Why Do Asian Banks Still Hesitate on Green Finance? Taxonomy Fragmentation Meets Data-Driven Evidence

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Abstract

Climate change presents a profound and growing financial threat to Asia, with a substantial portion of regional economic output at risk over the coming decades. While commercial banks holding US$165 trillion in global assets possess the capital capacity to bridge a financing gap exceeding US$7.2 trillion annually, their participation in Asian green finance remains limited. This paper argues that the binding constraint is not capital scarcity but structural fragmentation in green classification systems. Drawing on multilateral finance data, ADB investor surveys across ASEAN, and comparative taxonomy analysis spanning the EU, China, and ASEAN frameworks, we demonstrate that the absence of interoperable green taxonomies raises verification costs, prevents risk pooling, and undermines the co-investment structures that Asian market conditions require. Taxonomy standardization across ASEAN, enabling lead underwriters to establish credible cross-market eligibility baselines, is identified as the most actionable lever for mobilizing commercial bank participation in renewable energy and clean transportation financing at scale.

1. Introduction

Most experts agree that climate risk is emerging as the top economic risk (Elsner et al., 2025). In fact, in the IMF's Global Risk Report 2025, extreme climate risk ranks second among risks over the next 2 years. There is also consensus that weather conditions caused $417 billion in losses in 2024 (Larsen et al., 2025), and this figure is expected to increase to 10% of GDP by 2050. The Climate Risk Index by German Watch (Adil et al., 2025) estimates that climate change between 1995 and 2024 led to over 832,000 lives lost and US$ 4.5 trillion in losses attributable to these incidents. The details of these losses are in Figure 1.

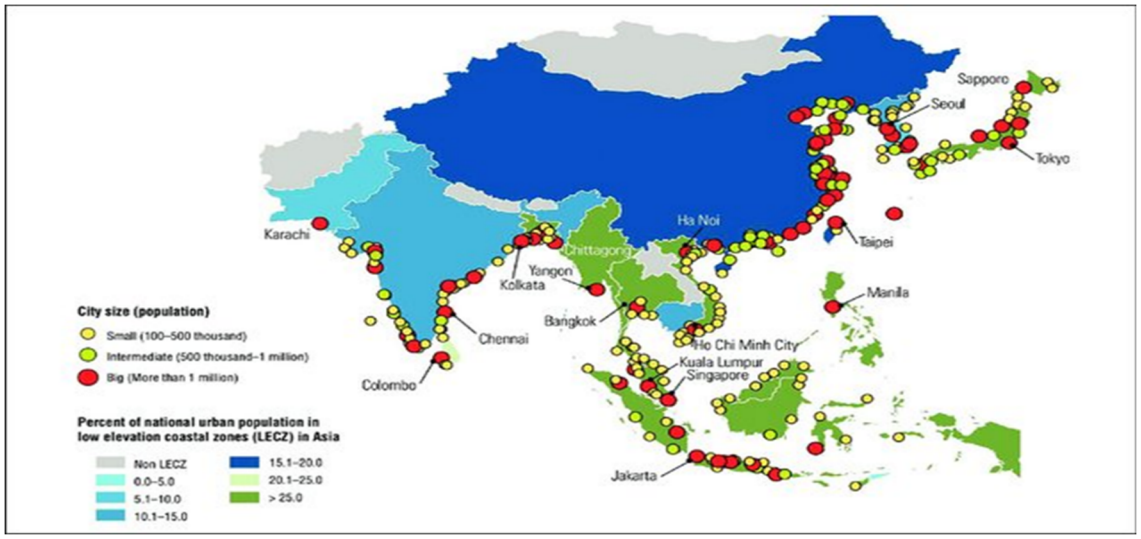
Figure 1 – Global losses attributable to climate incidents (1995-2024)

Hazard	Fatalities	Affected people (millions of people)	Economic loss (US$ billions- inflation adjusted)
Drought	25,283	1,825.08	286.95
Flood	205,452	2,720.01	1,314.01
Heatwave	278,395	33.93	32.86
Storm	274,753	988.26	2,637.27
Wildfire	2,791	15.26	177.57
Others	45,611	112.30	64.96

Source: Adil et. al, 2025

These levels of losses and threats are unsustainable. The situation could be worse for Asian markets, where roughly 33% of GDP is estimated to be at risk due to climate change. Rollins et al. (2022) have indicated that Asia is a coastal economy where rising sea levels could be an existential threat. UNDP (2024) further estimates that Asia could experience a GDP contraction of 26.5% by 2048, far exceeding the global average of 18%, making climate risk a macro-financial imperative, not merely an environmental one. The main Asian production centers can be depicted in Figure 2.

Figure 2 – Asia Pacific urban centers with estimates of population in those areas



Source: Rollins et al. (2022)

This potential loss must be viewed in both existential and economic contexts. The economic impact is significant, as sustainability is defined in economic terms. The United Nations Brundtland Commission (UN, 1987) defines sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." In a World Bank policy paper, Ashiem (1994) argues that sustainability leads to a non-decreasing, intergenerational quality of life. The view from Asheim (1994) was considered justified as it was assumed that technology is not stationary. As generations consume natural resources, efficiency forces new technologies and processes that help

maintain the balance. Financing that transition, however, requires capital at a scale that public institutions alone cannot provide. Mitigation finance alone must exceed US$8.4 trillion annually by 2030, against current investment of only US$1.2 trillion in 2021/22 (WEF, 2025), a gap that public budgets cannot close. Commercial banks, which collectively hold US$165 trillion in assets, represent the most plausible source of capital at this scale, yet their engagement in green finance across Asia remains limited and fragmented.

The central research problem is that despite possessing sufficient capital, commercial banks in Asia remain structurally constrained from leading green finance. Prior research has identified several potential barriers, including high capital costs, regulatory unpredictability, and lack of tax incentives (ADB, 2022), yet the role of green taxonomy fragmentation as a structural constraint on bank participation has received limited systematic attention in the ASEAN context (Alessi & Battiston, 2022; IPSF, 2021). Without interoperable classification frameworks, banks cannot effectively pool risk, calibrate credit exposure, or structure the co-investment deals that Asian market conditions require. This gap motivates the present study.

This paper addresses two research questions: (1) Why does green taxonomy fragmentation constrain commercial bank participation in green finance across Asia? (2) How can taxonomy standardization enable the risk-pooling and co-investment mechanisms necessary to mobilize bank capital for renewable energy and clean transportation at scale? This paper makes three contributions. First, it reframes the Asian green finance gap as a structural classification problem rather than a capital-scarcity issue. Second, it identifies co-investment viability, contingent on taxonomy interoperability, as the critical mechanism linking standardization to bank participation. Third, it demonstrates the applicability of the EU-China Common Ground Taxonomy model to the ASEAN context, offering a replicable pathway for regional harmonization.

The paper is organized as follows. Section 2 explains the method. Section 3 outlines banks' climate-risk exposures. Section 4 reviews environmental, social, and governance (ESG) funding gaps and the need for commercial bank leadership. Section 5 maps the Asian green-finance landscape. Section 6 analyzes taxonomy frameworks, interoperability barriers, and policy implications. Section 7 examines ESG segment viability, Section 8 notes data limitations, and Section 9 concludes.

2. Method

This paper adopts a qualitative synthesis approach to examine the relationship between green taxonomy fragmentation and commercial bank participation in sustainable finance across Asia. Rather than generating primary data, the analysis draws on three complementary evidence streams. First, aggregate climate finance flows and investment gap estimates are sourced from multilateral institutions, including the OECD, WEF, Climate Policy Initiative, and IMF, providing a quantitative baseline for the financing

shortfall. Second, investor and underwriter preferences are examined through the ADB (2022) survey of 314 investors and 96 underwriters across ASEAN, which constitutes the most comprehensive available dataset on green finance appetite and structural barriers in the region. Third, existing green taxonomy frameworks, specifically the EU taxonomy, China's ICNEA-based taxonomy, and the IPSF Common Ground Taxonomy, are examined comparatively to identify interoperability gaps and their implications for cross-border risk pooling. Fourth, ESG startup survivability data from Kakar (2024), drawn from a Crunchbase sample of 196 ventures analysed using logistic regression, provides complementary quantitative evidence on the return viability of green segments relevant to commercial bank participation. Together, these evidence streams are synthesized to construct an argument about the structural conditions under which commercial banks can scale green finance participation. The paper does not test hypotheses statistically; rather, it builds a theoretically grounded analytical case for the standardization of taxonomies as a precondition for the viability of co-investment in ASEAN markets.

3. Climate risk and why it should matter to banks

Alegria et al. (2024) refer to the climate risk definition as per the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) as “The potential for adverse consequences for human or ecological systems, recognising the diversity of values and objectives associated with such systems. In the context of climate change, risks can arise from potential impacts of climate change as well as human responses to climate change.”

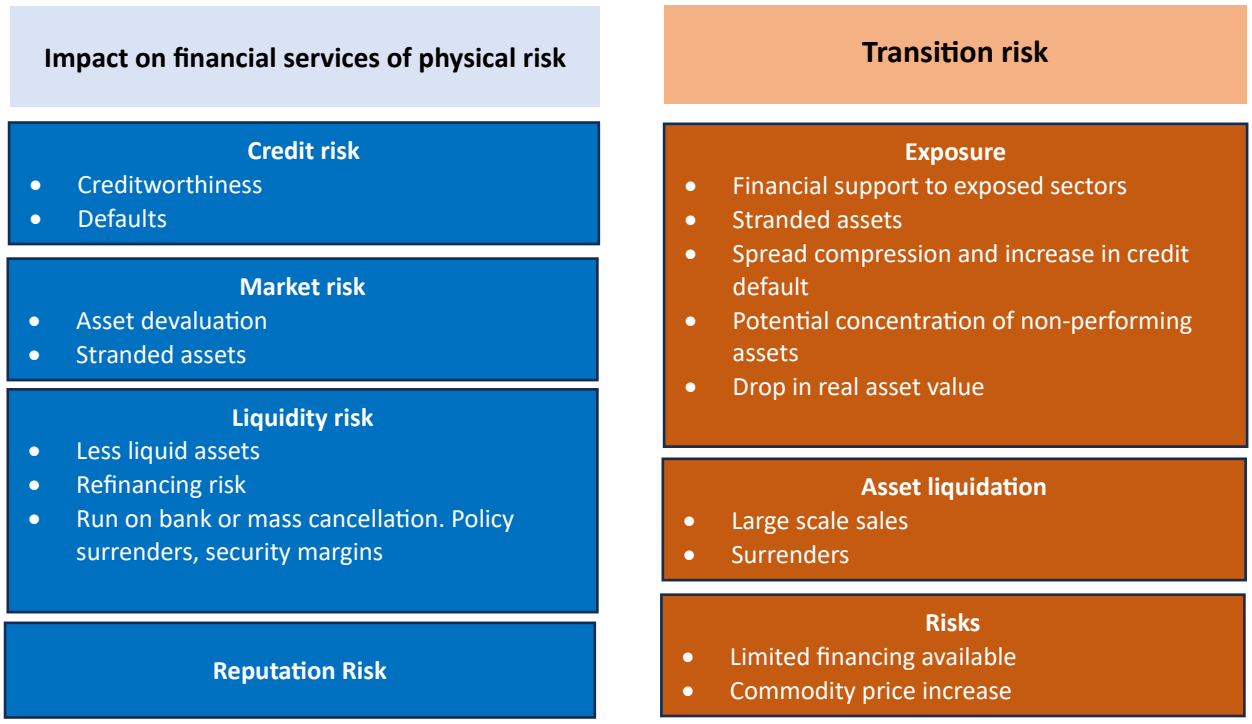
Climate risk is evaluated in two main ways. Most international associations categorize risk into physical and transition risk (EIB, 2025). Physical risk includes risk factors such as (i) damages due to extreme weather, (ii) agricultural losses due to disasters, (iii) cost of protecting due to rising sea levels, (iv) cost of upgrading infrastructure, (v) productivity losses due to increasing heat, and (v) economic loss due to water scarcity (EIB, 2025). Transition risk is the challenge that companies, governments, and ecosystems face as they transition to net zero. Transition risk is best understood by addressing the variables that impact it. Capturing and impacting these variables is critical to impact transition risk. The variables include (i) greenhouse gas emissions, (ii) commitment to mitigate greenhouse gas emissions and UN assigned global greenhouse budgets, (iii) energy consumption both globally and as a % of GDP, (iv) fossil fuel rents, (v) renewables current level and trends, and finally (vi) national policy addressing climate change (EIB, 2025).

For commercial banks, these transition-risk variables translate into concrete balance-sheet vulnerabilities (Zhang & Ming, 2025). Carbon-intensive borrowers face rising default probabilities as carbon pricing mechanisms tighten, asset prices in high-emission sectors become increasingly volatile, and banks risk holding stranded assets whose collateral value rapidly erodes under evolving climate policies. Importantly, these risks compound: a bank holding collateral tied to fossil-fuel infrastructure faces simultaneous credit, market, and liquidity risks if transition policies accelerate (Alessi et al.,

2024). These dynamics elevate climate risk from a peripheral ESG concern to a core credit risk determinant, with direct implications for long-term bank solvency and capital adequacy ratios (D'Orazio, 2025).

ECB (2022) and other organizations, such as the IMF (in ECB, 2022), split risk into three different parts. These are climate change mitigation, climate change adaptation, and transition risk. Mitigation addresses the principal determinants of climate risk, i.e., greenhouse gases, while adaptation refers to building the social, ecosystem, and economic systems in response to the physical risk. Financial resilience and safeguarding financial capacity are an adaptation strategy. Transition in the context of ECB (2022) is defined as policy changes, disruptive innovations, and changes in consumer behavior that mitigate the climate risk.

Figure 3- Financial risk resulting from climate drivers for the financial sector



Adapted from Climate Policy Initiative (2022) & authors own experience

There are two reasons climate risk should matter to banks. Climate change is increasing banking risks, and there are principles for responsible investment that may affect them, though these are more relevant for institutional investors. Principles of responsible investment (UN, 2005) were established by UN to promote ESG investment. The six principles include incorporating ESG into investment analysis and decision-making processes, incorporating ESG into ownership policies and practices, seeking appropriate ESG disclosures by entities where funds invest, promoting the acceptance of the principles within the investment industry, enhancing the effectiveness of responsible investment principles within the investment industry, and reporting on the practices and implementation of

responsible investment principles. Currently, there are 5,000+ participants with almost $140 trillion in assets under management (AUM) governed by these principles. Next, we consider the impact of climate change on banking risk. These are best explained using Figure 3

A 2021 estimate (Climate Policy Institute, 2022) estimates that over $1 trillion of assets in India were at risk due to climate change. The number is significantly higher globally. Given the significant risks posed by climate change, it is important to address it. Addressing it requires funding. In its sovereign debt fund guidance, the World Bank has stated that, as Boitreaud et al. (2020) note, the world of finance is also recognizing its important role in supporting the just transition. Commercial banks should play a large part in this funding. But is that the case? And what is stopping them from increasing their exposure in ESG projects?

4. ESG projects funding. Are banks taking the lead?

There are three methods to finance green projects. These are funding from multilateral agencies, private credit, and commercial banks. The final solution could also be hybrid. Multiple financing instruments, such as grants, debt, convertible debt, and equity, are used to fund these transactions. Commercial banks and private credit have been segregated in this study based on the differences in their investment appetite. The role of both multilateral agencies and commercial banks would be in focus as private credit has limited assets under management (AUM).

OECD (2025) estimates that solving this challenge would require an estimated annual funding gap of $6.4 trillion. WEF's (2025) estimates that the gap could be larger. WEF (2025), citing the Climate Policy Initiative (CPI), projects that funding needs will rise to $9 trillion by 2030 and exceed $10 trillion annually from 2031 to 2050. Mitigation finance alone must surpass $8.4 trillion per year by 2030, yet only $1.2 trillion was invested in 2021/2022. That increases the gap to $7.2 trillion.

It is notable that most of these gaps are based on the Paris Agreement (United Nations Climate Change, 2025), which limits temperature increase to 1.5 degrees from the pre-industrial era, and do not include the new requirements arising from COP30. The gap is expected to widen based on the evident risk that the Paris Agreement will be breached. Solving the funding gap is critical, or the anticipated losses from extreme weather will materialize.

WEF (2025) has further stated that enhanced public financing mechanisms are crucial, but so is private-sector engagement. Private investors need a lever to estimate pool risk. The current risks perceived by private investors include high capital costs, political and regulatory unpredictability, and the complex landscape of climate finance. Let us break down the landscape in which public financing, multilateral agencies, and private funding operate.

Multilateral agencies fund ESG projects using a mix of grants, low-cost project debt, and market-rate debt (Climate Policy Initiative, 2024). Market-rate debt comprised 79% of the estimated multilateral agencies' funding in 2021/ 22 (Climate Policy Initiative, 2024). Multilateral agencies' funding capacity could be affected by anticipated rate compression, currency fluctuations that can impair repayment capacity, especially in emerging markets with US dollar-linked debts, and geopolitical tensions. Avila-Yiptong et al. (2025) expect investment flows to emerging markets to be affected, thereby impacting ESG funding. The second important fact is that some multilateral agencies may not include ESG funding within their mandate.

Concerning IMF financing targeted to climate change, important questions have been raised in the ECB (2022) working paper. These include the fact that, while funding for climate change is emerging as a priority, especially after 2022, its purpose may not align with the IMF's. The IMF's main trust fund until 2022 was the Poverty Reduction and Growth Trust (PRGT). The IMF is increasingly linking sustainability funding to the Balance of Payments position, and PRGT is not designed to address Balance of Payments issues in the very long term. The new IMF-administered Resilience and Sustainability Trust (RST), established with effect from 2022, will further support countries' efforts to strengthen their resilience to climate change shocks. RST frameworks can successfully track the balance of payments in the medium- and long-term. Secondly, as per the ECB (2022), the IMF cannot (and should not) be the sole or main provider of funding to meet the enormous global financing needs related to climate change. IMF funding is aimed at driving additional sources of funding, especially private funding. This intensifies the need for private ESG funding.

Private funding should be tracked in two dimensions (i) what % of funding is from private sources, and (ii) where are the large funding gaps where private funding must be increased. Table 4 estimates the split between private and public funding. This urgency becomes sharper when near-term funding requirements are set against current investment trajectories. While only US$1.2 trillion was invested in climate mitigation in 2021/22, annual needs must exceed US$8.4 trillion by 2030 and continue rising toward US$12.4 trillion by 2050, representing a more than sevenfold increase within this decade alone. The widening disparity reveals a systemic financing shortfall that public budgets cannot close; multilateral development agencies collectively invested only US$137 billion in 2024, against a gap of over US$7.2 trillion. Mobilizing commercial banks at scale is not simply a policy preference; it is a structural necessity.

Table 4- Funding split between private and public funding (US$ bn, 2022) for mitigation and adaptation

Mitigation	Private funding	Public International	Public Domestic	Unknown	%of private
Energy	279	30	262	-	49%
Transportation	257	24	122	-	64%

Building & construction	161	8	86	-	63%
Agriculture	1	2	4	-	14%
Industry	1	9	5	11	4%
Waste	13	0.1	8	-	62%
Water & Wastewater	1	2	8	-	9%
Other	1	15	1	1	6%
Adaptation	60	37	33	-	46%
Dual Benefits	10	47	17	-	14%
Total	784	174	546	12	52%

Source: Climate Policy Initiative (2024)

Transition financing is not included in the above table. Building commercial capacity is also important, as proceedings from COP30 (UN Climate Change, 2025) indicate that the multilateral Green Fund is only $18.3 billion, compared to the $ 7.2 trillion required. Multilateral development agencies invested roughly $137 billion in 2024, according to the European Development Bank, whereas the top 1,000 commercial banks have an estimated $103 trillion in deposits and $165 trillion in assets. While private funding currently accounts for 52% of total funding, they will need to do more. The $7.2 trillion gap will need to be funded by commercial banks rather than multilateral agencies. Secondly, while the global funding split is 50:50, funding is skewed towards selected segments and developed markets. Within transportation, the focus is on electric vehicles. Next, we consider the funding gap by segment. The details are in Table 5.

Table 5- Funding gap by segment

Sector	**Actual Investment**	**Annual Investment 2030**	**Annual Investment 2050**
Transport	$95.9 billion (2019-20)	$2.5 trillion	$3.2 trillion
Energy	$1.74 trillion (2023)	$4.5 trillion - $ 5.7 trillion	$125 trillion (cumulative for energy transformation)
Building and Infrastructure	$14.2 billion (2019-20)	$731 billion	
Industrials	$10.2 billion (2019-20)	$320 – 540 billion	
Agriculture, forestry, and land use	$6.5 billion (2021-22)	$130 billion	

Source: Climate Policy Initiative in WEF (2025)

Given the economic and existential risk associated with climate change, there is a need to accelerate funding. The scale of financing required for mitigation and adaptation efforts, limited government budgets, and competing priorities imply that public funding alone is insufficient to address climate change challenges (WEF, 2025). Given available funding capacity, commercial banks should lead the funding initiative.

It must be mentioned that climate funding is also in the commercial banks' interest. The risk of inaction is evident in Figure 3, where banks that fail to address climate risk may be exposed to credit, market, liquidity, and reputation risks. That risk becomes acute for Asian banks, as Figure 2 shows that Asia faces significant economic damage from rising sea levels. As per UNDP (2024), "Asian institutional investors and asset managers have strong financial incentives to be proactive about climate change and other ESG issues, as their long-term exposure across sectors makes them vulnerable to systemic risks that individual companies might dismiss as externalities. Asia faces some of the most acute risks. UNDP (2024) further projects that climate-related losses could reach 26.5% of Asian GDP by 2048, a trajectory that commercial banks in the region cannot treat as peripheral to their risk management.

5. Asian green financing landscape

Asian green financing falls within the broader scope of ESG investing. Three aspects are clear for Asia ESG investments. (i) while Asian investments are growing, they lag global investment focus, (ii) commercial banks will need to play a much larger role in funding, and (iii) Asia would require significant green financing investments.

The environment was collateral damage in the rapid Asian growth in parts of the twentieth and early twenty-first century. UNDP (2024) estimates that Asia has lost 60% of its mangrove forests and 40% of its coral reefs. So much so that one hundred and thirty-five thousand square kilometers of forests, around eleven percent globally, were lost between 2000 and 2015. Many environmentalists attribute the 2011 Thailand funds to the turning point in Asia’s green efforts. The 2011 Thailand floods inundated 9.1% of the total area, resulting in $46.5 billion in losses. There is a consensus that industrialization, without concern for environmental damage, led to such vast destruction (Poaponsakorn & Meethom, 2013: Gale & Saunders, 2013). 2011 was a wake-up call that triggered green funding.

The macro-financial scale of this risk is significant. With approximately 33% of Asian GDP exposed to climate-related disruptions, the scale of projected economic contraction in Asia substantially exceeds the global average (UNDP, 2024). These projections are not abstract environmental benchmarks; their implications extend well beyond environmental policy. Regional banks' lending portfolios, collateral valuations, and credit exposures are heavily concentrated in the coastal urban

economies most susceptible to sea-level rise and extreme weather. Asia's outsized climate vulnerability relative to the global average is therefore not merely an environmental concern, it is a systemic risk embedded in the balance sheets of regional commercial banks, making it a prudential risk management imperative they can no longer treat as peripheral.

As Asia accelerates its decarbonization and green goals, it is estimated that China alone would require between US$14 and US$ 21 trillion (UNDP, 2024). In Southeast Asia, it is estimated that $210 billion in annual investment would be required to align with the 1.5 degrees global warming goal (UNDP, 2024). UNDP (2024) estimates are benign compared to estimates from Basu and Lim (2024) from the IMF. Basu and Lim (2024) estimated the Asian green funding gap at US$ 800 billion annually.

The often-cited 1.5 degrees is the threshold for temperature increase from preindustrial levels, agreed in the Paris Convention (COP 21, Conference of the Parties) within the UNFCCC (United Nations Framework Convention on Climate Change). It is often referred to as the Paris Agreement. The Paris Agreement currently has 194 signatories (UNFCCC, 2026). Three sectors are expected to dominate Asian green financing funding. These include renewable energy, the electrification of transportation, and the development of greenfield technologies such as hydrogen fuels.

How does Asia fund these initiatives? Initial data suggest that corporate banks would need to lead the funding. Globally, in 2023, (UNDP, 2024) ESG fund market was estimated at US$ 3 trillion. Within the US$ trillion fund market, there are 830 Asia-domiciled funds with a total corpus of $87 billion. UNDP (2024) has also opined that the banking industry should be in focus, as it has greater capacity to provide and withhold capital. Also, banks are not constrained by a minority stock position that affects asset managers. Banks are in a stronger position to fund and influence a corporation's behavior. But the business needs to be profitable for banks for them to invest. Next, we examine survey findings on banks' preferences for green finance.

ADB (2022) surveyed 314 investors and 96 underwriters across ASEAN. According to the survey, most Asian bankers are still exploring ESG and have not integrated it into their mainstream investments. ADB (2022) identified three main reasons impacting banks' funding. There is a lack of tax incentives, regulatory policies, and a common taxonomy. Among these three, a common taxonomy could make a significant difference and can be agreed upon by practitioners, whereas regulatory policy and tax incentives require government action. Before diving into taxonomies, let us consider another important aspect of the surveys: the investment drivers.

Given that Asian bankers are still integrating ESG within their portfolios, it is not surprising that they prefer relatively smaller investment ticket sizes. The surveys also indicate a co-investment possibility. The majority of ASEAN investors prefer ticket sizes below US$10 million, while most underwriters prefer issuances between US$11 million and US$50 million (ADB, 2022). Based on the preferences, only a lead underwriter and a co-invested structure could fit. While tokenization could and

securitization could be constructs, they would not change the basic requirement. Risk would need to be pooled and co-invested. That is where investors' risk preferences become critical, and that is where it is important to create pooled risk.

ADB (2022) survey results indicate that both valuations and credit are critical for investors. Investors prefer renewable energy, energy efficiency, and clean transportation segments. There are country-specific preferences, such as waste management in Malaysia and water management in Vietnam. Surprisingly, clean buildings are not a priority for ASEAN investors (ADB, 2022). The survey also indicated that, to date, green investments are primarily about maintaining a green image rather than generating alpha. Alpha is an investment concept defined as the excess return above the compensation for systematic risk that the strategy earns (Berd, 2011). In simpler terms, every investor wants to generate returns that exceed the market index. Investors have a choice. They can invest in an index-linked fund, such as an ETF (exchange-traded fund), or in specific investments. Investors must generate returns that exceed the index returns, i.e., generate alpha. Generating alpha is critical as it transforms ESG investments into a business proposition integrated within an investor's portfolio. Historically, ESG funds have generated returns comparable to those of conventional funds (Bello, 2005). ESG investment needs to be a strategy, not a hobby. The question then is what is preventing investors from developing a mainstream ESG investment strategy.

One reason is the lack of clear regulatory guidelines (ADB, 2022), particularly the need for a standardized green taxonomy. However, then what is this common taxonomy, and what is required to arrive at a single understanding globally, if not across Asia to begin with? An important finding (IPSF, 2021) is that green taxonomies require interoperability. Converting a potentially multi-billion-dollar project into a $10 million investment ticket size requires a common taxonomy, as tax policies vary across countries. (Alessi and Battiston, 2022) noted the same in an EU context, though studies in the ASEAN context have largely existed as a gap. IPSF (2021), a pioneering effort to establish green financing between China and Europe, called for a common taxonomy. They called the taxonomy "Common Ground," a consistent framework between the EU and China.

6. What is a green taxonomy, and why do we need to standardize it?

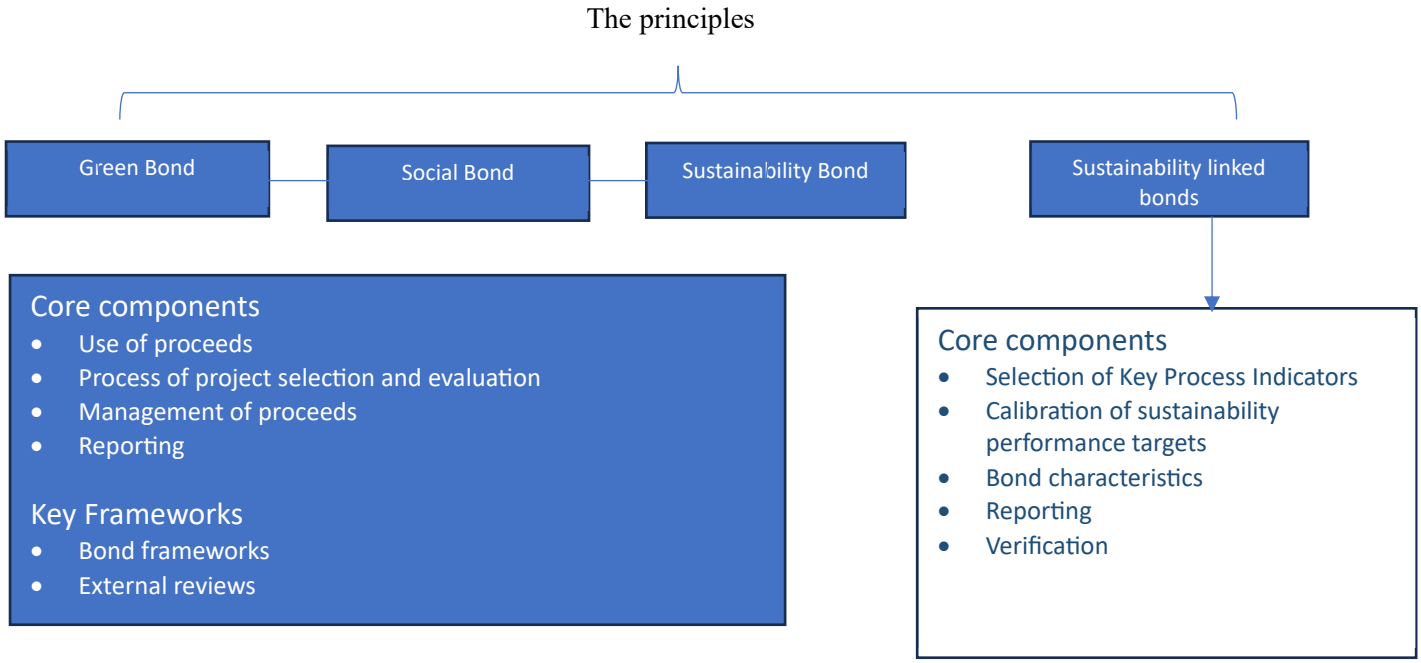
Sustainable taxonomy is defined as a classification system that establishes criteria for economic activities aligned with a net-zero trajectory by 2050 and with broader environmental goals beyond climate change (European Commission, 2025). For Europe, taxonomy allows financial and non-financial companies to share a common definition of economic activities that can be considered environmentally sustainable. In this way, it helps Europe scale up its sustainability investments (European Commission, 2025). UNDP (2024) has estimated that the European fund market is approximately $2.5 trillion of the total US $3.0 trillion globally. But why must Asia standardize its taxonomy?

Interoperability is not simply a regulatory preference; it is the foundational financial mechanism that determines whether commercial banks can syndicate large green projects across borders. Without a shared taxonomy, due diligence requirements differ across markets, increasing verification costs and preventing effective risk pooling. A harmonized framework enables a lead underwriter to establish a credible, cross-market baseline for project eligibility, allowing co-investors to rely on standardized assessments rather than independently repeating the full due diligence process. In the ASEAN context, where ADB (2022) surveys show co-investment as the preferred structure given ticket-size constraints, taxonomy interoperability is not a bureaucratic nicety but a direct enabler of the deal structures that make bank participation economically viable.

Standardized taxonomy has been raised as a precondition to enabling green finance in multiple studies (ADB, 2022; IPSF, 2021). Even Ritu & Lim (2024) in the IMF departmental papers have stated that "As in any innovative financing instrument, standardization is crucial to ensure market development. Taxonomies in some jurisdictions have facilitated the development of robust standards for bonds that promote transparency." These standards project transparency, and this would be key to enabling risk pooling.

There are multiple challenges limiting the development of a common taxonomy. These include (i) the extent to which the market is dependent on fossil fuels, (ii) classification and standards differences, and (iii) data limitations. Irrespective of challenges, green bond definitions have been standardized and are explained in Figure 6. It is important to state that this classification is voluntary, and markets could customize it.

Figure 6- Green bond structure and definitions (ICMA, 2025)



6.1 Dependence on fossil fuels

Emerging markets remain highly dependent on fossil fuels, which influence local taxonomy and standard-setting, as well as regional variations (Ananthkrishnan et al., 2023). Table 7 depicts these differences. This challenge is magnified by what might be termed the 'residual life' dilemma of Asian power infrastructure. Many coal-fired plants across emerging Asia are under 15 years old, leaving more than a decade of productive operation before retirement becomes economically feasible. An abrupt divestment mandate would materially increase transition risk across bank loan portfolios, particularly for lenders with significant exposure to energy utilities in Indonesia, Vietnam, and the Philippines. A well-designed taxonomy must therefore accommodate nuanced 'shades of green' (Alessi & Battiston, 2022) rather than imposing binary classifications, enabling orderly, credible transition pathways that protect both environmental integrity and financial stability.

Table 7- Fossil fuel dependence

Categories of coal-using economies	EMDE examples
Phasing out coal	Chile, Kazakhstan, Romania
Established coal user economy	Cambodia, China, India, Morocco, Myanmar, Thailand, Türkiye
Expanding coal fired capacity	Bangladesh, Côte d'Ivoire, Ethiopia, Kenya, Mongolia, Mozambique, Pakistan, Philippines, Sri Lanka, Vietnam
High export dependence on coal extractive industry	Colombia, Indonesia, South Africa, Venezuela

Source **:** Ananthkrishnan et al., 2023 ,

Coal is the source of approximately 20% of the greenhouse gas emissions. Yet, a mix of its relative economic importance and the age of the plant may lead a market to classify it as a transition risk rather than an immediate priority (Ananthkrishnan et al., 2023; Lee, 2024). That also results from the economic costs resulting from the residual life of the power plant. Coal-fired plants have a useful life of 30+ years. Many emerging-market coal-fired plants are less than 15 years old (Ananthkrishnan et al., 2023), with over 15 years of productive life remaining. Different taxonomies classifying fossil fuels differently may not be interoperable.

Lack of interoperability may impact some projects, but it may not be a showstopper. IEA (2025) estimates that electricity demand from data centres worldwide will double to 945 terawatt-hours by 2030. The proliferation of AI largely drives that, and it is estimated that demand for data centres driven by AI will exceed that from all manufacturing and services combined. As the industry builds data centre capacity, it must also plan for electricity generation capacity. Conventional electricity generation sources may not be optimal, and renewable energy could be preferred to avoid the climate impact of such mammoth scale of new generation capacity. Standardized taxonomies focusing on additional renewable electricity capacity enable possibilities of risk pooling.

The surge in AI-driven data-centre demand, projected to double to 945 TWh by 2030 (IEA, 2025), creates an entirely new class of electricity-intensive infrastructure that must be financed at scale and, increasingly, sustainably. For commercial banks, this represents a concrete near-term opportunity: applying standardized green taxonomies to renewable energy procurement for data centres, grid upgrade financing, and green data-centre construction enables consistent risk classification, due diligence efficiency, and pooled investment structures. Unlike many green finance opportunities that are constrained by long payback horizons, data-centre infrastructure offers shorter investment cycles and technology-sector counterparties with strong credit profiles, making it a natural entry segment for banks seeking to build green finance capacity while managing risk (Lee et al., 2025).

6.2 Classification and standard differences

Most taxonomies, barring exceptions like China, are voluntary and are largely qualitative. Green bond classification may not be binary, and there could be "shades of Green" (Alessi & Battiston, 2022). Globally, Europe and China are among the best-known sustainable taxonomies, but they also differ. Even the industry classification that underlies taxonomies differs. European taxonomy classifies industries based on NACE (Nomenclature statistique des Activités économiques dans la Communauté européenne) whereas Chinese taxonomy is based on The Industrial Classification for National Economic Activities (ICNEA 2017) of China (IPSF, 2024).

IPSF (2024) created a Common Ground Taxonomy (CGT) between Europe and China but to do so

- They had to refer to a common International Standard Industrial Classification of All Economic Activities (ISIC) classification and map industries to standardize taxonomies
- European green objectives of (i) climate change mitigation, (ii) climate change adaptation, (iii) sustainable use and protection of water and marine uses, (iv) the protection and restoration of biodiversity and ecosystems, (v) transition to a circular economy, and (vi) pollution prevention and control had to be mapped to the China green objectives of (i) climate change response, (ii) environmental improvement, and (iii) more efficient resource utilization

As per IPSF (2024), CGT was a tool to help direct capital flows to green, sustainable projects, as enabling such flows worldwide requires interoperability among taxonomies. If interoperable, taxonomies can help investors direct capital across borders more easily, for instance, by reducing the costs of verification and due diligence.

Taxonomy interoperability will enable green investments to behave similarly to conventional investments. A lead underwriter estimates the project risk based on which the lead investor assumes a position. Since co-investors can trust the risk, they are comfortable assuming a co-investment position,

with limited due diligence. Although ASEAN green taxonomies differ slightly, a common approach is possible, which could be the solution to increased bank engagement in green financing.

6.3 Implications for Policy and Practice

The analysis in this paper demonstrates that climate-finance bottlenecks in Asia stem less from capital scarcity and more from structural inconsistencies in classification systems. Commercial banks hold approximately US$165 trillion in assets globally, capital that dwarfs multilateral development finance but remains largely undeployed for green projects due to high verification costs, uncertain risk-pooling frameworks, and regulatory uncertainty. For policymakers, this implies that accelerating private-sector participation requires prioritizing taxonomy interoperability over expanding incentive schemes alone. Harmonized classification standards lower the transaction costs that currently prevent co-investment structures from scaling (Brabec & Macháč, 2025; Delina et al., 2026; Lin et al., 2026).

For commercial banks, interoperable taxonomies reduce information asymmetry between lead underwriters and co-investors, enabling diversified pools of green assets suitable for syndication across ASEAN markets. For institutional investors, interoperability offers clearer cross-border comparability, reduces the cost of independent verification, and enhances long-term confidence in green asset valuations (Brabec & Macháč, 2025). Ultimately, taxonomy standardization in Asia is not a technical compliance exercise; it is the infrastructure of a functioning green capital market. Policymakers who prioritize this infrastructure create the conditions for private capital to flow at the scale required by the region's climate transition (Delina et al., 2026; Lin et al., 2026).

7. Evidence from ESG Startup Survivability: Implications for Green Segment Viability

The taxonomy and co-investment challenges identified in the preceding sections raise a practical question for commercial banks: beyond the structural barriers, do green finance segments in renewable energy and clean transportation offer sufficiently attractive returns to justify engagement once those barriers are reduced? Evidence from ESG startup survivability modelling provides a useful, if indirect, signal. Drawing on a machine-learning analysis of 196 ESG startups (Kakar, 2024), this section examines the investment viability of key green segments that a standardized ASEAN taxonomy would need to cover.

In the thesis, “Driving venture capital funding efficiencies through data-driven models. Why is this important and what are its implications for the startup ecosystem?” Kakar (2024) argues that machine learning algorithms can be used to predict a startup's survival and the factors that determine its fundability. For ESG, Kakar (2024) built survivability models to predict where the investments could be secure. For this study, a total of 196 ESG startups were identified from Crunchbase from a

base of 1,000 startups. These were funded by either venture capital or private equity. Out of these 1,000 startups identified in the study, a final sample of 196 was selected, of which 91 were active, and 105 had closed. Logit classification regression was used to draw inferences from the data. The results are in Table 8 below

Table 8- Logit regression analysis of survivability

Data Element	Specific test	Definition	p>|z|, Result - Logistic model	Coefficient	VIF
Risk	Ecosystem: Investment Cross product factor	Does the sustainability startup require a new ecosystem to be built like battery charging If yes, are investments being made for that	0.011	8.39	2.67
Market size and growth	growth dividend	The market grows (GDP) at a certain rate. If the rate is higher than GDP growth, it should lead to new markets for startups to capture	0.025	20.47	**10.47**
Founders profile	Founder with a PhD Cross product factor	In a technology space, a Phd should be an added qualification indicating an ability to create new IP	0.034	11.55	5.49
Signals	Press articles in the last 6 months	Recency of coverage should be more important than previous coverage	0.001	37.13	2.06
Patents	**Not Significant**				
Trademark	Trademarks	Binary variable. Yes or No	0.029	9.21	3.21

Source: Kakar (2024)

The model efficiencies were as follows

```
from sklearn.metrics import  recall_score, precision_score, f1_score, roc_auc_score,accuracy_score
print("Recall:",recall_score(Y,Y_hat))
print()
print("Precision:",precision_score(Y,Y_hat))
print()
print("F1 Score:",f1_score(Y,Y_hat))
print()
print("Roc Auc Score:",roc_auc_score(Y,Y_hat))
```

```
Recall: 0.8791208791208791

Precision: 0.8602150537634409

F1 Score: 0.8695652173913043

Roc Auc Score: 0.8776556776556776
```

The scores can be explained as follows

- Recall – How good is the model in predicting positive outcomes?
- Precision – The proportion of correctly predicted positive instances among the instances that have been marked as positive.
- F1 score – a score of the model's accuracy
- Roc_Auc_Score – An aggregated metric that specifies the accuracy of the model in classifying positive and negative instances.

  All these metrics are close to 87%.

Kakar (2024) helps build a case for standardizing the taxonomy of renewable energy and clean transportation. The model predicts that new segments will be profitable if there is ecosystem development with government investing in enablers such as charging stations, and AI spends requiring data centre electricity consumption. Also, these segments are growing faster than the global GDP growth. Based on these factors, the model would suggest that these segments can generate positive returns for commercial banks. These findings complement the taxonomy argument developed in Section 6: standardized green classification frameworks not only reduce verification costs and enable risk pooling, but do so in segments where underlying return fundamentals, ecosystem growth, GDP-outpacing market expansion, and strong IP signals suggest commercial viability for banks willing to engage.

8. Data limitations

This study relies primarily on secondary data aggregated from multilateral sources, industry surveys, and policy documents, which introduces several constraints. First, climate finance figures are drawn from reports with differing base years (2019–2023) and varying definitional boundaries; some include transition finance, others do not, limiting strict comparability. Second, the ADB (2022) survey evidence on ASEAN investor preferences, while the most directly relevant dataset available, predates several major policy developments and may not fully reflect current market conditions. Third, while the paper addresses Asia broadly, the empirical grounding is strongest for ASEAN markets; findings should be interpreted cautiously when applied to South Asian or Northeast Asian banking contexts where regulatory environments differ substantially. Fourth, the absence of bank-level portfolio data means that estimates of commercial bank capacity and green asset exposure remain approximations based on aggregate balance sheet figures. These limitations suggest that the co-investment and risk-pooling mechanisms proposed here require validation through primary data collection, particularly bank-level surveys and project-level financing data, which the authors identify as a priority for future research.

9. Conclusion

Asia's climate transition faces a paradox: the region holds sufficient banking capital to fund the green transformation it urgently needs, yet commercial banks remain structurally sidelined. This paper has argued that this paradox is explained primarily by taxonomy fragmentation rather than capital shortage. Across ASEAN, heterogeneous classification standards inflate due diligence costs, prevent reliable risk pooling, and make the co-investment structures preferred by regional investors, with ticket sizes below US$10 million, commercially unviable at scale.

Four findings emerge from this analysis. First, climate risk is a direct bank solvency concern, not merely an ESG preference, given the compounding credit, market, and liquidity exposures embedded in carbon-intensive loan portfolios. Second, the EU-China Common Ground Taxonomy demonstrates that interoperability between divergent frameworks is achievable, offering a replicable model for ASEAN. Third, emerging opportunities, particularly AI-driven data centre infrastructure, offer near-term entry points for applying standardized green taxonomy to assets with strong credit profiles and shorter investment cycles. Fourth, ESG startup survivability modelling indicates that the green segments most relevant to commercial bank participation, renewable energy infrastructure, and clean transportation, demonstrate above-GDP market growth and ecosystem investment signals that support positive return expectations, reinforcing the case that taxonomy standardization unlocks commercially viable, not merely socially desirable, investment opportunities.

Future research should validate these mechanisms through bank-level portfolio data and primary surveys of ASEAN underwriters, particularly as COP30 commitments reshape the regulatory landscape. Taxonomy harmonization is not a technical footnote; it is the foundational infrastructure of a functioning Asian green capital market.

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