GREEN FINANCE PRACTICES BY MALAYSIAN BANKS: ENVIRONMENTAL IMPLICATIONS, ISSUES AND CHALLENGES

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ABSTRACT

This research delves into green finance and green banking practices, an area well-known within academia and the financial industry. However, there is still much to uncover, especially the environmental impacts they bring. Although various studies have been conducted on these topics, their scopes vary, and their findings are mixed. Due to limited data availability, this study extracted information on green finance and green practices through climate-related disclosure from reports of four selected Malaysian banks and relevant environmental data from respective websites. Using the data collected for 2017-2022, green finance, green practices and environmental data were descriptively analyzed. Pooled Ordinary Least Squares (OLS) regression was used to examine four dependent variables and determine the implications of green finance (total proceed of green finance) and green practices (total logarithm of greenhouse gas emissions by banks) on the environment. The study's findings indicated significant effects of green finance by the Malaysian banks on the environment. Moreover, the study identified two potential challenges that could impede Malaysian banks' implementation of green finance. This underscores the importance of future studies on green finance to address these challenges and utilize larger sample sizes, incorporating both quantitative and qualitative data on green finance.

Keywords: Sustainability management, financial institutions, climate change, green practice.

INTRODUCTION

Green finance, though still in its infancy, is a field of immense potential. Research on green finance has grown steadily, with an aggregate growth rate of 21% in the past 15 years (Dervi et al., 2022). The global adoption of green finance from developed to developing countries clearly indicates its importance and the collective effort toward environmental sustainability (Agirman & Osman, 2019; Dikau & Volz, 2021; Razak & Ali, 2023). Green finance has emerged in alignment with Sustainable and Responsible Investment (SRI) initiatives, sharing similar objectives and connecting us all in a more significant movement (Dervi et al., 2022; Swaty, 2023).

Green finance refers to the "financial restraint behavior of high pollution and high energy consumption industries and the financial support behavior of energy conservation and environmental protection industries" (Yaoteng & Xin, 2022). Based on this definition, it is plausible that these behaviors are directed to at least three authorities: 1) the behavior of the energy emission firms, 2) the behavior of green finance providers through green offerings, , products, services as well as 3) behavior of the policy maker in supporting the behaviors of the first two. olicymakers act as the primary enabling authority in supporting green growth, for example through institutions such as central banks (Dikau & Volz, 2021; Jasmi et al., 2011; Sachs et al., 2017). In Malaysia, green finance has been embedded within several policy initiatives led by key policymakers, including the Government of Malaysia, Bank Negara Malaysia (BNM), and the Securities Commission (SC).

In Green Technology Master Plan 2017-2030 (NGTP) (Ministry of Energy, Green Technology and Water Malaysia, 2017), green finance is considered one of the market enablers towards the adoption of green technology as well as an enabler of an economic shift towards green growth. Likewise, the Financial Sector Blueprint (Bank Negara Malaysia, 2022) also projected the targets of more than 50 percentgreen financing activities by 2026 and steady growth in greening finance and financing green. Similarly, Social and Responsible Investment sukuk (SRI) and bonds have significantly funded large green projects. A report issued by Ernst & Young (2022) has recorded exponential growth of sustainability-related bonds and sukuk from 2016 until 2020, at 185 percent of Compound Annual Growth Rate (CAGR) and 278 percent CAGR, respectively. In the Capital Market Masterplan (SC, 2021), capital markets have also been engineered to enable more opportunities to obtain green financing, especially for smaller businesses. It was noted that transforming all businesses to a zero-net future requires transition financing beyond the parameters set for green finance.

In the context of green finance providers, namely financial institutions, green finance has been promoted through climate change reporting frameworks. As outlined in the Climate Change and Principle-based Taxonomy (CCPT) (Bank Negara Malaysia [BNM], 2021), green finance solutions and services are identified as intended outcomes of standardized climate change reporting, as encouraged by the CCPT. Another driver of green finance is the Value-Based Intermediation (VBI) initiatives and guidelines, in which green finance is positioned as a core VBI strategy. For example, BNM (2018) identifies green finance—encompassing green financing, green bonds, and green investment—as best practices under the VBI framework. Socially Responsible Investment (SRI) sukuk is recognized as Malaysia's first green finance product (Liu & Lai, 2021).

Notwithstanding this, green finance is still a new avenue for financial institutions. A study showed that despite the optimism shown by the policymakers, the financial institutions have been facing some obstacles (Amran et al., 2018; World Bank Group, 2019). These include problems relating to the green finance applicants, lack of information on the potential project viability, limited track record or success

studies on the potential project, and lack of knowledge of green technology. These have hindered their active participation in the financing (Amran et al., 2018). In tandem with findings of global research on green finance, green projects are also associated with uncertainty, risks, and low rate of return (Sachs et al., 2017; Sunio et al., 2021). In 2000, a community-based green project called the Hokkaido Green Fund was only 20 percent successfully funded by the banks, while individual investors and donors raised 80% of the fund. In the recent study by Liu and Lai (2021), it was argued that the green sukuk that have been issued since 2017, 20 percent of the green sukuk ratings have been downgraded to 'Tier 3', indicating a shallow impact on the low carbon future. Similarly, it was argued that the ecological impacts of green finance are unfeasible because as much as green finance has progressed, other financing of polluting activities, , funding fossil fuels, is still ongoing (Chenguel & Mansour, 2024).

On the other hand, a study by Khan et al. (2022) discovered significant ecological implications of green finance. Using the climate mitigation finance (CMF) issued by the Asian Development Bank and ecological footprint, the study found a significant negative relationship between the two. However, the study's reliance on limited data from six Asian countries and the lack of specific information on which country's ecological footprint was analyzed against which CMF highlights the need for more comprehensive research in this area. Another study focusing on the impact of green finance on reducing carbon emissions (CO_2) in Vietnam (Tran, 2022) also underscores the importance of further research. This study, which used CO_2 emission data from the World Bank database and green loans and investments from the Central Bank of Vietnam, found a significant impact of green finance on CO_2 emissions but also noted the limitations of the evidence provided. Other positive implications of green finance were also observed in improving enterprise green technology innovation (Li et al., 2023), assisting in low-carbon energy transformation (Wang et al., 2024).

At the other end of the spectrum, these recent studies have signaled that research on green finance has progressed in the current research trend due to its importance. This is also acknowledged by some studies devoted to the literature review of green finance (Akomea-Frimpong et al., 2022; Sachs et al., 2017; Saleem, 2013). In addition, it is notable that these research have documented different approaches and mixed findings. While some provided a significant relationship between green finance and the environmental benefits, , reduction in CO_2 emission, energy efficiency or energy intensity, etc. (Khan et al., 2022; Quang & Thao, 2022; Tran, 2022), other studies have reported vice versa (Liu & Lai, 2021). More importantly, studies on green finance from the Malaysian perspective are still insignificant. Most are limited to descriptive analysis of green finance vis a vis sustainable financing (MSFI, 2020; Volz, 2018; Yatim et al., 2017).

Regarding Malaysia, green finance has been embedded in the policies related to VBI. Nonetheless, the green taxonomy was not addressed adequately (World Bank Group, 2019). This may result in the weak reporting of green finance, particularly on how the 'greenness' can be achieved. Although studies on the empirical evidence supporting the environmental benefits or implications have been conducted before, as seen in Khan et al. (2022), Quang and Thao (2022) and Tran (2022), it is notable that studies from the Malaysian perspective are still lacking. In conundrum with the government's aims to develop its green taxonomy (World Bank Group, 2019), empirical evidence, theoretical frameworks, and data accuracy are vital. In support of these, the objectives of this study are to identify green finance and green practices by Malaysian banks and determine their environmental implications and challenges.

Considering the literature on green finance, there are several ways in which green finance has been perceived. In a study, green finance was perceived as an attitude towards environmental preservation and protection (Yaoteng & Xin, 2022). On the other hand, green finance was perceived straightforwardly as

financing initiatives directed toward environmental conservation and protection. According to Khan et al. (2022) and Zhang et al. (2019), the concept of green finance has not been unanimously agreed upon. Hence, it opens to different understandings. It is also notable that the focus of green finance in the literature varied. While some studies used merely green bonds (Anh Tu & Rasoulinezhad, 2022; Cheong & Choi, 2020; Quang & Thao, 2022), others include green investment (Tran, 2022), green stock (Gao et al., 2021), green credit (Tran, 2022), the climate-related fund (Khan et al., 2022) as well as green building projects (Agyekum et al., 2021).

Green practice refers to the bank's operations that minimize the climate risk. Green practice is an element within green banking practices (GBPs). GBPs were reflected as "a blend of risk management (screening and managing environmental & social (E&S) risks as part of banks' decision-making processes) and green loan origination (supporting businesses and industries with a positive impact on the environment and society)." (International Finance Corporation, 2017). These practices include three categories: 1) environmental and sustainability risk management, green lending products and services, and greening banks' own operations. Green practice is an uncommon term used in this study to differentiate green practice from GBPs and green finance itself. Nonetheless, it was found that some studies do employ green banking to denote the third category of GBPs, (Bukhari et al., 2020; Pakistan Infrastructure Housing & SME Finance Department, 2017; Paluszak & Paluszak, 2016; Shaumya & Arulrajah, 2017) solely. In another study, different terms were employed to denote similar meanings, , bank sustainability practices (Siddik et al., 2024) and green banking adoption practices (GBAP) (Aslam & Jawaid, 2023). While some of these studies discussed the theoretical aspects of green practices, some have provided empirical results on the implications of green practices on the environment. Shaumya and Arulrajah (2017) indicated that the green banking of the banks in Sri Lanka affects the banks' environmental performance as perceived by the banks' employees. In a similar vein, it was also found that GBAP was also found to be significantly related to the Pakistan banks' financial, operational, and environmental performances, as perceived by the banks' managers (Aslam & Jawaid, 2023). Quite similar findings were also found in Kala et al. (2020). However, the findings were not discussed in length.

In terms of the institutions in the focus of the literature, it was found that some studies have associated green finance with commercial banks (Julia & Kassim, 2019), financial institutions (Dong et al., 2021), emission-intensive firms (Zhang et al., 2021) and also start-ups (Bergset, 2018). In the study of Julia and Kassim (2019), the performance of selected commercial banks offering green financing in Bangladesh was examined. Despite the study's aims, it was found that none of the Bangladeshi commercial banks fully meet the green policy requirements. While this study explores the impacts of green finance on the bank, the study of Dong et al. (2021) has examined the practice of green finance, i.e., in terms of green finance disclosure. It was found that there are stages of green disclosure practices by financial institutions, and the regulatory regime has a significant role in promoting such practices. In line with this, a study conducted on emission-intensive firms found that the regulation in China, i.e., the green credit policy, has contributed to better performance of these firms (Zhang et al., 2021). Bergset (2018), who studied the access to finance by the green start-ups in Finland, Germany, and Sweden, has suggested that the former have been facing more challenges than ordinary start-ups. This is due to a lack of business education and the expected high level of innovation within the business. In analyzing the findings, the study suggested that risks, rate of return, and long development period are underlying factors of the challenges. Impliedly, the findings of this study also provided a low preference or appetite for green finance providers to fund the green project, as also found by Sunio et al. (2021).

Besides these, many correlational studies on green finance have been discovered. For instance, two studies examined the cointegration between green finance and energy efficiency (Quang & Thao, 2022; Tran, 2022). Green finance was significantly related to energy intensity and efficiency in these studies. While Quang and Thao (2022) focused on Vietnam, Tran (2022) focused on ASEAN countries. In addition, the study also extends the correlational analysis between green finance and other variables, i.e., economic growth, energy impact, and CO2 emissions. Other than these, as indicated earlier, other studies have examined the relationship between green finance and the financial performance of the green finance provider, as well as the relationship between green finance and corporate environmental performance (Awawdeh et al., 2022).

In addition to these, it is noteworthy that past literature on green finance and green practices has been restricted to certain countries, , China (Dong et al., 2021; Jiakui et al., 2023; Liu et al., 2021; Ren et al., 2024; Wang et al., 2024), Bangladesh (Julia & Kassim, 2019), Ghana (Agyekum et al., 2021), Vietnam (Quang & Thao, 2022), Philippines (Sunio et al., 2021), Indonesia (Faizi et al., 2024), ASEAN countries, OECD countries, etc. As mentioned in some of these studies, the countries have been selected due to their low-ranked position in the pollution index, thus simulating urges for green development. Other than this, studies focusing on China may also be due to the strong urges from the governmental or regulatory sides. For Malaysia, the studies (Khan et al., 2022; Liu & Lai, 2021; Yatim et al., 2017) and reports (in the form of working paper) are limited to practices (MSFI, 2020; Volz, 2018), factors affecting green finance (Arumugam & Chirute, 2018; Dikau & Volz, 2021), challenges (Khan et al., 2022; Liu & Lai, 2021; Yatim et al., 2017) as well as the relationship between green finance and environmental benefits (Liu & Lai, 2021). At the same time, most of these studies employed descriptive analysis of secondary data.

Some of this literature has been analyzed qualitatively and visualized as below (Figure 1). Significant number of recent studies on green finance are evident. However, studies on green finance focusing on the perspective of Malaysian and Malaysian banks are still understudied, although their functions as green finance providers are essential for developing value-based and sustainable economics. Therefore, an in-depth study analyzing the potential of green finance to benefit the environment is indispensable.

METHODOLOGY

This study is on the green finance practices of Malaysian banks and their environmental implications. To do this, this study has reviewed the sources of green finance data from Sustainability Reports issued by the FIs, i.e., reports for 26 commercial banks in Malaysia for 2017-2022. However, a review of the reports has shown different types of reporting on green finance. Locally owned banks report their green finance in sustainability reports, which were found as early as 2011. Some foreign-owned banks have issued a "Sustainability Report," and others have issued an "Environment, Social and Governance Report.' For foreign-owned banks, it was observed that different reporting standards were followed, presumably in line with their originating country's standards. For instance, Bank of America Malaysia Berhad has reported on sustainability practices, including green finance, in more than one report, following a few standards, i.e. 2022 Performance Data Summary and Global Reporting Initiative Index, Task Force on Climate-related Financial Disclosures (TCFD) Report, Task Force on Climate-related Financial Disclosures (TCFD) Report and Verification Opinion Declarification on Greenhouse Gas (GHG).

Figure 1

Number of Recent Studies on Green Finance
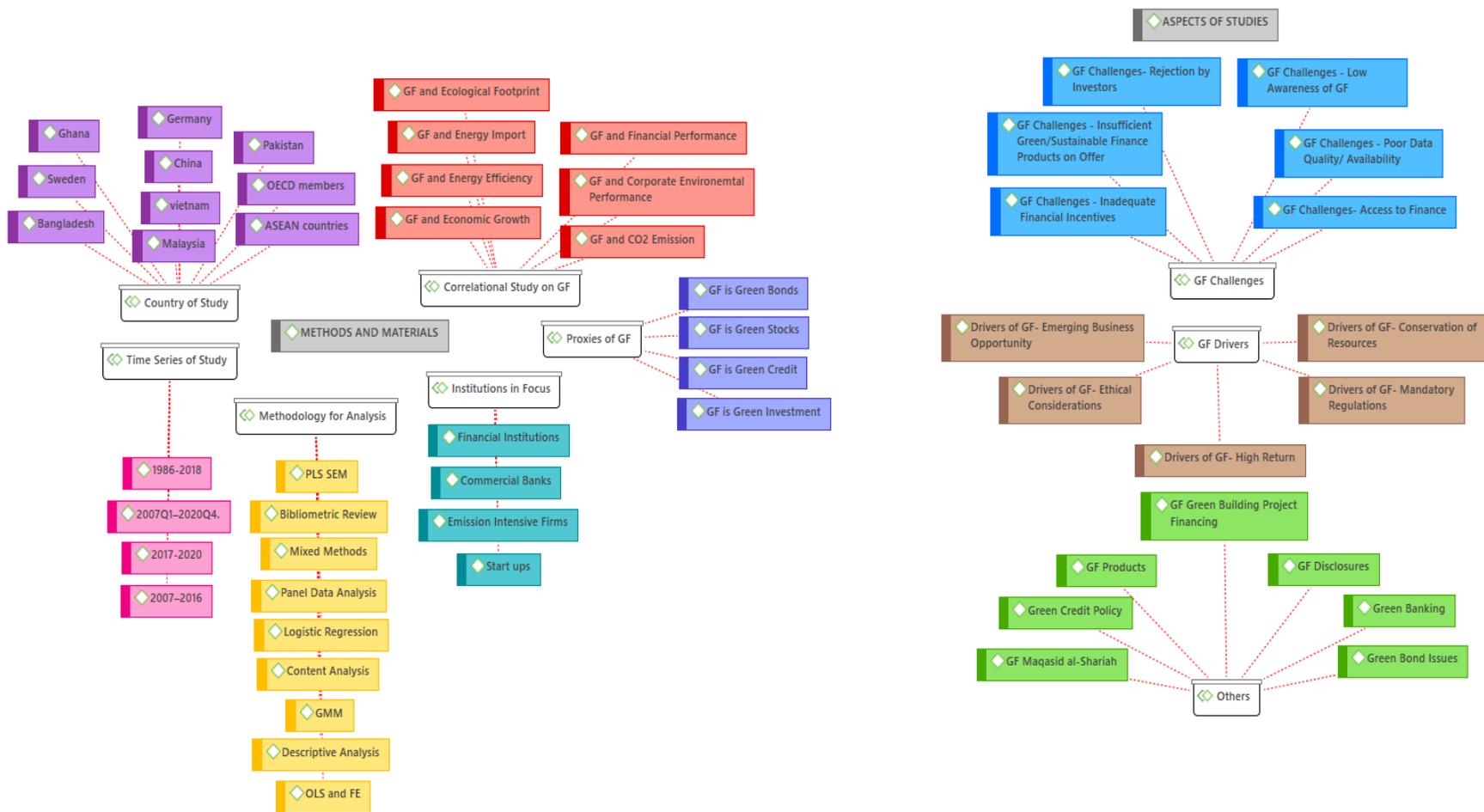
For locally owned banks, these reports were not evident. Local banks report their green finance merely through the Sustainability Report, while some disclose their green finance strategies, milestones, and achievements only through the banks' official websites. Differing reports imply that these banks' reporting standards may differ, and shared data throughout the dataset cannot be obtained. These may result in restrictions to conducting regression analysis on the quantitative data/standard variables. The details of the differing reports are outlined in Table 1.

Considering this, the final datasets are shortlisted into eight banks that reported their green finance and practices in the Sustainability Reports or equivalence. Initially, this study shortlisted ten banks that documented their green finance and practices in Sustainability reports. Nevertheless, standard reporting within this type of report was unclear, and some data were insufficient. Notably, only ten banks issued sustainability reports. Ambank had sustainability reports available for 2021 and 2022 but only provided brief sustainability statements for the other two years. In contrast, Sumitomo Mitsui Banking Corporation Malaysia and United Overseas Bank (Malaysia) Berhad had different reportings than local banks that issued Sustainability reports. For instance, the former's reports were very detailed, referring to various files (with provided links). In contrast, the latter's reports mainly consist of qualitative data and percentages with limited information on actual amounts in currency or metrics (, GHG emissions were reported as percentages of increase and decrease). This analysis considers only banks that have issued reports for five consecutive years to address the data limitation in the selected bank reports. Expectations of missing data persist within the available five-year reports. Furthermore, the study revealed variations in the reporting of green finance and practices among the eight banks. The scope of their green finance reporting is presented in Table 2.

Based on Table 2, it was found that the types of data on green practices as reported by the banks are not uniform except for a few, , total GHG, total GHG Scope 1, total GHG Scope 2, total GHG Scope 3, and water consumption. With at least seven banks reporting the same data, not all have unanimously employed similar units for calculation/metric systems. For instance, while five banks reported their GHG emissions by tons of carbon dioxide equivalent (tCO2eq), others have employed CO2eq. Above all these, it was notable that the data on GHG emissions are also not associated with banks' operations in Malaysia

 Instead, the data represent the GHG emissions of the banks' group in various markets outside of Malaysia. Only CIMB and RHB have reported the GHG emissions from the Malaysian and bank groups' operations. With these, the dataset has been shortlisted to only four banks. It is confined to at least five years of data available for total proceeds of green finance, total GHG emissions, GHG emissions Scope 1, 2, and 3, energy consumption, water consumption, and paper consumption. The final datasets are colored as grey as showed in table 2.

The relevant environmental data for the environmental implications has been collected from relevant websites. These websites also provide valuable data from previous studies (Anh Tu & Rasoulinezhad, 2022; Khan et al., 2022; Quang & Thao, 2022). Initially, the use of environmental data specific to Malaysia was intended for this study. However, it was evident that the green finance data was not specific to those banks categorized under Malaysian operation. Instead, the data were group-wide, including data mostly from Southeast Asian banks' home markets. Unfortunately, environmental data specific to Southeast Asia are not available. To solve this, environmental data specific to Asia were employed. Besides these, this study has also considered additional data on biocapacity and ecological footprint (number of earths ratio) as dependent variables. Details of the final data and variables used in this study are explained in Table 3 .

Table 1

List of Licensed Banks in Malaysia and Availability of Green Finance-related Reports by Year

	Ownership (L/F)	Reporting	2022	2021	2020	2019	2018	2017
Affin Bank Berhad	L	Website						
Alliance Bank Malaysia Berhad	L	Website						
AmBank (M) Berhad	L	Sustainability Report	/	/	/	/		
Bangkok Bank Berhad	F	Sustainability Report	/	/	/	/	/	
Bank of America Malaysia Berhad	F	Various reports						
Bank of China (Malaysia) Berhad	F	Website						
BNP Paribas Malaysia Berhad	F	Website						
China Construction Bank (Malaysia) Berhad	F	Environmental Information Disclosure TCFD Report	/					
CIMB Bank Berhad	L	Sustainability Report	/	/	/	/	/	
Citibank Berhad	F	ESG Report	/	/	/	/		
Deutsche Bank (Malaysia) Berhad	F	Non-Financial Report	/	/	/	/	/	/
Hong Leong Bank Berhad	L	Sustainability Report	/	/	/	/	/	/
HSBC Bank Malaysia Berhad	F	Website						
India International Bank (Malaysia) Berhad	F	-						
Industrial and Commercial Bank of China (Malaysia)	F	ESG Report	/	/				

	Ownership (L/F)	Reporting	2022	2021	2020	2019	2018	2017
Berhad								
J.P. Morgan Chase Bank Berhad	F	ESG Report & Website	/	/	/	/	/	/
Malayan Banking Berhad	L	Sustainability Report (since 2011)	/	/	/	/	/	/
Mizuho Bank (Malaysia) Berhad	F	Integrated Report and TCFD Report in 2022	/					
MUFG Bank (Malaysia) Berhad	F	-						
OCBC Bank (Malaysia) Berhad	F	Sustainability Report		/				
Public Bank Berhad	L	Sustainability Report (since 2016)	/	/	/	/	/	/
RHB Bank Berhad	L	Sustainability Report	/	/	/	/	/	/
Standard Chartered Bank Malaysia Berhad	F	Various reports (Sustainable Banking Report)	/					
Sumitomo Mitsui Banking Corporation Malaysia	F	Sustainability Report	/	/	/	/		
The Bank of Nova Scotia Berhad	F	ESG Report	/					
United Overseas Bank (Malaysia) Berhad	F	Sustainability Report	/	/	/			

Table 2

List of Shortlisted Banks and Types of Data on Green Finance

Name of banks/ Detials	Unit/ Value	Bangkok Bank Berhad	CIMB Bank Berhad	Deutsche Bank (Malaysia) Berhad	Hong Leong Bank Berhad	J.P. Morgan Chase Bank Berhad	Malayan Banking Berhad	Public Bank Berhad	RHB Bank Berhad
Home/primary markets		Thailand, Cambodia, China, Hong Kong, Indonesia	Malaysia, Indonesia, Singapore, Thailand	Germany, Belgium, Italy, Spain & India	Malaysia, Singapore, Hong Kong, Cambodia, Vietnam	America	Malaysia, Singapore, Indonesia	Malaysia, Cambodia, Vietnam	Malaysia, Singapore, Indonesia, Thailand
Total proceeds of green finance	RM	/ (Bhat)	/ (Malaysia & group)	/ (€)	/	/ ($)	/	/	/
Total proceeds of green bonds/ *sukuk*	RM	/ (Bhat)	/	/ (€)	/ (issuer)	/ ($)	/		/
Use of proceeds: renewable energy/solar (group)	RM	/ (Bhat)	/[1]		/		/	/	/
Use of proceeds: electric vehicles/ clean transportation (group)	RM		/		/			/	/
Use of proceeds: energy efficiency (group)	RM		/[1]				/		/
Use of proceeds: green buildings (group)	RM				/		/		/
Total GHG emissions[2]	tCO2eq	/	/	/	/	/	/	/	/
Total GHG: Scope 1[3]	tCO2eq	/ (CO_2e)	/ (Malaysia & group) (tCO_2e)	/ (CO_2e)	/	/ ($mtCO_2e$)	/	/	/ (Malaysia & group)
Total GHG: Scope 2[4]	tCO2eq	/ (CO_2e)	/ (Malaysia & group)	/ (CO_2e)	/	/ ($mtCO_2e$)	/	/	/ (Malaysia & group)

Name of banks/ Detials	Unit/ Value	Bangkok Bank Berhad	CIMB Bank Berhad	Deutsche Bank (Malaysia) Berhad	Hong Leong Bank Berhad	J.P. Morgan Chase Bank Berhad	Malayan Banking Berhad	Public Bank Berhad	RHB Bank Berhad
			(tCO2e)						
Total GHG: Scope 3[5]	tCO2eq		/ (Malaysia & group) (tCO2e)	/ (CO$_2$e)	/	/ (mtCO$_2$e)	/	/	/ (Malaysia & group)
Green practices: energy consumption	kWh	/ (MWh)	/ (MWh)	/ (GJ)	/	/ (MWh)	/	/ (MWh)	/
Green practices: fuel/petrol consumption	Litres				/			/ (by country)	
Green practices: water consumption	(in cubic metres)	/	/	/	/	/ (water withdrawal)	/	/	/
Green practices: paper consumption	kg				/ (reams)		/ (2017-2019 in sheets)	/ (recycled)	/ (reams)
Green practices: waste management	kg		/ (generated, landfilled, incinerated, recycled)(kg)	/ (produced, landfilled, incinerated, composted, recycled)(t)			/	/ (Quantity of ICT equipment disposed)	
Green practices: e-procurement[6]	Quantity/ Unit							/	
Financed emissions[7]	RM		/ (ktCO$_2$e & / (% over the total Bank's Group total financing)	/ (€)			/	/ (% over the total Bank's Group total financing)	
Frameworks	Qualitative data	/	/	/	/	/	/	/	/
Other Data	Qualitative data	/	/	/	/	/	/	/	/

Note: [1]The data for these were mixed, i.e., the bank calculated in percentage all the proceeds for renewable energy and energy efficiency; [2]Calculated using the tons of carbon dioxide equivalent
[6]Average number of electronic purchase orders via e-procurement (per month);[7]Finand emission refers to total assets, investments that emitted carbon.

Table 3

Details of Data and Variables

Green Finance	
Total proceeds of green finance (lgf)	The total volume of green financing in Ringgit Malaysia (RM). The data were obtained from the Sustainability Reports of 4 Malaysian commercial banks (extracted manually for 2017-2022 to the extent of the data availability/disclosure in the reports). For the regression analysis, this variable has been transformed into a logarithm and used as a proxy for green finance.
Green practices: Energy consumption	The total energy/electric consumption volume for the banks' group operation is kWh (data obtained in MWh are converted into kWh).
Green practices: Water consumption	Total volume of water consumption for the banks' group operation in m^3.
Green practices: Paper consumption	Total volume of paper consumed/ purchased for the banks' group operation. However, 2 of the four banks have reported the volume of recycled paper instead of consumed/purchased. The latter was included in the volume of paper consumption due to the assumption that an increase in paper consumption is equivalent to an increase in paper recycled. These data are in kg (data obtained in reams or sheets are converted into kg= (2.34 kg x no. ream)/ (5 g x no. of sheet). These calculations are based on general assumptions and are counter-checked with similar data from other banks.
Total GHG emissions (lghg)	The total volume of GHG emissions recorded for the banks' group operation is in tons of carbon dioxide equivalent (tCO2eq). For the regression analysis, this variable has been transformed into a logarithm. It is used as a proxy for green practices.
Total GHG: Scope 1	The total volume of direct GHG emissions recorded for the banks' group operation, , emissions from petrol and diesel consumption from company-owned vehicles, etc. Reported in tons of carbon dioxide equivalent (tCO_2eq).
Total GHG: Scope 2	The total volume of indirect GHG emissions recorded for the banks' group operation, , emissions from imported energy/electricity, etc. Reported in tons of carbon dioxide equivalent (tCO_2eq).
Total GHG: Scope 3	The total volume of other indirect GHG emissions recorded for the banks' group operation, , emissions from business air and road travel, leased assets, staff commuting, etc. Reported in tons of carbon dioxide equivalent (tCO_2eq).
Environmental Implications	
Ecological Footprint (lefasia1)	Ecological footprint generally refers to a metric used to measure the demands of resources by individuals or operations, , businesses, against the capacity of the Earth to generate the resources. As employed in this study, ecological footprint refers to "how much demand human consumption places on the biosphere." It is measured in standard units called global hectares (GHA). Data were retrieved from_https://data.footprintnetwork.org/ for Asia. For the regression analysis, this variable has been transformed into a logarithm. It is anticipated that the ecological footprint will decrease with an increase in green finance and practices, , as banks provide green financing, businesses will adopt low-carbon/ green technology that reduces resource demands.

Ecological Footprint (Number of Earths) (lefasia2)	This refers to a similar metric as the ecological footprint. However, this data is presented in a ratio. It is calculated based on an individual's ecological footprint over the Earth's regenerating capability. Thus, the ratio of 1.8 implies that individuals consume resources 1.8 times faster than the Earth can regenerate them. Data were retrieved from https://data.footprintnetwork.org/ for Asia. For the regression analysis, this variable has been transformed into a logarithm. It is anticipated that the ecological footprint (the number of the earth) will decrease with an increase in green finance and practices, , as the banks provide green financing, businesses will adopt low-carbon/ green technology that reduces the demands of resources.
Biocapacity (lbioasia)	Biocapacity or the biology capacity to *"produce useful biological materials and to absorb carbon dioxide emissions".* It is calculated by *"the area of biologically productive land and ocean area to provide food, fiber, and timber, accommodate urban infrastructure, and absorb excess CO2."* Global Footprint Network (GFN) has been reporting the biocapacity of countries accompanying the ecological footprint. High biocapacity implies a higher capacity to regenerate resources. It is measured in standard units called global hectares or GHA. Data were retrieved from https://data.footprintnetwork.org/ for Asia. For the regression analysis, this variable has been transformed into a logarithm. It is anticipated that biocapacity will increase with an increase in green finance and practices, , as the banks provide green financing, businesses will adopt low-carbon/ green technology that reduces demands of resources and allow the natural resources, , land, to regenerate.
Ecological deficiency (ledasia)	Ecological deficiency is calculated based on the difference between the ecological footprint and the biocapacity for Asia from 2017-2022. As indicated in https://data.footprintnetwork.org/, the ecological deficit is, *"An ecological deficit occurs when the Ecological Footprint of a population exceeds the biocapacity of the area available to that population. A national ecological deficit means the country is net-importing biocapacity through trade, liquidating national ecological assets, or emitting more carbon dioxide waste into the atmosphere than its ecosystems absorb."* It is anticipated that the ecological deficiency will decrease with an increase in green finance and practices, , as the banks provide green financing, businesses will adopt low-carbon/ green technology that reduces the demands of resources, allows the resources to regenerate, and stimulates the ecological reserve.
CO_2 Emissions (lco2)	The volume of carbon dioxide emissions in metric tons per capita for Malaysia. Data were retrieved from https://data.worldbank.org/. This variable has been transformed into a logarithm for the regression analysis.

This study also conducted semi-structured interviews to complement the quantitative data on green finance. Besides this, the interview is to provide data on the challenges in the green finance practices of Malaysian banks. This study employed a purposive sampling technique to select the informants. As seen in the study of Ringel and Mjekic (2023), who studied sustainable financing, the prospective informants may range from investment managers, project finance officers, sustainability managers, and relevant regulatory authorities. Thus, in replicating this, but subject to suitability, the banks in the study have been

contacted individually to identify the informants. Unfortunately, only one interview has been secured. The informant was selected given his key roles and responsibilities in providing review and oversight on implementing sustainability initiatives, including green finance, at the bank.

To determine the environmental implications of green finance, this study has employed panel data regression analysis using pooled Ordinary Least Square (OLS). Based on the results of Breusch and Pagan Lagrangian multiplier test for random prob>chi = 1.000, the null hypothesis of the homogeneity of data has been accepted, and Panel OLS, fixed effect (FE), and random effect (RE) have been neglected. It is anticipated that significant findings of the analysis will suggest that green finance and practices have contributed towards environmental benefits or have environmental implications. Hence rejecting the null hypothesis. In contrast, insignificant findings will suggest that the environmental implications resulting from green finance and practices cannot be proven. Hence, the null hypothesis is accepted. On the other hand, data collected from the interview have been employed using thematic analysis with pre-developed themes based on the research objectives.

Estimation Method

Pool and Panel Ordinary Least Square (OLS) regressions are utilized to ascertain the relationship between the Malaysian banks' green finance for 2017-2022 and the environmental data. With these, green finance is proxied by the logarithm of total green finance of 4 Malaysian banks from 2017-2022 and total GHG emissions of the banks for a similar year range. Environmental implications as dependent variables are measured using the logarithm of the ecological footprint of Asia (gha)(lefasia1), the logarithm of the ecological footprint of Asia (number of earth)(lefasia2), the logarithm of the biocapacity of Asia (bioassay) and the logarithm of carbon dioxide emissions (lco2). The estimation method is explained in table 4.

Table 4

Details of Variables

Variables	Estimation	Attitude
lefasia1 = $lefasia1_{it}$=	f (TOTAL GREEN FINANCE + TOTAL GREEN PRACTICE) $\beta_0 \pm \beta_1 lgf_{it} \pm \beta_2 lghg_{it} \pm \varepsilon_{it}$	-
lefasia2 = $lefasia2_{it}$=	f (TOTAL GREEN FINANCE + TOTAL GREEN PRACTICE) $\beta_0 \pm \beta_1 lgf_{it} \pm \beta_2 lghg_{it} \pm \varepsilon_{it}$	-
lbioasia = $lbioasia_{it}$=	f (TOTAL GREEN FINANCE + TOTAL GREEN PRACTICE) $\beta_0 \pm \beta_1 lgf_{it} \pm \beta_2 lghg_{it} \pm \varepsilon_{it}$	+
$edasia$= $edasia_{it}$=	f (TOTAL GREEN FINANCE + TOTAL GREEN PRACTICE) $\beta_0 \pm \beta_1 lgf_{it} \pm \beta_2 lghg_{it} \pm \varepsilon_{it}$	-
lco2 = $lco2_{it}$=	f (TOTAL GREEN FINANCE + TOTAL GREEN PRACTICE) $\beta_0 \pm \beta_1 lgf_{it} \pm \beta_2 lghg_{it} \pm \varepsilon_{it}$	-

RESULTS

Green Finance of the Malaysian Banks

Data from the selected sustainability reports (4 banks for six years) indicate each bank's increasing amount of green finance from 2017-2022. Each of these banks has dedicated significantly to its

Sustainability and Development Goals, including green finance. It was reported in each of the banks' Sustainability Report 2022 (SR22) that they are dedicated to mobilizing significant amount for sustainability financing that includes green finance; Public Bank has dedicated to mobilize RM33 million for electric car financing by 2025, Maybank with RM50 million for sustainability financing by 2025, Hong Leong Bank (HLB) with RM2 billion for renewable energy financing by 2025 and RHB with RM5 billion for green financing and RM20 billion for sustainable financial products and services by 2026. A small drop was reported for Maybank and HLB. However, the drop in Maybank may be due to changes in green finance reporting that the green finance amount was mixed with sustainable finance. This has caused the accumulative total of green finance to drop since some amount cannot be ascertained. For HLB, the amount has dropped by approximately RM40 million. This drop may be due to the bank having reached close to its dedicated amount for green finance.

Regarding the scope of green offerings, it was found that each bank has mobilized on different scopes of green finance. From 2017-2020, Maybank has consistently mobilized its green finance in three green areas: hydro, solar, and waste energy projects. For these, Maybank has been financing a few hydropower plant projects, large-scale solar photovoltaic power plants, and waste-to-energy facilities. These have all contributed to escalating the generation of renewable energy. For HLB, the total amount of green finance in 2017 was below RM10 million; in 2018, the total amount of green finance was not explicitly reported. However, this amount escalated in 2019 from approximately 542 million to 1 billion in 2022. The scope of green finance includes green home financing/ solar financing for residential premises, green technology, and green vehicle (electric or hybrid vehicles) financing. As seen in HLB Sustainability Report 2021 (SR2021), HLB was among the most prominent supporters of a government scheme called the "Green Technology Financing Scheme," where approximately 30 projects related to green technology have been financed by HLB. The financing worth was approximately RM300 million.

Figure 2

Volume of Green Finance by Individual Banks for 2017-2022


Source: Individual bank reports, 2017-2022

For RHB, green offerings include lending, advisory, and/or investment activities. This bank has dedicated a considerable amount to green activities. As seen in 2019, approximately RM2.8 billion has been employed in green activities. However, the bank's Sustainability Report 2019 (SR19) has not provided details on green activities or each scope. Towards the later years, various green offerings have been identified for retail and non-retail, , sustainable water and wastewater management), eco-efficient and/or circular economy adapted products, clean transportation, etc. All of these proceeds/ uses of proceeds were categorized into 'green non-retail sustainable financing' and 'green retail sustainable financing.' It is presumed that green finance is mixed with sustainable finance as well. These types of reporting were also evident in Maybank's SR21 and SR22. Nonetheless, the latter did not categorize them as 'green finance.' For Public Bank, the green finance disclosure was only available from 2019. However, it can be noted that the significant scope of green finance at the bank was on electric vehicle financing, which is called "Energy Efficient Vehicles" (EEV) financing. EEV in Public Bank's SR21 refers to "vehicles that bring minimal harmful impacts to the environment in terms of carbon emission level (gCO2 eq/km) and fuel consumption (L/100km) compared to normal internal combustion engine vehicles. These include fuel-efficient vehicles, hybrid electric vehicles, and alternative fuel vehicles that utilize CNG, LPG, biodiesel, ethanol, hydrogen, and fuel cell. From the interview, the informant also explained that the products of the Public Bank on green finance include BAE Solar panel financing, AITAB HP-i for EVs, and BNM-funded low carbon transition financing (LCTF). Figure 3, Figure 4 and Figure 5 is the description of the green finance scopes across selected banks in Malaysia.
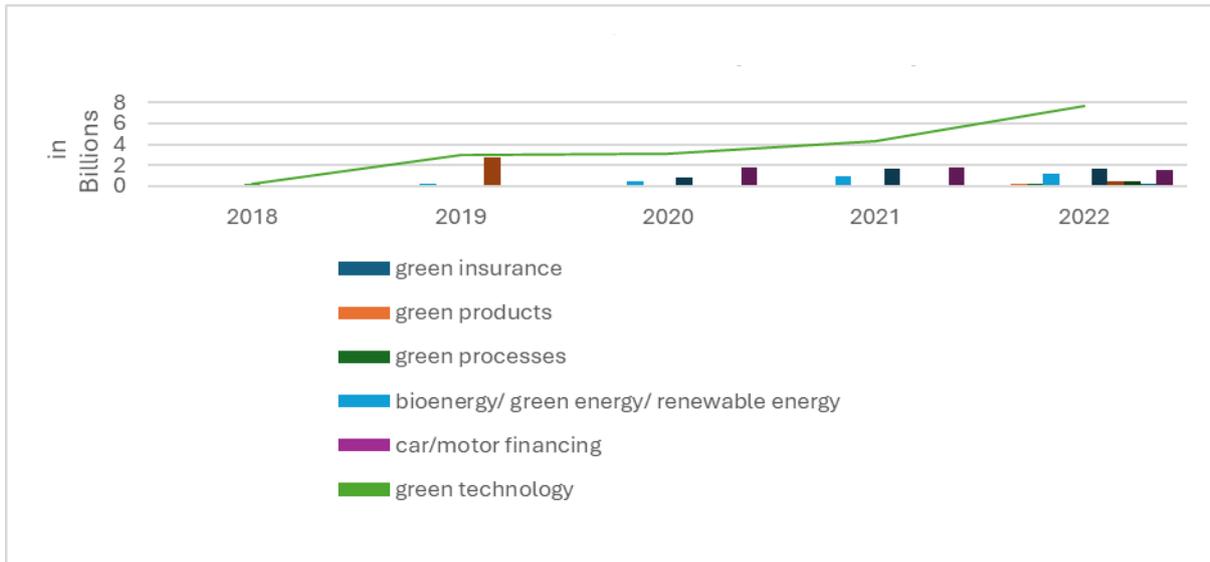
Figure 1

Maybank Green Finance for 2017-2020
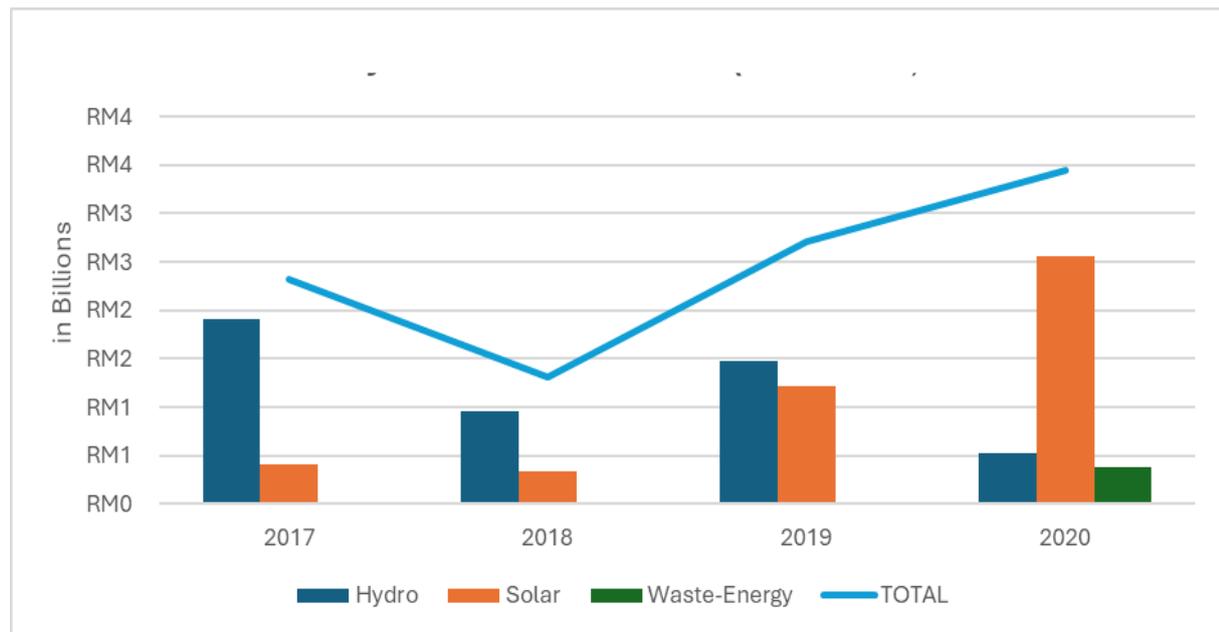
Source: Maybank Sustainability Report 2017 – 2022
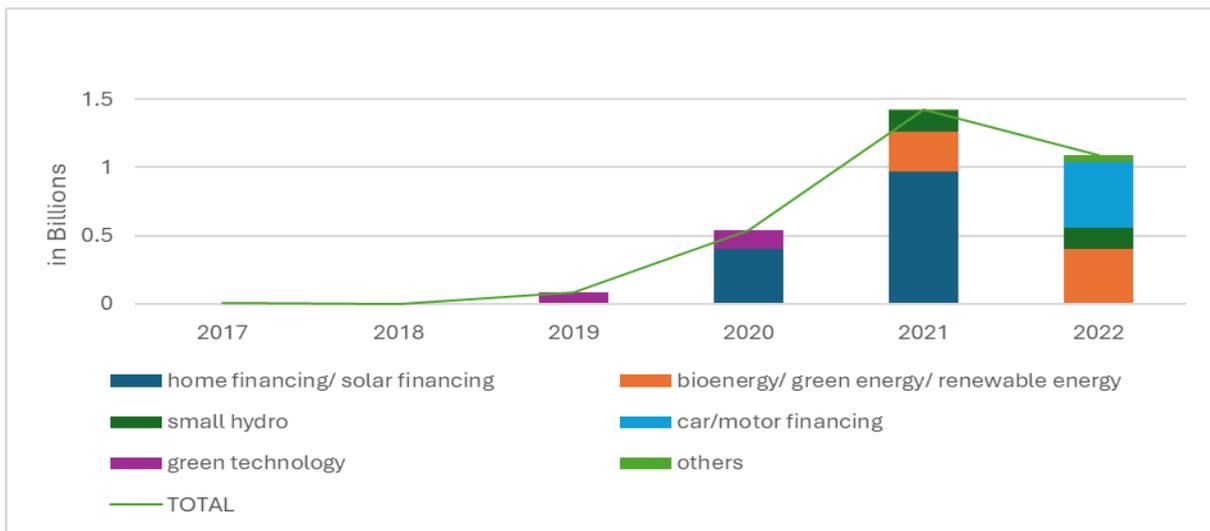
73

Figure 2

 RHB Bank Green Finance for 2017-2022

Source: RHB Bank Sustainability Report 2017 – 2022
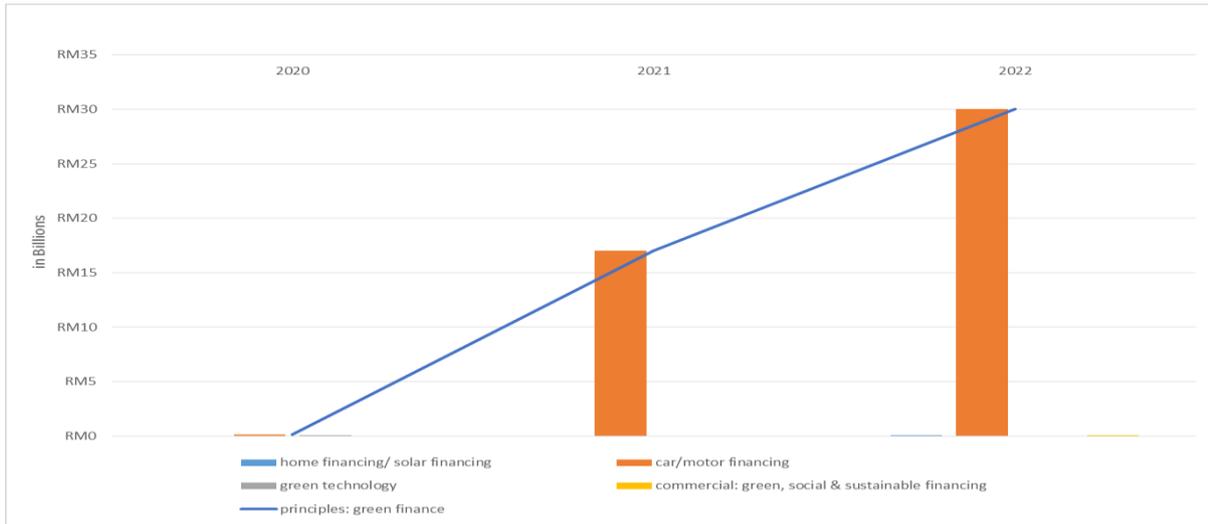
Figure 5

 RHB Bank Green Finance for 2017-2022

Source: Hong Leong Sustainability Report 2017 - 2022

Figure 3

Public Bank Green Finance for 2020-2022

Source: Public Bank Sustainability Report 2017 – 2022

In addition to green finance amount and scope of offerings, this study also found optimistic Malaysian banks' conduct towards green practices. Most banks have committed to climate change disclosure in the sustainability reports and recorded their green practices. For instance, disclosure on banks' operation GHG emissions, water consumption, energy consumption, fuel/petrol consumption, waste management, paper consumption, etc. Most banks have also disclosed their alternatives for green practices, , certification of green building for their operation offices/ buildings/ towers, replacement of energy-saving gadgets, , LED bulbs, staff training for green finance-related education, community programs to educate and nurture awareness on green lifestyles, offsetting projects, , replanting and restoring natures/forests, etc. Nevertheless, all of these practices that were reported qualitatively were not considered in this study. Other quantitative data cannot be analyzed further due to ununiformed data presented in the SRs. Thus, the green practices analyzed descriptively in this study are confined to the banks' operation GHG emissions, water consumption, energy consumption, and paper consumption.

Figure 4

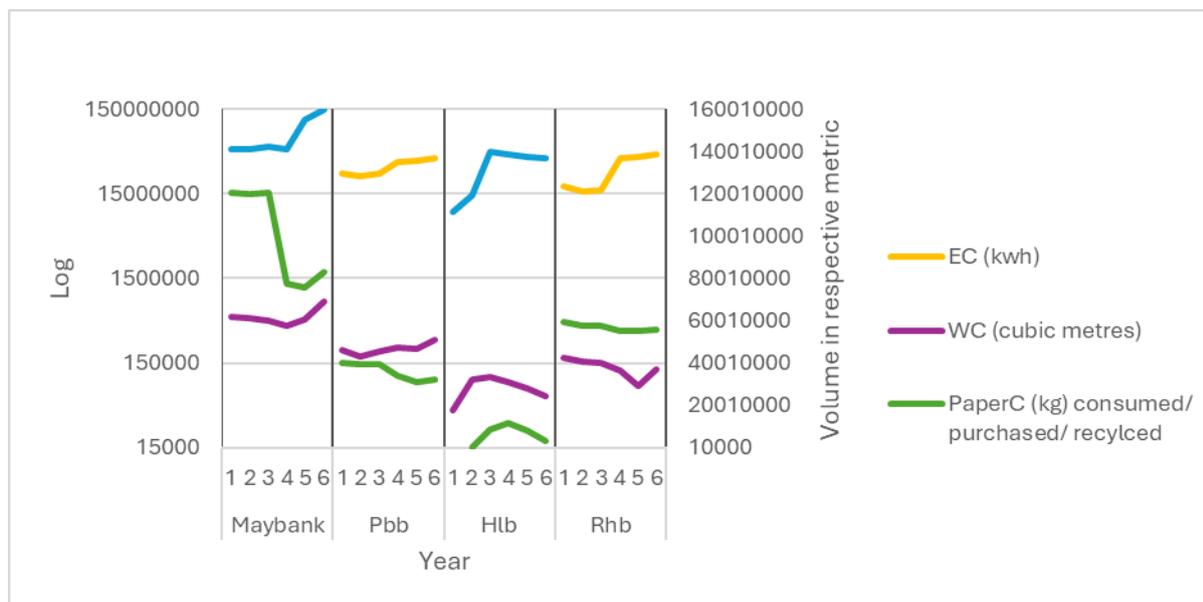*Greenhouse Gas (GHG) Emissions by the Banks for six years period*
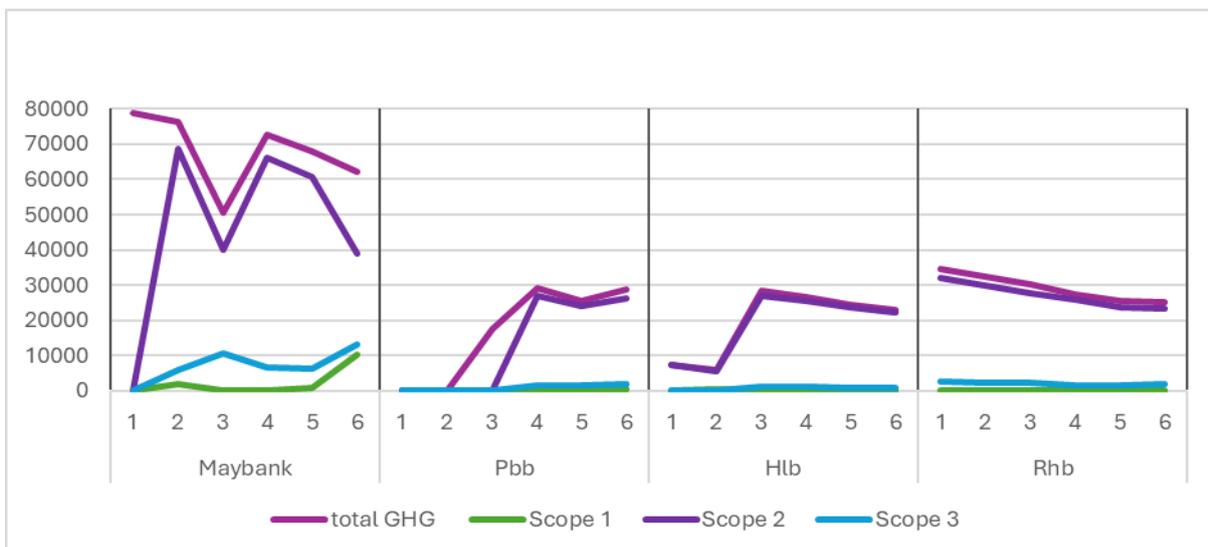
Note: 1 – 6 is representing year 2017 -2022.

Source: Sustainability and climate-related disclosures. Individual bank reports, 2017-2022.

Figure 5

Green Practices by the Banks

Note: 1 – 6 is representing year 2017 -2022.
Source: Sustainability and climate-related disclosures. Individual bank reports, 2017-2022.

Based on the first figure, the GHG emissions from the banks' direct and indirect operations have shown a consistent decrease from year 3 or 4 onwards. An increase in GHG emissions for Maybank in the fourth year was presumed to be due to changes in the GHG calculations. For Public Bank, disclosure of the GHG emissions has only started in year 2 for total GHG emissions, while GHG Scope 1, 2, and 3 only started in the third year. Based on the figure, it was found that some banks have emitted higher GHG emissions than others. Nonetheless, these data should be understood in line with the range of the banks' operations. For banks that operate in more buildings/premises and countries, it is perceivable that their GHG emissions should be higher than those operating in small-range operations. It was also noted that the banks have different interpretations when calculating GHG emissions. While some banks include staff commuting in their GHG scope 3 emissions, others have excluded it or added an additional scope 3.

In terms of energy consumption, the banks have generated similar patterns. Particularly for 2020-2021, there were slight changes in energy consumption moving to the following year. Some banks have noted that the work-from-home policy during COVID-19 has somewhat reduced energy consumption. Besides this, other energy consumption details were not provided in the SRs. Most banks only have the highlights, particularly on reducing their energy consumption, without explaining the specific contributing factors or further analysis. These may be because they have disclosed their green initiatives, which may be understood as part of the contributing factors. Notably, Maybank has reported higher consumption for water consumption than others. This may be due to the bank's range of operations, number of staff, number of buildings, etc. For paper consumption, Maybank and RHB have reported on the amount of paper consumed/purchased by the banks. On the contrary, Public Bank and HLB have reported on the amount of paper that they recycled. Starting from the third year, each bank has reduced its paper consumption. The amount of recycled paper is also reduced due to reduced consumption/ purchase.

For the environmental data, the findings have shown a consistent increase in the ecological footprint (GHA) and ecological footprint (NOE) for Malaysia and Asia. However, due to the abovementioned, only the data for Asia are presented here.

Table 5

Descriptive Analysis of the Environment Data

Variable	Obs.	Mean	Std. Dev.	Min	Max
lefasia1	24	23.02	0.02	23.00	23.04
lefasia2	24	0.37	0.02	0.34	0.40
lbioasia	24	21.80	0.01	21.79	21.81
edasia	24	-6.98e+09	1.53e+08	-7.23e+09	-6.79e+09
lco2	16	1.99	0.02	1.95	2.01

The ecological footprints of Asia (lefaasia1) from 2017 to 2022 generally increased between 2017 and 2019, and again in 2022, with a slight decline observed from 2020 to 2021. Similar trends were found for the ecological footprint measured in terms of the number of Earths (lefasia2) and for Asia's biocapacity (lbioasia) over the same period. Patterns for ecological deficit, however, showed contrasting directions: a consistent decrease occurred from 2017 to 2019, followed by a slight increase in 2020, before the earlier decreasing trend resumed. These fluctuations, particularly the deviations in 2020, may be attributed to the impact of COVID-19 movement restrictions, which limited individual, household, and industrial activities. Data on carbon dioxide emissions were available only for 2017–2020. During this period, emissions increased from 7.04 tons per capita in 2017 to 7.46 tons in 2019, followed by a slight decline to 7.38 tons per capita in 2020. These trends are illustrated in figure 9.

Figure 9

Environment data 2017-2022
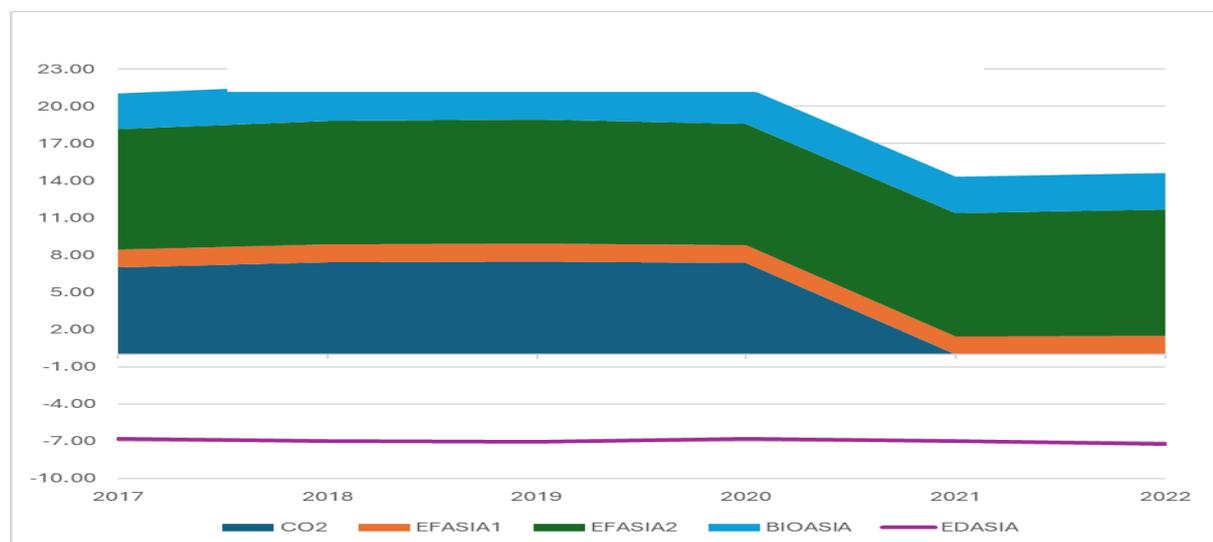
Source: Sustainability and climate-related disclosures. Individual bank reports, 2017-2022.

In order to determine the implications of green finance and practices on the environment, the effects of the total green finance (lgf) and green practices proxied by total GHG emissions (lghg) on the environment data (lefasia1, lefasia2, lbioasia, edasia and lco2) have been investigated. Table 6 summarises of all dependent and independent variables as follows:

Table 6

Descriptive Analysis of Dependent and Independent Variables

Variable	Obs	Mean	Std. dev.	Min	Max
lgf	19	21.13	1.93	16.09	24.12
lghg	24	10.75	1.63	8.71	16.70
lefasia1	24	23.02	0.02	23.00	23.04
lefasia2	24	0.37	0.02	0.34	0.40
lbioasia	24	21.80	0.01	21.79	21.81
edasia	24	-6.98e+09	1.53e+08	-7.23e+09	-6.79e+09
lco2	16	1.99	0.02	1.95	2.01

The logarithm of total green finance (lgf) was available for only 19 observations (N = 19). As this study employs panel data analysis, missing values were treated using interpolation. The mean value of lgf is 21.13 with a standard deviation of 1.93. The logarithm of total greenhouse gas (GHG) emissions (lghg) records a mean of 10.75 and a standard deviation of 1.63. The average values of lefasia1 and lefasia2 are 23.02 and 0.37, with corresponding standard deviations of 0.02 and 0.02, respectively. The logarithm of biocapacity (lbioasia) has a mean of 21.80 and a standard deviation of 0.01. Ecological deficit (edasia) exhibits a mean of -6.98×10^9, while the logarithm of carbon dioxide emissions (lco2) shows an average of 1.99 with a standard deviation of 0.02.

For correlational analysis, all tests were checked for significance collinearity by reviewing each variable's variance inflation factor (vif). The correlation coefficients among the independent variables are low (less than 0.80), suggesting the absence of multicollinearity problems. For each test conducted, the variance inflation factor (vif) indicates a value below 4.0, again to strengthen the absence of multicollinearity.

Regression Analysis

Based on the Table 7 it was found that there are significant effects of lgf on the ecological footprints (lefasia1) and ecological deficiency (edasia), with p=0.05. A significant effect was also observed of lgf on the ecological footprints (lefasia2) and biocapacity (lbioasia), with p=0.001. These findings, to some extent, support the previous studies (Khan et al., 2022; Tran, 2022). However, a significant effect of lgf on the lco2 was not observed. In addition, it was found that the Malaysian banks' green practices have insignificant effects on the environment. relationship between the variables is positive, except for the ecological deficiency. It may be understood that with an increase in the total amount of green finance, the ecological footprint and the biocapacity also increase. This implies that when the Malaysian banks mobilized more for green finance, this led to more demands for resource consumption instead of reducing the demands. Nonetheless, with increased green finance mobilized by the banks, the capacity of resources to regenerate also increases as anticipated

Table 7

Pooled OLS Analysis

Variables	(1) lefasia1	(2) lefasia2	(3) lbioasia	(4) edasia	(5) lco2
lgf	0.00**	0.01***	0.00***	-4.40e+07**	0.03
	(0.00)	(0.00)	(0.00)	(2.07e+07)	(0.04)
lghg	-0.01	-0.01	-0.00	6.02e+07	0.01
	(0.01)	(0.01)	(0.00)	(6.95e+07)	(0.13)
Constant	22.98***	0.32***	21.79***	-6.69e+09***	6.74***
	(0.07)	(0.08)	(0.02)	(6.49e+08)	(0.84)
Observations	19	19	19	19	11
Number of ID	4	4	4	4	4

Note: Standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Although these findings support the effects of green finance by Malaysian banks on the environment, the . In line with this, Malaysian banks' total amount of green finance has significantly contributed to reducing ecological deficiency. Although unexpected, these findings shed light on the 'climate cost' of green finance. As delineated by Chenguel & Mansour (2024), the missing point between the green practice and its favorable implications lies in the lack of knowledge and standard calculation to measure the climate cost and the blurry concept of 'green'. While the banks perceive the green objectives as attaining the green goal, operationally, climate costs are involved, such as promoting the use of electric vehicles and neglecting the non-green costs of high-carbon energy use in manufacturing the vehicle. Thus, the positive relationship between green finance and the ecological footprint can be expected. On the other hand, the relationships between green finance, biocapacity, and ecological deficiency showed that the former has implications for the environment also confirming some results of previous studies (Khan et al., 2022; Quang & Thao, 2022; Tran, 2022)

On the other hand, it was not evident that the green practices (i.e., total GHG emissions of the banks) that were reduced over the years have implications for the environment. These findings are different from past studies, which confirmed the contrary. These are due to the nature of data used in this study compared to others that employed survey data to measure the implications of green practices on environmental performance (Shaumya & Arulrajah, 2017) and sustainability practices (Siddik et al., 2024). Given these, these findings offer another dimension of the environmental implications of green practices by banks.

The informant also acknowledged the implications of green finance on the environment. He said that from the green finance offerings, there was an increase in customer savings from the electricity generated from solar panels, lower carbon emissions from the financing of EV cars, and facilitation of working capital for commercial customers transitioning to a "green company." These insights have suggested more positive implications of green finance in addition to the positive effects on the environment.
In the perspective of challenges, the informant has explained at least two challenges:

1. Market Challenges: The informant thought that green finance is still considerably new and yet to mature. Therefore, limited commercial customers may be classified as transitioning per the BNM CCPT.

2. Incentive Challenges: The informant believed that limited incentives exist to support green finance. The informant said,

"Despite there are fund allocations, , LCTF, incentives such as tax subsidies, stamp duties may further support the advancement of the agenda."

CONCLUSION

The objectives of this study are to identify the Malaysian banks' green finance and green practices, their environmental implications, and the challenges in green finance faced by the banks. Considering an insignificant number of previous studies on green finance or emerging trends of green finance literature, this study's findings may shed some light on Malaysian banks' green finance and practices and their impact on the environment. Nonetheless, this study has employed small samples, i.e., four Malaysian banks, and limited environmental data. In terms of the data, some of the limitations are:

1. There was unstandardized reporting/ disclosure of green finance volume throughout the dataset, , paper consumption was reported by the purchased/procured volume, consumed volume, or recycled volume. The reporting also found different terminologies, , solar home financing and green home financing, electric vehicle financing and clean transportation, etc. Another limitation was also contributed by some banks' insufficient description of the green finance products/solutions, , 'green processes', 'eco-efficient and/or circular economy adapted products'.

2. There was unstandardized calculation/ metric system unit used to report/disclose green finance volume, , for paper consumption, some banks have employed 'reams', or 'sheets' or 'kg' metrics.

3. Changes in the use of reporting/ disclosure standards over the 6-year period by individual banks. For 2017-2019, the report of GHG emissions was restricted to the main building's operation, and later, more buildings were included.

4. Different growth of each bank's green finance reporting/ disclosure developments. For instance, while some banks have initiated the GHG emissions disclosure for Scope 1, 2, and 3 since 2017 or prior, some banks have initiated it a later year.

Besides these, this study also found that the implications of green finance and practices by Malaysian banks are not only restricted to the environment. As indicated above, the implications also extend to the Malaysian banks themselves. As a result, future studies can consider these aspects of challenges and large data/ samples for more insights.

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