhibiting unique characteristics that complement each other in driving regional sustainable financing.

**Table 1.**  
**The Uniqueness of Green Bonds in ASEAN**

Country	The Uniqueness of Green Bond Implementation	Literature Source
<b>Indonesia</b>	The world's first sharia-based Green Sukuk issuance, focusing on state budget projects.	Cendekiawan & Firmansyah (2024), ADB (2022), Aini et al.
<b>Singapore</b>	MAS incentive scheme and national green taxonomy; regional leader in ESG transparency	Kapoor et al. (2021), Fadhillah & Wahyu (2024), Chang (2019)
<b>Malaysia</b>	Development of SRI Sukuk by the private and public sectors, with technical reporting guidelines	Asmadi Naim (2019), Azhgaliyeva et al. (2020), Wahab (2021)
<b>Thailand</b>	Focus on green transportation projects (MRT); domestic green bond index development plan	Pongsiri et al. (2020), Climate Bonds Initiative (2018)
<b>Vietnam</b>	Long-term approach based on national strategy; integration of green finance into policy	Nguyen et al. (2022), Azhgaliyeva et al. (2020), Nepal et al. (2021)

The implementation of green bonds in ASEAN shows a varied but consistent approach in promoting sustainable finance. Indonesia and Malaysia stand out with their sharia approach thru green sukuk, Singapore leads in terms of regulation and incentives, Thailand is actively developing green transportation projects and the secondary market, while Vietnam focuses on long-term policies. Green bonds have become an important instrument in supporting the transition toward a green economy and achieving the SDGs in the region.

#### **Key Factors Influencing the Successful Adoption and Market Development of Green Bonds in ASEAN**

The development of green bonds in ASEAN shows diverse dynamics, influenced by policy factors, investor awareness, and market conditions in each country. Indonesia places the government as the central actor thru the role of the Ministry of Finance as the pioneer in issuing green sukuk (Muslim Cendekiawan & Firmansyah, 2024). POJK Regulation No. 60/2017 provides the basis for issuing green bonds, although its effectiveness still requires strengthened cross-sectoral coordination. On the investor side, market education and increased transparency are key to broadening interest, as demonstrated by the Asian Development Bank (2022). Indonesia's main challenges lie in the limited number of bankable green projects and the high perceived market risk, necessitating fiscal incentives and strengthening domestic ratings (Aini et al., 2023; Richy Wijaya et al., 2024).

Singapore has become the most advanced country in the development of green bonds thru comprehensive policy instruments such as the Green Bond Grant Scheme and the Green Finance Action Plan designed by the Monetary Authority of Singapore (MAS). A clear legal framework and a national green taxonomy strengthen Singapore's position as a regional green financial hub (Fadhillah & Wahyu, 2024). High investor awareness, supported by a transparent reporting system, also contributed to market growth (Kapoor et al., 2021).

However, Singapore faces issues such as potential greenwashing and the lack of uniform standards for green definitions (Youngho Chang, 2019).

Malaysia developed the SRI Sukuk Framework, which integrates Shariah principles and sustainability, providing clear guidelines for issuers and investors (Asmadi Naim, 2019). Despite having good regulatory preparedness, the development of green bonds in Malaysia is still limited by the low number of investable private green projects (Azhgaliyeva et al., 2020). Sharia investors show strong interest, but the market remains highly dependent on government initiatives as the role of the corporate sector is still limited.

Thailand adopts a collaborative approach to green bond development thru the Thailand Sustainable Finance Initiatives. The SEC Thailand issued a Green Bond Notification that sets project classifications and reporting guidelines (Pongsiri et al., 2020). Domestic investor awareness is still low, so more intensive education and campaigns are needed (Climate Bonds Initiative, 2018). The Thai market is generally focused on green public transportation projects, but liquidity in the secondary market remains low, prompting efforts to establish a national green bond index.

Vietnam is still in its early stages and faces structural constraints such as limited technical regulations, low green financial literacy, and the absence of independent rating agencies (Nguyen et al., 2022). Support from international organizations such as the ADB and GGGI plays an important role in strengthening national capacity (ADB, 2021). Although the domestic market is still weak, Vietnam has a strong long-term commitment thru the integration of green financing into its national climate change and green growth strategies (Nepal et al., 2021).

Here is a table summarizing the main factors influencing the development of green bonds in each ASEAN country (Indonesia, Singapore, Malaysia, Thailand, and Vietnam), based on the results of a literature review:

**Table 2.**  
**Factors Influencing the Development of Green Bonds in ASEAN**

Country	Policies & Regulations	Investor Awareness	Market Dynamics	Source / Main Journal Author
Indonesia	- POJK No. 60/2017 by OJK Green Sukuk by the Ministry of Finance	- Low, needs green financial literacy and transparency in green projects	- Bankable green projects are limited	Muslim Cendekiawan & Firmansyah (2024), ADB (2022), Aini et al. (2023), Richy Wijaya et al. (2024)
	- National Green Bond & Sukuk Framework		- High risk perception and domestic ratings are needed	

Country	Policies & Regulations	Investor Awareness	Market Dynamics	Source / Main Journal Author
<b>Singapore</b>	<ul style="list-style-type: none"> <li>- MAS: Green Bond Grant Scheme &amp; Green Finance Action Plan</li> <li>- National Green Taxonomy</li> </ul>	<ul style="list-style-type: none"> <li>- High, mature and transparent market environment</li> <li>- Proactive institutional investors</li> </ul>	<ul style="list-style-type: none"> <li>- Regional green bond center</li> <li>- The scale of domestic projects is limited due to the small territory.</li> </ul>	Fadhillah & Wahyu (2024), Kapoor et al. (2021), Youngho Chang (2019), Osangthammont (2018)
<b>Malaysia</b>	<ul style="list-style-type: none"> <li>- SRI Sukuk Framework by the Securities Commission</li> <li>- Regulations supporting Shariah-compliant green sukuk</li> </ul>	<ul style="list-style-type: none"> <li>- High among Sharia investors - Less active than the corporate sector</li> </ul>	<ul style="list-style-type: none"> <li>- Private projects are less developed</li> <li>- Dependence on government initiatives</li> </ul>	Asmadi Naim (2019), Azhgaliyeva et al. (2020), Kapoor et al. (2021), Wahab & Naim (2021)
<b>Thailand</b>	<ul style="list-style-type: none"> <li>- Green Bond Notification by the SEC</li> <li>- Cross-agency coordination within the Sustainable Finance Initiative</li> </ul>	<ul style="list-style-type: none"> <li>- Low, especially retail investors</li> <li>- Needs public campaigns and education</li> </ul>	<ul style="list-style-type: none"> <li>- Focus on green transportation</li> <li>- The secondary market has not developed optimally</li> </ul>	Pongsiri et al. (2020), Climate Bonds Initiative (2018), Nepal et al. (2021), Richy Wijaya et al. (2024)
<b>Vietnam</b>	<ul style="list-style-type: none"> <li>- Draft Green Bond</li> </ul>	<ul style="list-style-type: none"> <li>- Low, influenced by low</li> </ul>	<ul style="list-style-type: none"> <li>- The scarcity of bankable</li> </ul>	Nguyen et al. (2022), ADB (2021),

Country	Policies & Regulations	Investor Awareness	Market Dynamics	Source / Main Journal Author
	Guidelines by the Ministry of Finance & State Bank - Still in the early stages	green literacy - Dependent on international support	green projects - Lack of local rating agencies	Azhgaliyeva et al. (2020), Nepal et al. (2021), Quang & Thao (2022)

From the five ASEAN countries reviewed, it is evident that the adoption and development of green bonds are significantly influenced by three main pillars: policy & regulation, investor awareness, and market dynamics. All three play a crucial role in shaping a sustainable green financial ecosystem.

The development of green bonds in ASEAN shows varying degrees of progress influenced by policy readiness, market conditions, and investor participation levels. Indonesia has demonstrated its commitment thru POJK Regulation No. 60/2017 and the issuance of green sukuk by the government. However, the effectiveness of implementation is still hampered by limited institutional capacity, low investor literacy, and a lack of investment-worthy green projects. This condition confirms that the availability of a policy framework is not sufficient without systemic support in the form of market education, fiscal incentives, and strengthening the green project ecosystem.

Singapore is the most mature country in the region with a sustainable financial system. Policy initiatives from the Monetary Authority of Singapore (MAS) and the strength of the institutional investor base have made the country a regional hub for green bond issuance. Nevertheless, the limited domestic projects indicate that market success does not always align with the availability of green projects, so regional collaboration and cross-border project integration remain necessary.

Malaysia stands out thru the implementation of the SRI Sukuk Framework, which is based on Shariah principles. High investor awareness, especially from the sharia segment, supports the development of green bonds, although private sector participation remains low. The heavy reliance on government initiatives underscores the need for an increased role for corporations to strengthen the market sustainably and inclusively.

Thailand is adopting an inter-agency collaborative approach with a focus on green transportation projects. However, the low interest from retail investors and the underdeveloped secondary market indicate that public education and strengthening market instruments are still needed. The effort to develop a domestic green bond index is an important step toward a more competitive sustainable financial system.

Vietnam is in the early stages of development, with immature policies and a still-limited market. Dependence on international support, low green financial literacy, and a lack of bankable projects underscore the need for institutional reform, strengthening domestic rating agencies, and enhancing market capacity to drive domestic green bond growth.

## **The Impact of Structural Barriers on Green Bonds in ASEAN**

The green bond market in ASEAN has significant potential to support sustainable financing, but its development is still limited by three main obstacles: low domestic awareness, inconsistent reporting standards, and a limited supply of bankable green projects. These barriers manifest differently in each country, reflecting varying market readiness and capacity.

In Indonesia, low investor literacy and a lack of understanding of the long-term benefits of green bonds are major obstacles (Asian Development Bank, 2022). Inconsistent reporting standards, despite being regulated by POJK No. 60/2017, reduce investor confidence due to the lack of uniformity in reporting impact and fund usage (Muslim Cendekiawan & Firmansyah, 2024). Additionally, the limited number of bankable green projects makes the project pipeline insufficient to support market expansion (Aini et al., 2023; Richy Wijaya et al., 2024).

Singapore has a higher level of domestic awareness, but still faces challenges related to the inconsistency of the definition of "green" and the potential for greenwashing, which can undermine market credibility (Youngho Chang, 2019). As a regional publishing hub, Singapore is also affected by the diversity of reporting standards from publishers in other countries that have not yet adopted adequate transparency practices (Kapoor et al., 2021). The limitations of domestic green projects due to their narrow geographical scope mean that most publications are aimed at overseas projects, thus slowing the growth of the domestic market.

Malaysia faces challenges in green investment literacy, particularly in the private sector. Limited understanding hinders the demand for green bonds, even though regulatory infrastructure such as the SRI Sukuk Framework is available (Azhgaliyeva et al., 2020; Wahab & Naim, 2021). Irregular reporting, which is still voluntary, creates information gaps and reduces investor confidence (Asmadi Naim, 2019). Viable green projects are still largely driven by government institutions, indicating a high dependence on the public sector and low corporate participation.

In Thailand, retail investor awareness is still low, so the green bond market tends to be dominated by institutional investors (Climate Bonds Initiative, 2018). Although the Green Bond Notification regulations have been published, the implementation of reporting standards has not been consistent, leading to variations in the quality of reporting among issuers (Pongsiri et al., 2020). Green projects are also limited, with a dominant focus on the public transportation sector, making the market less diversified and vulnerable to dependence on a single sector.

Vietnam faces the most significant challenges. Investor literacy and understanding of green finance are still very low, even among regulators (ADB, 2021; Nguyen et al., 2022). Reporting standards are still under development and lack comprehensive national guidelines, which hinders publishers from producing credible reports (Nepal et al., 2021). Additionally, the lack of bankable green projects and the absence of independent domestic rating agencies make the Vietnamese green bond market heavily reliant on support from international institutions like GGGI.

To concretely understand how structural barriers impact the development of green bonds in ASEAN, it is necessary to examine the differences in conditions in each country. Each country has its own level of preparedness and challenges in addressing issues of

domestic awareness, reporting standards, and the availability of green projects. The following table presents a summary of the main obstacles faced by five ASEAN countries.

**Table 3.**  
**Obstacles to Issuing Green Bonds in ASEAN**

Country	Lack of Domestic Awareness	Irregularities in Reporting Standards	Limitations of the Green Project	Author / Journal Source
<b>Indonesia</b>	Green financial literacy is still low (ADB, 2022); investor education is not yet optimal (Muslim Cendekiawan & Firmansyah, 2024)	Impact reporting is not yet standardized across publishers, even tho POJK No. 60/2017 is already in place	The scarcity of bankable projects, high risks, and a weak pipeline of green projects (Aini et al., 2023; Richy Wijaya et al., 2024)	Muslim Cendekiawan & Firmansyah (2024), ADB (2022), Aini et al. (2023), Richy Wijaya et al. (2024)
<b>Singapore</b>	High, but challenges still arise from the practice of greenwashing (Youngho Chang, 2019)	There is no uniform definition of "green" in ASEAN; cross-country reporting is not yet standardized (Kapoor et al., 2021)	A narrow geographical scope limits local projects; publications are dominated by foreign projects	Youngho Chang (2019), Kapoor et al. (2021), Fadhillah & Wahyu (2024)
<b>Malaysia</b>	The private sector has not been active in green investment; awareness is high but uneven (Azhgaliyeva et al., 2020)	Voluntary project reporting, not strictly audited; less transparent (Asmadi Naim, 2019; Wahab & Naim, 2021)	Most of the government's green projects; private sector involvement is still low	Azhgaliyeva et al. (2020), Asmadi Naim (2019), Wahab & Naim (2021), Kapoor et al. (2021)
<b>Thailand</b>	Retail investors are not yet interested; public education is still minimal (Climate Bonds Initiative, 2018)	Green bond notification exists, but its implementation is not yet widespread (Pongsiri et al., 2020)	Green projects are limited to public transportation; lack of project diversification	Climate Bonds Initiative (2018), Pongsiri et al. (2020), Nepal et al. (2021), Richy Wijaya et al. (2024)

Country	Lack of Domestic Awareness	Irregularities in Reporting Standards	Limitations of the Green Project	Author / Journal Source
Vietnam	Investor and regulator awareness is low; green financial literacy is minimal (ADB, 2021; Nguyen et al., 2022)	There is no national reporting guideline yet; impact reporting is not yet standardized (Nepal et al., 2021)	The scarcity of local rating agencies; difficulty attracting investors to projects; dependence on international institutions	ADB (2021), Nguyen et al. (2022), Nepal et al. (2021), Quang & Thao (2022)

From the table above, it can be seen that although ASEAN has a collective commitment to sustainable financing, its implementation is heavily influenced by complex domestic factors. Indonesia and Vietnam face fundamental challenges in terms of green awareness and literacy, while Malaysia and Thailand are stagnating due to limited private projects and a lack of transparent reporting. On the other hand, even Singapore, which is more institutionally advanced, still faces the problem of inconsistent definitions of green taxonomy in the region.

This gap highlights the importance of standard harmonization and strengthening domestic capacity, both in terms of policy, financial education, and technical support for green projects. If these structural barriers can be addressed with appropriate and locally contextualized strategies, then green bonds can become a key pillar in financing the transition toward a green economy in the ASEAN region.

**Strategic Efforts of ASEAN Countries in Overcoming Barriers to Green Bond Issuance**

The issuance of green bonds in the ASEAN region faces a number of structural challenges that affect their effectiveness as a sustainable financing instrument. To overcome these obstacles, ASEAN countries are developing different strategies based on their national contexts. These efforts generally include strengthening regulations, increasing green financial literacy, providing fiscal incentives, and expanding international collaboration to build an inclusive and competitive green financing ecosystem.

In Indonesia, the strategy to strengthen the green bond market is pursued thru a combination of fiscal and sharia approaches. The government issued green sukuk as a sharia-based financing instrument to support environmentally friendly projects, and implemented POJK No. 60/2017 as a regulatory reference for the issuance of domestic green bonds. A national green bond and sukuk framework was also developed to guide the public and private sectors in financing green projects. Nevertheless, the market still faces challenges such as low investor literacy regarding the risks and benefits of green finance, inconsistent reporting of environmental impact, and the lack of a national rating system specifically for green bonds. To address this, the government is collaborating with the Asian Development Bank (ADB) and the Global Green Growth Institute (GGGI) to build the technical capacity of issuers and develop a pipeline of bankable green projects. Various educational programs are also being

intensified to strengthen market understanding and encourage broader private sector involvement.

Singapore has emerged as a leading green financial center in ASEAN through comprehensive initiatives such as the Green Finance Action Plan, the Green Bond Grant Scheme, and the development of a national green taxonomy. This policy allows for the issuance of cross-sector green bonds by both public and private institutions with strong support from the Monetary Authority of Singapore (MAS). However, challenges remain, particularly regarding the risk of greenwashing and the lack of uniformity in the definition of "green," which can affect market credibility. Additionally, the absence of a harmonized regional taxonomy hinders cross-border publishing. To address this, Singapore is strengthening transparency through mandatory climate disclosures, encouraging voluntary assurance, and accelerating the regional harmonization of standards. Given the limitations of domestic land, Singapore is also expanding funding to regional green projects, thereby strengthening its position as a cross-border green bond hub in Southeast Asia.

Malaysia has shown significant progress through the implementation of the SRI Sukuk Framework, which provides Shariah-compliant green bond issuance standards for both the public and private sectors. Although this framework has become one of the foundations for the development of green finance in ASEAN, private sector participation remains limited due to a lack of understanding, incentives, and a high degree of dependence on government initiatives. Inequality also arises in the reporting aspect because the obligation is still voluntary, which reduces transparency and investor confidence. Future national strategies include increasing fiscal incentives, expanding green financial literacy in the corporate sector, and international cooperation to broaden market access. Malaysia is also strengthening coordination among ASEAN regulators in an effort to harmonize standards and improve reporting accountability.

In Thailand, policies such as the Green Bond Notification issued by the Securities and Exchange Commission (SEC) and various Sustainable Finance Initiatives strengthen the green financing framework, particularly for public infrastructure projects like the MRT. However, low public awareness and retail investor participation limit market development. Additionally, the lack of standardized environmental reporting leads to variations in the quality of information provided by publishers. To address these challenges, Thailand is increasing public education, developing a domestic green bond index to attract investor interest, and providing incentives for the private sector to issue green bonds. International collaboration is also being expanded to enrich best practices and increase cross-border publishing.

Vietnam is in the early stages of developing its green bond market, with various policies still in draft form, such as the green bond guidelines from the Ministry of Finance and the State Bank. Ecosystem development faces constraints such as low institutional capacity, limited market participant literacy, and the absence of a national rating agency and comprehensive reporting standards. Reliance on support from international institutions like the ADB and GGGI indicates that domestic capacity for developing green projects is not yet fully independent. Therefore, Vietnam is now focusing on building a stronger legal framework, establishing local rating agencies, and enhancing the technical capacity of regulators and the private sector. International donor support remains a crucial driver in

accelerating the development of green projects and shaping a national sustainable financing ecosystem.

In facing the structural challenges of green bond issuance, ASEAN countries are adopting various strategies tailored to their respective domestic conditions. These efforts include strengthening regulations, fiscal incentives, international collaboration, and improving market and institutional capacity. Here are the strategic approaches implemented by Indonesia, Singapore, Malaysia, Thailand, and Vietnam to overcome these barriers and support the green finance-based sustainable development agenda.

**Table 4.**  
**ASEAN Member States' Strategies to Overcome Barriers to Green Bond Issuance in ASEAN**

Country	Regulatory Approach	Challenge	Concrete Efforts	Source Journal
<b>Indonesia</b>	POJK No. 60/2017; Green Sukuk Framework by the Ministry of Finance	Green literacy is low; the project is not yet bankable; impact reporting is not standardized	Investor education; ADB & GGGI collaboration; strengthening the green project pipeline	Muslim Cendekiawan & Firmansyah (2024); ADB (2022); Aini et al. (2023); Richy Wijaya et al. (2024)
<b>Singapore</b>	Green Finance Action Plan; Green Bond Grant Scheme; national green taxonomy	Greenwashing; the definition of "green" is not uniform; limitations of domestic projects	Climate disclosure; harmonization of regional standards; cross-border project financing	Fadhillah & Wahyu (2024); Youngho Chang (2019); Kapoor et al. (2021); Sudan (2023)
<b>Malaysia</b>	SRI Sukuk Framework by the Securities Commission	Voluntary reporting; low private sector involvement; dependence on government projects	Fiscal incentives; green literacy campaigns; regional regulator cooperation	Asmadi Naim (2019); Wahab & Naim (2021); Azhgaliyeva et al. (2020); Kapoor et al. (2021); Fawa'id & Utama (2023)
<b>Thailand</b>	Green Bond Notification by the SEC; Sustainable Finance Initiatives	Retail participation is low; impact reporting is not uniform; projects are limited in transportation	Public education; domestic green bond index; fiscal incentives for the private sector	Pongsiri et al. (2020); Climate Bonds Initiative (2018); Nepal et al. (2021); Richy Wijaya et al. (2024); Sudan (2023)

Country	Regulatory Approach	Challenge	Concrete Efforts	Source Journal
Vietnam	Draft green bond guidelines; development of a legal and technical framework	Institutional capacity is low; there are no national rating agencies or reporting standards yet	Technical training; development of local rating agencies; collaboration with ADB and international donors	Nguyen et al. (2022); ADB (2021); Quang & Thao (2022); Nepal et al. (2021)

From the table above, it can be concluded that despite differences in approach between countries, there is a common pattern of strengthening the regulatory framework, increasing literacy and transparency, and collaborating with international institutions as key elements in overcoming barriers to issuing green bonds. Countries like Singapore and Malaysia stand out with more established institutional approaches and strong fiscal policy support, while Indonesia, Thailand, and Vietnam still face structural challenges that require further institutional strengthening. Looking ahead, the harmonization of standards among ASEAN countries, coupled with private sector support and improved reporting capacity, will be key to building an inclusive and resilient green bond market in the region.

**Analysis of the Role of Government and International Institutions in the Green Bond Ecosystem in ASEAN**

Governments and international organizations play a crucial role in building the green bond ecosystem in the ASEAN region, especially since the sustainable finance market in this area is still in its developmental stage. In this context, state intervention becomes a crucial catalyst for providing regulatory infrastructure, increasing investor confidence, and encouraging private sector involvement. Thru a combination of domestic policies and global collaboration, ASEAN member states are striving to create an inclusive, transparent, and competitive green financing ecosystem to support the transition toward low-carbon development.

In Indonesia, the government, thru the Ministry of Finance and the Financial Services Authority (OJK), has played an active role by issuing green sukuk and establishing POJK No. 60/2017 as a guideline for issuing green bonds. The Green Bond & Green Sukuk Framework was also developed as a guide for the public and private sectors. However, the effectiveness of these policies still faces various obstacles, such as low market literacy regarding green finance, a limited number of bankable green projects, and weak environmental impact reporting mechanisms. To overcome these constraints, the role of international institutions such as the Asian Development Bank (ADB) and the Global Green Growth Institute (GGGI) becomes highly significant, especially in strengthening technical capacity, developing a pipeline of green projects, and providing training to issuing institutions (Muslim Cendekiawan & Firmansyah, 2024; ADB, 2022). This collaboration forms an important foundation for the early development of the green bond ecosystem in Indonesia, even tho the domestic market is still in its growth phase.

Singapore is becoming a benchmark for green finance in ASEAN thru the strong involvement of the Monetary Authority of Singapore (MAS). Various strategic policies, such

as the Green Finance Action Plan, the Green Bond Grant Scheme, and the development of a national green taxonomy, strengthen the competitiveness of Singapore's green bond market. Collaboration with international organizations focuses on harmonizing standards, increasing transparency in climate risk reporting, and implementing international standards to prevent greenwashing. Additionally, the limitations of domestic projects are pushing Singapore to expand financing to cross-border projects, thereby strengthening its position as a credible and globally attractive regional green bond hub (Fadhillah & Wahyu, 2024; Sudan, 2023).

In Malaysia, the government, thru the Securities Commission, is encouraging the development of the Shariah-compliant green bond market by releasing the SRI Sukuk Framework. This framework is one of the important foundations for integrating Sharia principles with sustainable finance in ASEAN. Government support is evident thru the provision of fiscal incentives, the promotion of green financial literacy, and increased cooperation among regional regulators. The role of international institutions in technical assistance also contributes to investor confidence and strengthens issuance standards. However, the still voluntary reporting mechanism and reliance on government support highlight the need for increased private sector participation to create a more independent and sustainable market (Wahab & Naim, 2021; Azhgaliyeva et al., 2020).

Thailand is strengthening the green bond ecosystem thru the Green Bond Notification policy by the Securities and Exchange Commission (SEC) and support for public infrastructure projects like the MRT issued by state-owned enterprises. The government is focusing on projects with a real environmental impact, while developing a domestic green bond index to attract investor interest. Nevertheless, low literacy among the public and retail investors remains a significant obstacle. The role of international organizations is present thru knowledge sharing and policy benchmarking, which helps strengthen the regulatory process. The government's role appears active, but it has not been fully able to create optimal public and private participation (Pongsiri et al., 2020; Nepal et al., 2021).

Vietnam is in the early stages of developing its green bond market, with government policies still in the form of basic guidelines and draft technical frameworks. Limited institutional capacity, low market literacy, and the absence of local rating agencies are the main obstacles to developing the domestic ecosystem. International organizations such as the ADB, GGGI, and international donors play a dominant role in providing technical training, publication mentoring, and funding for pilot projects. This indicates that Vietnam's green bond market is still heavily reliant on external support. Therefore, strengthening national government capacity is an important step toward reducing dependence and strengthening long-term sustainability (Nguyen et al., 2022; Quang & Thao, 2022).

Based on the results of a literature review of various academic studies and reports from international organizations, the role of national governments and support from international institutions have proven to be key factors in shaping and strengthening the green bond ecosystem in the ASEAN region. Each country exhibits variations in policy approaches, institutional capacity, and structural challenges that influence the success of green bond issuance. The following table presents a comparison of five ASEAN countries regarding government initiatives, forms of international support, and the main obstacles faced, as identified in several analyzed pieces of literature.

**Table 5.**  
**The Role of Government in Issuing Green Bonds in ASEAN**

<b>Country</b>	<b>The Role of the Government</b>	<b>The Role of International Organizations</b>	<b>Main Challenges</b>	<b>Journal Source</b>
<b>Indonesia</b>	The Ministry of Finance and the Financial Services Authority (OJK) issued green sukuk, OJK Regulation No. 60/2017, and the Green Bond & Sukuk Framework	ADB & GGGI support the technical, training, and development of green projects	Market literacy is low, impact reporting is weak, and the project is not yet bankable	Muslim Cendekiawan & Firmansyah (2024); ADB (2022)
<b>Singapore</b>	MAS is developing a Green Finance Action Plan, a Green Bond Grant Scheme, and a green taxonomy	Global collaboration focuses on harmonizing standards, climate reporting, and cross-border financing	Limited domestic projects, challenges in defining "green," potential for greenwashing	Fadhillah & Wahyu (2024); Sudan (2023)
<b>Malaysia</b>	The Securities Commission initiated the SRI Sukuk Framework, promoted literacy, offered fiscal incentives, and fostered ASEAN cooperation	Technical assistance, international benchmarking to boost investor confidence	Voluntary reporting, reliance on incentives, minimal private sector involvement	Wahab & Naim (2021); Azhgaliyeva et al. (2020)
<b>Thailand</b>	The SEC issued a Green Bond Notification, supporting MRT projects and forming a domestic green bond index	International organizations only play a role in knowledge sharing and benchmarking	Public literacy is low, and private and retail participation is still minimal	Pongsiri et al. (2020); Nepal et al. (2021)

Country	The Role of the Government	The Role of International Organizations	Main Challenges	Journal Source
Vietnam	Just developing green bond guidelines and a technical framework, and institutional capacity is still limited	ADB, GGGI, and donors are providing technical assistance, training, and funding for the project	High dependence on external support, no independent national initiatives yet	Nguyen et al. (2022); Quang & Thao (2022)

Overall, these countries are promoting green financing thru regulation, incentives, and global collaboration, but still face obstacles such as low literacy, dependence on external support, and the risk of greenwashing. In Indonesia, the Ministry of Finance and the Financial Services Authority have issued green sukuk, OJK Regulation No. 60/2017, and the Green Bond & Sukuk Framework to facilitate green projects, with technical assistance, training, and development from the ADB and GGGI. However, the main challenges are low market literacy, weak impact reporting, and projects that are not bankable. Singapore, thru the Monetary Authority of Singapore, is developing a Green Finance Action Plan, a Green Bond Grant Scheme, and a green taxonomy, with global collaboration emphasizing the harmonization of standards, climate reporting, and cross-border financing. However, it faces limited domestic projects, difficulties in defining "green," and potential greenwashing.

Malaysia, under the Securities Commission, initiated the SRI Sukuk Framework, promoting literacy, fiscal incentives, and ASEAN cooperation, supported by technical assistance and international benchmarking to build investor confidence, although challenges include voluntary reporting, reliance on incentives, and minimal private sector involvement. Thailand, with its Securities and Exchange Commission issuing the Green Bond Notification, supporting MRT projects, and establishing a domestic green bond index, only receives international institutional support for knowledge sharing and benchmarking. However, public literacy is low, and private and retail participation remains limited. Vietnam, which has just developed green bond guidelines and a technical framework with limited institutional capacity, relies on assistance from ADB, GGGI, and other donors for technical support, training, and project funding, but does not yet have its own national initiatives.

### **The Development of Green Bonds in ASEAN Using Meta-Analysis**

A meta-analysis approach was used to integrate the quantitative findings so that common patterns, trends in results, and consistency across studies could be identified. Meanwhile, meta-synthesis summarizes qualitative findings into key themes that provide a deeper understanding of the dynamics of green bond policies and markets. The results of the meta-analysis show that green bonds contribute positively to strengthening sustainable financial markets and support environmental goals in most ASEAN countries. However, its effectiveness is still limited in financing renewable energy, especially in countries with low project capacity, high macroeconomic risk, and immature market infrastructure. This confirms that the success of green bonds is highly dependent on the readiness of supporting ecosystems such as regulations, transparency, and investor literacy.

Thru meta-synthesis, six main themes emerged in the literature: (1) the role of green financial regulation, (2) investor dynamics and market structure, (3) renewable energy financing, (4) green technology development, (5) contribution to SDGs, and (6) regional structural challenges. These themes illustrate the variation in progress between countries, where Singapore and Malaysia have more mature green finance ecosystems, Indonesia is developing thru innovation in sovereign green sukuk, Thailand excels in low-emission transportation financing, while Vietnam still faces institutional limitations and project readiness.

**Table 6.**  
**Score Meta-Analysis on Research on Green Bond Issuance in ASEAN**

No	Region	Method	Variable	Effect	Strength	Quality
1	1	1	1	-1	4	4
2	4	3	2	+1	4	4
3	4	3	6	+1	5	5
4	4	7	5	-1	4	4
5	2	2	1	+1	5	5
6	3	1	6	+1	4	4
7	5	7	5	+1	4	4
8	4	1	3	-1	5	5
9	4	1	3	-1	4	4
10	4	5	1	-1	4	4
11	4	6	3	+1	5	5
12	5	7	6	-1	4	4
13	4	1	6	+1	4	4
14	4	7	4	+1	5	5
15	3	1	1	-1	4	4
16	4	4	6	-1	5	5
17	4	2	1	+1	5	5
18	4	4	3	-1	4	4
19	4	6	5	+1	5	5
20	4	4	5	+1	5	5
21	4	1	6	+1	4	4
22	5	7	6	-1	4	4
23	4	5	6	+1	4	4
24	4	5	4	+1	5	5
25	1	5	2	-1	5	5

The results of the meta-analysis indicate that most research on green bonds in ASEAN is conducted at the regional level, suggesting that the development of this instrument is better understood as part of regional economic integration thru standards such as the ASEAN Green Bond Standards. This pattern also reveals differences between countries, with Indonesia still facing challenges such as low investor literacy, green projects that are not bankable, and

inconsistent reporting. Conversely, Singapore and Malaysia showed positive results due to more mature regulations, fiscal incentives, and Shariah integration thru SRI Sukuk.

From a methodological perspective, most studies utilize a literature review and policy analysis approach, indicating that research on green bonds is still in the early stages of mapping the phenomenon. Empirical methods such as panel data and econometric regression provide more consistent findings because they are better able to explain causal relationships. This indicates the need for increased quantitative research to strengthen the literature.

Variable analysis shows the dominance of studies on market development, reflecting that the green bond ecosystem in ASEAN is still in its developing stage. On the other hand, energy variables tend to show a negative effect because renewable energy projects are still limited and high-risk. Regulatory variables and SDGs yielded varied findings, depending on the institutional capacity of each country. This indicates that green bonds are more effective in strengthening markets and governance than in being a primary driver of the energy transition. Overall, 58% of the studies showed a positive effect, while 42% showed a negative effect. Negative effects are more pronounced in countries with low regulation and market readiness, particularly in the energy sector. This finding confirms that the effectiveness of green bonds is highly dependent on strong regulation, consistent reporting, the availability of bankable green projects, and investor engagement.

## CONCLUSION

The results of the meta-analysis show that green bonds in ASEAN are developing positively, although their effectiveness is not yet uniform. Approximately 58% of the research indicates a positive impact, particularly in countries with strong regulations such as Singapore and Malaysia, while Indonesia, Thailand, and Vietnam still face regulatory constraints, green project readiness, and market literacy. Regulations and reporting standards are the main determinants of the success of green bonds, followed by the limited liquidity and investor interest in the market's development. This instrument is also not yet optimal for supporting renewable energy financing due to projects that are not bankable and high risk. Regional analysis confirms significant disparities between countries in their readiness for the green finance ecosystem. The meta-synthesis identified six main themes – regulation, market, energy, green technology, contributions to SDGs, and structural challenges – which highlight the need for a cross-sectoral integrative approach. Overall, green bonds have great potential to strengthen sustainable finance in ASEAN. However, increased effectiveness requires strengthening regulations, harmonizing policies, improving the quality of green projects, and expanding investor participation to promote a more inclusive green transition in the region.

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