Climate-related Financial Risks in Jamaica

An overview of climate risks, financial transmission channels, industry readiness and a timeline to embed these risks into supervisory activities

December 2023

Acknowledgements

This paper on Climate Related Financial Risks in the Jamaican financial system is aimed at initiating the reporting and analysis of Jamaica's climate-related exposures and their risks for the financial system. The paper will support the Bank of Jamaica's (BOJ's) and the Financial Services Commission's (FSC's) endeavours to integrate the management of these risks into their supervisory activities.

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Abbreviations

AFD: Agence Française de Développement/ French Development Agency

ASON: Late Rainfall Season

BIS: Bank of International Settlements

BOJ: Bank of Jamaica

BSA: Banking Services Act

CBAM: Cross-Border Adjustment Mechanism

CAR: Capital Adequacy Ratio

CAT Bond: Catastrophe Bond

CBES: Climate Biennial Exploratory Scenario

CCRIF-SPC: Caribbean Catastrophe Risk Insurance Facility Segregated Portfolio Company

CGS: Cambium Global Solutions

CRFRs: Climate-Related Financial Risks

DTIs: Deposit Taking Institutions

ENSO: El Niño Southern Oscillation

ESG: Environmental, Social, and Governance

FHC: Financial Holding Company

FSC: Financial Services Commission

FUM: Funds Under Management

GCF: Green Climate Fund

GDP: Gross Domestic Product

GHG: Greenhouse Gas

IEA: International Energy Agency

IFRS: International Financial Reporting Standards

IIASA: International Institute for Applied Systems Analysis

IMF: International Monetary Fund

IPCC: Intergovernmental Panel on Climate Change

ISSB: International Sustainability Standards Board

JDIC: Jamaica Deposit Insurance Corporation

JGCRI: Joint Global Change Research Institute

LCR: Liquidity Coverage Ratio

MSCI: Morgan Stanley Capital International

NAP: National Adaptation Plan

NDC: Nationally Determined Contribution

NDTFI: Non-Deposit Taking Financial Institutions

NGFS: Network of Central Banks and Supervisors for Greening the Financial System

NHT: National Housing Trust

NNDRF: National Natural Disaster Reserve Fund

PIK: Potsdam Institute

PIMA: Public Investment Management Assessment

PIOJ: Planning Institute of Jamaica

RCPs: Representative Concentration Pathways

RWA: Risk-Weighted Assets

RSF: Resilience and Sustainability Facility

SASB: Sustainability Accounting Standards Board

TCFD: Task Force on Climate-related Financial Disclosures

UNEP FI: United Nations Environment Programme Finance Initiative

UNFCCC: United Nations Framework Convention on Climate Change

2 Glossary

Biodiversity Losses: Reductions in the variety and abundance of species in an ecosystem.

Carbon Prices: Costs associated with carbon emissions, such as carbon taxes.

Climate Impacts: The effects and consequences of climate change, including both physical impacts and challenges related to transitioning to a low-carbon economy.

Climate Opportunities: Opportunities for financial gains related to climate-related activities or investments.

Climate-Related Financial Risks: Risks associated with the impact of climate change on the financial system, including potential disruptions and financial losses due to climate events.

Ecosystem Service Losses: Decline in the benefits and functions provided by ecosystems to humans.

Emissions Trajectories: Emissions trajectories represent the paths of greenhouse gas emissions over time. They are used to project the impact of emissions on future climate conditions.

Global Warming: The long-term increase in Earth's average surface temperature due to human activities, primarily the release of greenhouse gases from burning fossil fuels, deforestation, and industrial processes. This warming trend contributes to climate change, impacting weather patterns, sea levels, and ecosystems.

Greenhouse Gas: Gases in Earth's atmosphere that trap heat. They let sunlight in but prevent some of the heat that the Earth would otherwise radiate back into space from escaping

Gross Domestic Product: The total value of goods and services produced in a country within a specific time frame.

Liquidity Coverage Ratio : A regulatory requirement that ensures financial institutions have enough high-quality, liquid assets to cover short-term liquidity needs. It's a measure of a bank's ability to withstand short-term financial stress.

Macroeconomic Transmission Channels: These mechanisms describe how climate change affects the macroeconomy, including aspects like labour productivity and economic growth, and how these changes impact financial institutions.

Microeconomic Transmission Channels: These are causal pathways through which climate change impacts the counterparties of individual financial institutions, resulting in financial risks. These risks affect both individual financial institutions and the broader financial system.

Nationally Determined Contributions: Commitments made by countries under the Paris Agreement to reduce greenhouse gas emissions and address climate change.

Net Zero: The balance between the amount of greenhouse gas emissions produced and the amount removed from the atmosphere. Achieving net zero emissions involves reducing emissions as much as possible and offsetting any remaining emissions through activities like reforestation or technology that removes carbon dioxide from the atmosphere

Network for Greening the Financial System: An international network of central banks and supervisory authorities focused on promoting the transition to a greener and more sustainable financial system. NGFS has contributed to the understanding of how climate-related risks are transmitted into the financial system.

Physical Risk: Risks that result from physical events or conditions, such as extreme rainfall, and can have adverse effects on various aspects of the environment, including agriculture, water resources, and ecosystems.

Rainfall Variability: The natural fluctuations in the amount and timing of rainfall over a certain period. Increased rainfall variability suggests more significant changes in rainfall patterns over time.

Real Assets: Tangible assets such as infrastructure, buildings, and land.

Renewable Energy: Energy derived from sources that are naturally replenished, such as sunlight, wind, and rain. Transitioning to renewable energy sources is a part of the shift towards a low-carbon economy.

Risk-Weighted Assets: Assets assigned a risk factor to account for their varying levels of risk, used to determine the minimum amount of capital that financial institutions must hold to cover potential losses.

Statista: A leading provider of market and consumer data.

Stranded Assets: Assets that lose economic value or become obsolete due to changes in environmental or market conditions.

Supply Chain Disruptions: Interruptions in the flow of goods and services from suppliers to consumers.

Sustainable Development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

Transmission Channels: The pathways through which climate risks are transmitted into the financial system and economy.

Transition Risks: Financial risks associated with the process of transitioning from high-carbon and environmentally harmful practices to more sustainable, low-carbon, and environmentally-friendly alternatives. These risks can arise from changes in regulations, market preferences, and technologies aimed at reducing carbon emissions and addressing environmental concerns.

Transition to a Low-Carbon Economy: The shift toward an economy with reduced reliance on carbon-based energy sources and increased use of cleaner, sustainable alternatives.

3 Introduction and Executive summary

3.1 Overall project context

Now more than ever, financial actors have come to appreciate the existential risks that climate change and the associated systemic risk factors pose to the society and economy. The impact of a warming world can devalue assets and disrupt supply chains (physical risks). At the same time, the need to rapidly transition to a low-carbon economy will create major challenges for many businesses. These climate impacts may first be felt in the real economy but will also have implications for the financial sector. Thus, regulators and financial institutions are seeking to better understand their preparedness and determine strategies to increase resilience to the changing economy.

The regulatory authorities for the financial system in Jamaica has embarked on a multi-year effort to support financial stability through the management of the country's climate-related financial risks (CRFR). This process begins with the exploration of Jamaica's climate risks and will continue with an assessment of the implications of these risks for the financial sector. After gaining a full understanding of the nature of CRFRs in Jamaica, BOJ and the FSC will seek to integrate these learnings into the supervision of Jamaica's financial system. Regulatory tools and guidance will help Jamaican financial actors build capacity around CRFRs and manage them more effectively in the future. This will ultimately result in a more resilient and climate-ready financial sector.

3.2 Contents of this paper

This paper provides an assessment of climate risks in Jamaica, the transmission channels of these risks into the financial system, reviews the current policies for climate risk management and outlines the Bank's commitments to embedding the management of these risks into supervisory activities. The paper focuses on identifying the key transmission channels in Jamaica, ranging from physical and transition risks through to financial risks. The paper also provides a review of peer practices in managing CRFRs and discusses the current climate readiness of Jamaica's financial sector. Finally, it outlines a range of commitments and related actions to be taken by the Bank to enhance its climate readiness. It represents the first step in a broader vision for addressing CRFRs.

The overall workplans for this project and future phases are further detailed in Section 11 of this paper.

3.3 Key takeaways

Physical and transition risks in Jamaica

As a Caribbean Island nation, Jamaica is exposed to a variety of powerful natural phenomena including tropical storms, floods, landslides, and high temperatures. Climate change is expected to create additional challenges for the island. Based on a variety of climate model projections compiled by the Planning Institute of Jamaica (PIOJ), some primary climate-related hazards have been identified (PIOJ, 2021). These include:

- **Temperature rise** - the average temperature in Jamaica is expected to rise in all climate scenarios, and the frequency of dangerous heatwaves is expected to grow as well.
- **Rainfall changes** - different parts of the island will see increases in drier or wetter average conditions compared to current averages. The frequency of heavy precipitation events that may cause flooding is likely to increase.

- **Tropical storms** - storms and hurricanes may become slightly less frequent according to some projections, but their windspeed and destructive potential are expected to increase.
- **Sea level rise** - coastal erosion and rising sea levels occur in all climate scenarios, with more rapid changes taking place in high emissions scenarios.

Regarding transition risks, there is a potential for decarbonization policies to have effects on energy prices and on the competitiveness of high-carbon industries on the island. Jamaica also imports a high proportion of goods consumed and used for investment purposes, which means that transition policies and activities in other nations may have an effect on the local economy. Most power is generated through imported fossil fuel and volatility in global oil markets during the net-zero transition might affect businesses and real assets in Jamaica. In addition, the imposition of carbon prices could impact both the desirability of Jamaican exports and the cost paid for imports.

Transmission channels for CRFRs in Jamaica

Transmission channels connect the impacts of climate and transition-related risks to the real economy and from there to the financial system. Channels associated with the hazards noted above included:

- **Temperature rise**- increased healthcare costs, decreased worker productivity, increased energy costs and burdens on energy and the built infrastructure.
- **Rainfall changes**- decreases in crop yields and increases in insurance claims, greater irrigation costs, and business disruption from landslides and floods.
- **Tropical storms**- direct damage to real assets and insurance losses, reduction in the desirability and valuation of real assets, and business and supply chain disruptions.
- **Sea level rise**- reduced desirability of coastal assets and decreasing valuations, increasing insurance and adaptation costs, and biodiversity losses as well as ecosystem service losses.
- **Domestic climate policies**- increased operating costs for high-carbon firms, potential disruption from low-carbon market entrants.
- **International net-zero transition**- shifts in tourism preferences (due to carbon pricing of flights), impacts on overseas investments, energy and import price volatility.

These transmission channels can create a variety of financial risks that are further elaborated in section 3.1. These risks include:

- **Credit risks-** Climate change and the transition to a low-carbon economy can reduce the ability of borrowers to repay loans, increasing credit risk. The destruction of assets from physical hazards such as hurricanes reduces available collateral, while "stranded assets" from the low-carbon transition may devalue businesses.
- **Market risks-** The unpredictability of extreme weather events introduces uncertainty into financial markets, potentially causing higher volatility. Transition-related changes in policy and technology can lead to shifts in investment decisions, affecting market prices.
- **Operational risks-** Climate-related disasters can disrupt businesses' physical operations, impacting supply chains and infrastructure. The need to adjust to climate-friendly practices or technologies may cause operational difficulties and increased costs.

- **Liquidity risks-** Severe climate events can increase precautionary demand for liquidity by financial institutions, households, and corporates, potentially straining liquidity buffers. Similarly, physical risks to counterparties can trigger withdrawals or utilization of credit lines, further exacerbating liquidity pressures.
- **Legal risks -** As government agencies introduce stricter regulations to combat climate change, businesses may face legal risks associated with non-compliance. Moreover, businesses may face legal action for contributing to climate change or not sufficiently adapting their operations to mitigate its effects.

Feedback from Financial Institutions on Climate Risk Readiness

BOJ assessed the climate risk awareness and activities of Jamaican financial actors. From this analysis, it was seen that the financial sector is at the beginning of their climate readiness planning journey.

Commitments for enhancing climate readiness

BOJ intends to take steps to enhance the climate resilience of the financial sector, aligning with global best practices. The Bank's key commitments include:

- Enhancing data collection and granularity.
- Active participation in international climate-related initiatives.
- Building capacity through education and collaboration.
- Producing its own TCFD report.
- Conducting climate stress tests for risk evaluation.
- Integrating climate risk into prudential supervision.

BOJ's commitment reflects its dedication to long-term financial stability and resilience in the face of climate change.

4 Jamaica's Climate – Related Risks

4.1 Physical Risks

Like other small island nations, Jamaica is confronted with significant physical risks stemming from climate change. These risks include rising temperatures, changing rainfall patterns, intensifying tropical storms, and rising sea levels, among others. They present formidable challenges to the country's environment, economy and populace. The four risks cited above also connect to other climate-related hazards, such as heatwaves, droughts, flooding, coastal erosion and the spread of infectious disease vectors. The sub-sections below provide a view of the emergence of these hazards and how they may grow in severity in a warming world.

4.1.1 Temperatures

Given Jamaica's tropical location, one of the major physical risks confronting the nation involves rising temperatures. The Planning Institute of Jamaica indicates that the island has undergone a discernible warming trend of approximately 0.16 C per decade from 1991 until the present (World Bank, 2023). This has resulted in heightened heat stress which carries implications for human health, agriculture, and water

resources. Elevated temperatures can also exacerbate drought conditions, compromising the availability of water for domestic and agricultural purposes.

Table 1: Current and future temperature trends

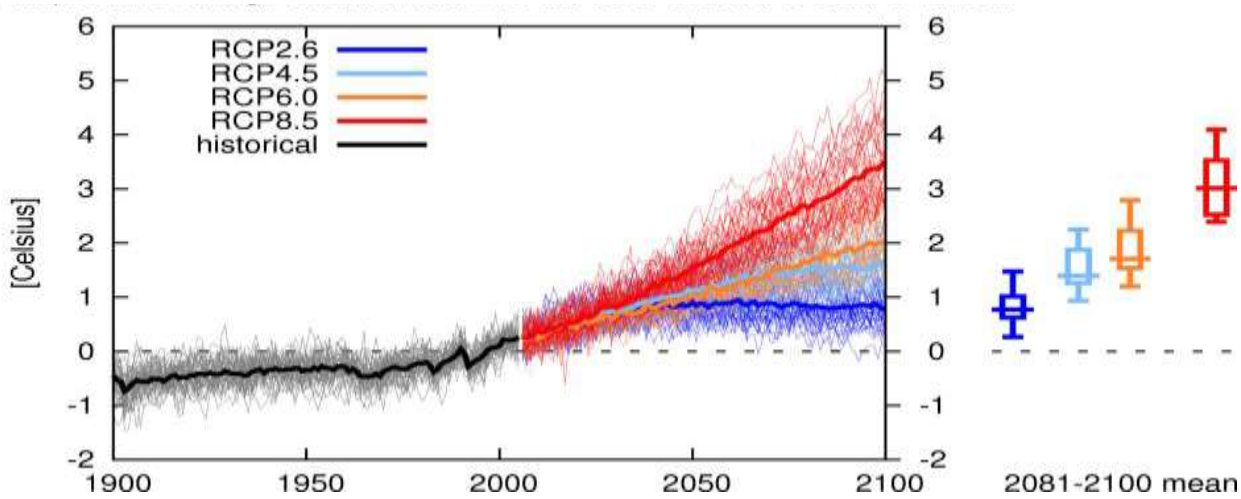
Current state	Future projection
• Maximum, mean, and minimum temperatures show upward (linear) trend. • Average minimum temperatures are increasing faster than maximum temperatures Mean temperatures increasing steadily as well. • Increases in temperature are consistent with global rates. • Daily temperature range has decreased.	• Minimum, maximum, and mean temperatures increase irrespective of scenario through to 2100. • The mean temperature increase (in Degree Celsius, or 'C') from the global model estimates will be 0.65-0.84 C by the 2030s: 0.86-1.10 C by the 2050s, 0.82-3.09 C for 2081-2100 with respect to a 1986-2005 baseline over all four common emissions scenarios. • Regional models suggest higher magnitude increases for the downscaled grid boxes – up to close to 4 C by 2100. • Temperature increases across all seasons of the year. • Coastal regions show smaller increases than interior regions. • Mean daily maximum temperature each month at the Norman Manley International Airport station is expected to increase by 0.18-1.3 C (1-2-2.0 C) across all pathways by early (mid) century. • The annual frequency of warm days in any given month at the Norman Manley International Airport station may increase by 2-12 (4-19) days across all pathways by early (mid) century.

Source: PIOJ, 2021

The latest climate projections for the Caribbean included in the IPCC's 6th Assessment report in 2021 suggest that these trends will intensify over time (IPCC, 2021). As figure 1 below shows, there is significant variability in estimates for future warming in Jamaica. The actual extent of the warming will depend on climate sensitivity (how much warming is created at different levels of atmospheric greenhouse gas concentrations) and the trajectory of emissions. However, in worst-case scenarios, temperature rises could reach nearly 4° C above the reference level by 2100 (IMF, 2023). Emissions trajectories in the figure 1 below are indicated by representative concentration pathways (RCPs). These reflect the energy added into the climate system by additional emissions.[1]

[1] The numbers that follow the RCPs are related to that additional energy, with higher numbers (e.g., 8.5 vs. 2.6) indicating more warming and more emissions than lower ones.

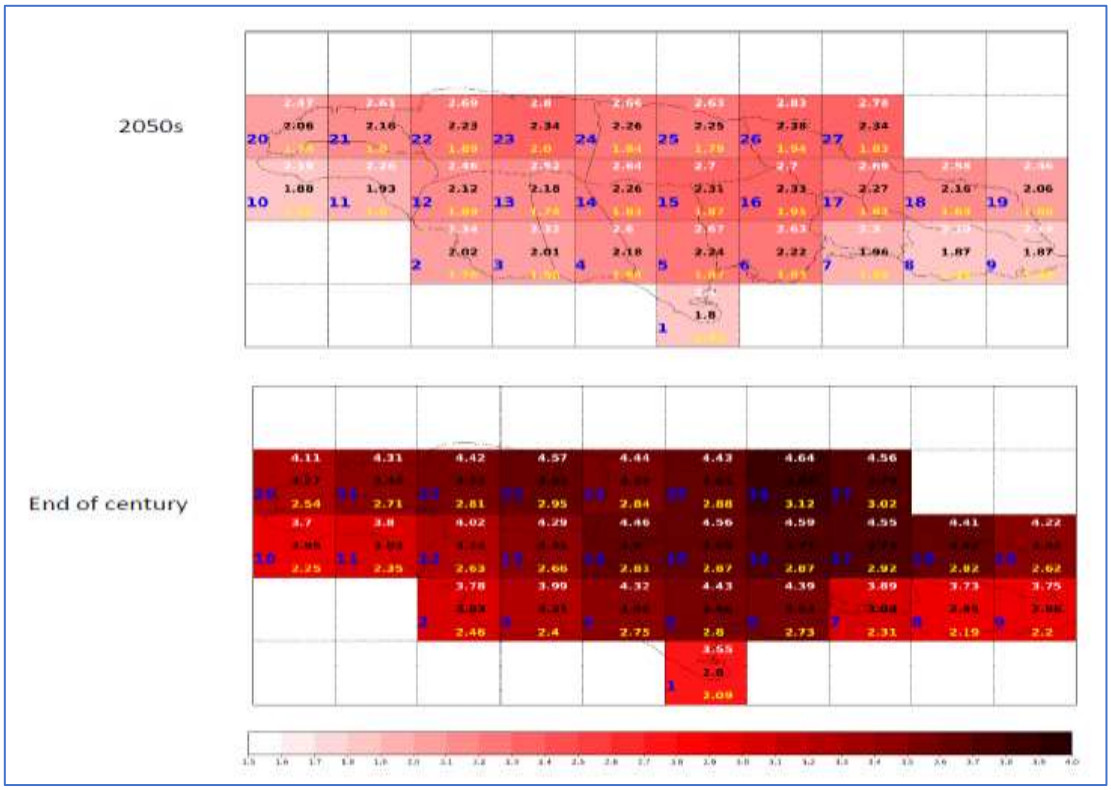
Figure 1: Average projected temperature change in Jamaica compared to 1986-2005 baseline



Source: [PIOJ, 2021](#)

It is important to recognize that warming will be distributed unevenly over the country, with certain areas seeing faster warming than others (see figure 2). This may have implications for the level of heat stress and for the productivity of different crops in different parts of the country ([LSE, 2015](#)).

Figure 2: Forecasted changes in temperatures (degrees C) in a high emissions scenario (A1B)
2050 to 2100 relative to 1961-1990



White numbers represent high end of temperature change projections, black numbers represent mean estimates, and yellow numbers represent low end of temperature projections. Blue numbers represent grid boxes covering local areas in the model. Source: [PIOJ, 2021](#)

4.1.2 Rainfall

In recent years, rainfall variability in Jamaica has amplified. Changes in rainfall patterns represent a significant physical risk for Jamaica. This change is characterized by more frequent occurrences of extreme rainfall events and by prolonged dry spells (UNFCCC, 2018). Such changes can have adverse effects on agriculture, water resources and ecosystems, thereby jeopardizing food security and livelihoods.

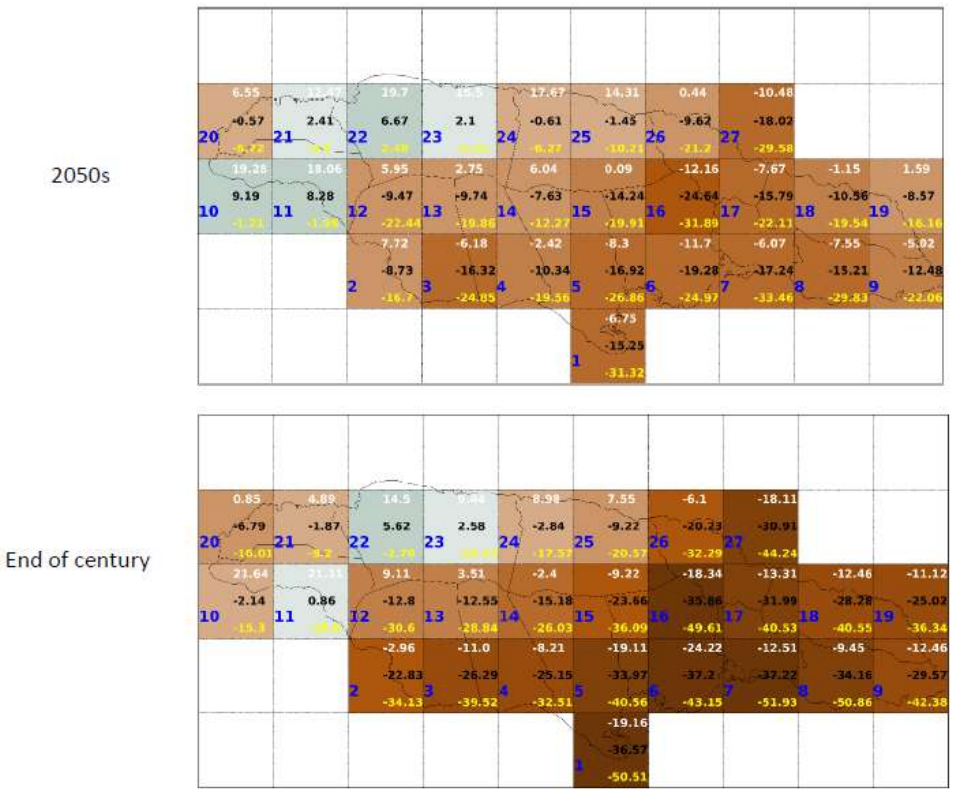
Table 2: Current and Future Rainfall Trends

Current state	Future projection
Significant year-to-year variability due to the influence of phenomenon like the El Niño Southern Oscillation (ENSO). • Insignificant upward trend • Strong decadal variability seen. Recent anomalies include: Wet anomalies in the 1960s, early 1980s, late 1990s, and mid to late 2000s. Dry anomalies in the late 1970s, mid and late 1980s, and post 2010. Four rainfall zones. • Interior (1), West (3) and Coasts (4) co-vary on decadal time scale. East least well correlated. • Intensity and occurrence of extreme rainfall events increasing between 1940-2010.	Model projections suggest that the 2030s will be up to 4 percent drier and the 2050s up to 9 percent drier, relative to the 1986-2005 baseline. By the end of the century, rainfall could be up to 21 percent lower for all four IPCC pathways . • The global models suggest that change in late rainfall season (ASON) is the primary driver of the drying trend. Dry season rainfall generally shows small increases or no change. • Regional model projections similarly reflect the onset of a drying trend from the mid-2030s which continues through to the end of the century. The amount of drying differs, depending on the reference baseline, scenarios examined, and region of the country being examined. In some regions, a decrease in rainfall of greater than 30 percent will be seen by the end of century. • There is spatial variation, with the country's southern and eastern regions tending to show greater decreases than its northern and western regions. • Intensity and occurrence of extreme rainfall events increasing between 2040-2100.

Source: PIOJ, 2021

Similar to warming, the overall change in rainfall will vary across the island. When rains do occur, they are expected to be more intense in most regions (PIOJ, 2021).

Figure 3: Forecasted Percentage changes in precipitation in a high emissions scenario (A1B) 2050 and 2100, relative to 1961-1990



White numbers represent high end of rainfall projections, black numbers represent mean estimates, and yellow numbers represent low end of rainfall projections. Blue numbers represent grid boxes covering local areas in the model.

Source: PIOJ, 2021.

4.1.3 Tropical storms

Global warming may have complex effects on tropical storms.

For the outlook, the expectations are that warmer oceans will provide more energy to the atmosphere. This energy, in turn, will promote the creation of storms. However, other forces are acting to decrease the frequency of tropical storms. Multiple climate models anticipate stronger storms, coupled with the attendant flooding and damage that these create (PIOJ, 2021). These stronger storms may mean that the island could experience unprecedented incidences, compared to the past.

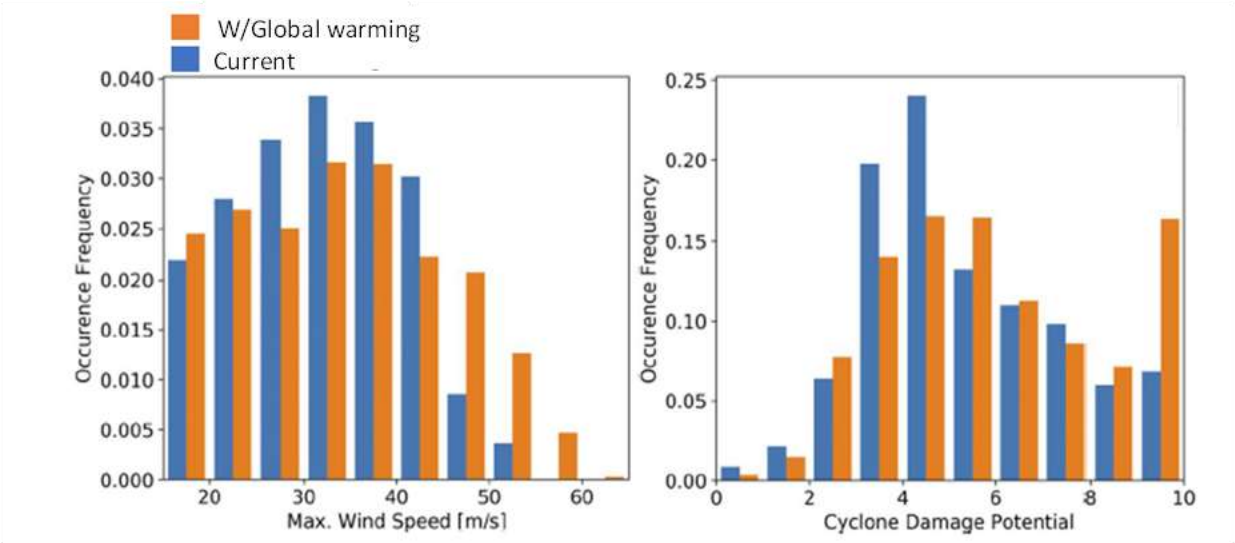
Table 3: Current and future tropical storm trends

Current state	Future projection
Increase in category 4 and 5 hurricanes; rainfall intensity, associated peak wind intensities, mean rainfall for same period. • South more susceptible to hurricane influence. • Majority of the storms or hurricanes impacting Jamaica are categories 3 and 4.	For global warming of 2C: • Number of storms appears to remain relatively constant. • Strength of storms appears to increase later in the century, with a shift in distribution toward higher wind speeds and potential damages. • Increase of +5 percent to +25 percent in hurricane rainfall rates. • Median change in the proportion of very intense storms (categories 4 and 5) of +13 percent.

Source: PIOJ, 2021

An analysis of maximum windspeeds for tropical storms and their damage potential suggests that warming will create more powerful and destructive tropical storms. This scenario remains the case even if the overall occurrence of storms slightly decreases (PIOJ, 2021).

Figure 4: Maximum sustained windspeed and cyclone damage potential (rated 1-10) with global warming (orange) and current (blue)



Source: PIOJ, 2021

4.1.4 Sea level rise

Jamaica faces significant risks from sea level rise, which poses a threat to its coastal areas and low-lying regions. As global temperatures increase, melting ice caps and thermal expansion contribute to rising sea levels (PIOJ, 2021). This can lead to coastal erosion, saltwater intrusion into freshwater areas and increased vulnerability to storm surges and flooding. The impacts of sea level rise can disrupt infrastructure, damage ecosystems and threaten coastal communities, including tourism and fishing industries.

Table 4: Current and future sea level rise trends

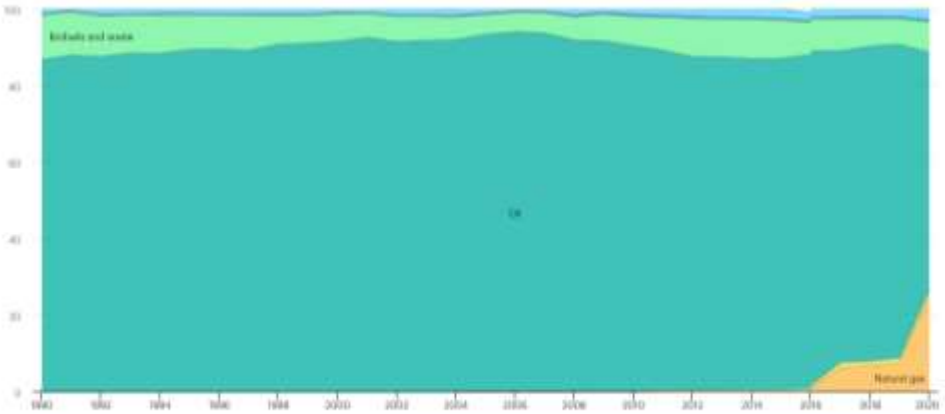
Current state	Future projection
• An average regional rate of increase of 1.8 ± 0.1 mm/year from 1950 and 2009. • Higher average rate of increase in later years: up to 2.5 mm/year between 1993 and 2010. • Caribbean Sea level changes are near the global mean. ○ Sea level rise at Port Royal, Jamaica, at 1.66 mm/year.	• For the Caribbean, the combined range for projected sea level rise may increase by nearly 1 m relative to 1986-2005 levels. Other studies suggest a rise in the Caribbean of up to 1.5 m under high emissions scenarios (NLM, 2019). • For Jamaica, projected mean sea level rise over all scenarios for the north coast is 0.6-0.9m by the end of the century. Rates for sea level rise are similar for the south coast.

Source: PIOJ, 2021

4.2 Transition risks

Significant transition risks confront the island. The country is heavily reliant on fossil fuels for electricity generation, with over 90 percent of its energy coming from imported oil (IEA, 2022) (see Figure 5 below). This dependence makes Jamaica vulnerable to fluctuations in the oil prices and disruptions in oil supply, as well as to the impacts of climate change on oil-producing regions. In addition, as an importer nation, carbon prices, both within Jamaica and internationally, impacts the costs of goods. The following sub-sections explore the main risks to Jamaica arising from the transition to net zero. It covers policy risks, such as those from carbon pricing, technology risks and reputational and legal risks.

Figure 5: Total energy supply in Jamaica 1990-2020



Source: IEA, 2022

4.2.1 Policy risks

Domestic policies designed to reduce Jamaica's carbon emissions may focus on increasing the price of carbon emissions on the island or on restricting environmentally harmful activities. These actions, while necessary, may have diverse consequences for different sectors of the Jamaican economy.

International climate policies may also have an impact on Jamaica. For example, efforts to impose carbon prices may affect Jamaican exports if the island is not levying a comparable carbon price domestically. This is the structure of the European Union's Cross-Border Adjustment Mechanism (CBAM) where exports from countries without carbon pricing will face a border charge.

In addition, the cost of imports to Jamaica may also change due to the pass-through of carbon prices to the final consumers of goods. Given Jamaica's status as a net importer, the changing availability of goods and changing prices may have consequences for inflation (Statista, 2023).

4.2.2 Technology risks

The shift towards a low-carbon economy may accelerate technology transition risks in the Jamaican economy. Traditional sectors, such as the energy-intensive mining industry, may face challenges in adapting to newer, greener technologies. The shift towards renewable energy may also render existing infrastructures and practices obsolete. Furthermore, businesses may incur significant costs associated with transitioning to climate-friendly technologies, potentially impacting profitability and competitiveness. In this context, Jamaica's inability to adapt swiftly could lead to stranded assets, loss of market share, and increased financial vulnerability.

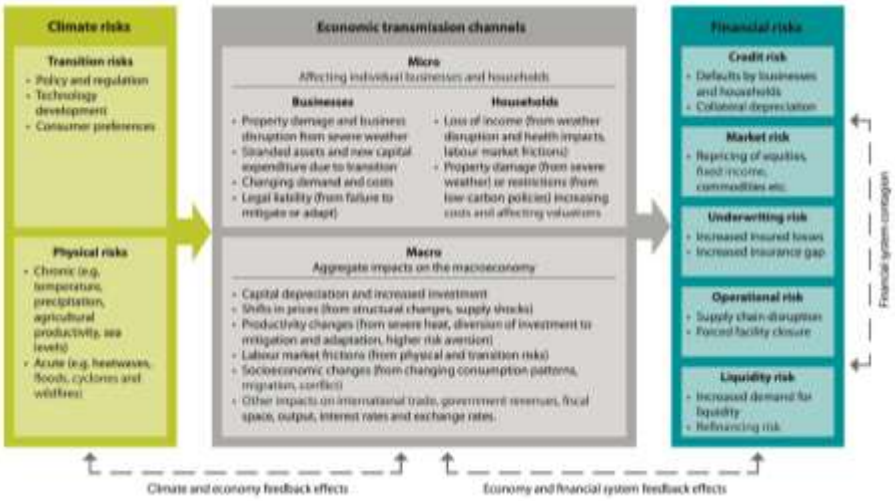
4.2.3 Legal and reputational risks

Jamaican businesses could also be exposed to substantial legal and reputational risks linked to climate change. As the government tightens environmental regulations to mitigate climate change, non-compliant businesses may face legal repercussions, including fines and sanctions. Moreover, stakeholders are increasingly attentive to businesses' environmental responsibility. Companies perceived as contributing to environmental degradation or failing to address climate change risks may face backlash, potentially damaging their reputation and customer loyalty. Climate-related litigation is also a growing concern, as businesses may be held legally accountable for climate change consequences.

5 Transmission channels of climate risk into the financial system

Climate-related physical risks and transition risks are widely acknowledged as drivers of financial risks. These climate-related risks can expose financial institutions to credit, market, operational, and other risks. The path from these climate-related drivers to financial implications are called 'transmission channels. The work of Network of Central Banks and Supervisors for Greening the Financial System (NGFS) has been pioneering in outlining these transmission channels. The figure below shows several examples of how CRFR may propagate through the real economy to the financial sector.

Figure 6:Transmission channels from climate risks to financial risks



Source: NGFS, 2021a

The following sub-sections describe how these transmission channels may manifest for different risks. This provides a foundation for the assessment of Jamaica's own transmission channels in section 6.

5.1 Transmission channels to specific risk types

The channels through which CRFR affect the financial system can be broadly categorised as microeconomic and macroeconomic transmission channels. Microeconomic transmission channels refers to the causal chains through which climate change affects the counterparties of individual financial institutions, resulting in financial risks to individual financial institutions and to the wider financial system. Macroeconomic transmission channels represent the mechanisms through which climate change affect the macroeconomy, including labour productivity and economic growth, and how these risk drivers impact financial institutions. Work undertaken by the Bank of International Settlements (BIS) is foundational in defining these different risk channels (BIS, 2021a).

This section explores both microeconomic and macroeconomic transmission channels and cover the risks outlined in the table below. The distinction between microeconomic and macroeconomic transmission channels is sometimes not pronounced. Climate change risks can have implications for the overall economic environment rather than being limited to specific actors or industries. Also, the nature of these risks are such that they are interconnected, which underpins their impact at both microeconomic and macroeconomic levels.

Table 5: Climate transmission channels and risks

Transmission channel	Risk type
Microeconomic/Macroeconomic transmission channels	• Credit risk • Market risk • Liquidity risk • Operational risk • Underwriting risk

Credit Risk

Natural disasters resulting from climate change will adversely affect the economy, both through direct damage to assets and through the disruption of economic activities. Furthermore, exposure to climate risk can raise borrowing costs, impacting economic activity and creditworthiness. Socioeconomic changes triggered by climate change, such as violent conflicts and mass migration, further complicate the assessment of credit risk by influencing economic growth and borrower creditworthiness.

The destruction of assets by physical hazards can increase credit risk in two respects. The first is that the damage and destruction of assets reduces the collateral available to secure loans and makes it riskier for lenders to extend credit to borrowers. Banks and other lenders face increased credit risks as the probability of borrowers defaulting on their loans rises due to the loss of assets. Repairing the damages and disruption of physical climate risks also reduces the income available to cover outstanding loans, thereby increasing the likelihood of default.

Secondly, the transition to a low-carbon economy can create "stranded assets" – namely, assets that are rendered economically worthless due to shifting regulatory, technological or market realities. In the shift away from high-carbon industries, certain assets and industries that rely heavily on fossil fuels may become economically unviable or obsolete. Financial firms that have exposure to these industries or assets face significant credit risks. Lenders that have extended credit to companies operating in carbon-intensive sectors may find themselves facing defaults or repayment difficulties as the value and profitability of these assets decline. Large, stranded assets can undermine the financial stability of both borrowers and lenders. On an individual level, energy inefficient properties may pose credit challenges as higher energy prices cut into income and make repayment of outstanding debts more challenging.

Furthermore, the effects of transition risks, such as carbon taxes and changing consumer preferences, can have broader macroeconomic consequences by reducing profitability and investment of firms and reducing household income, leading to lower consumption and gross domestic product (GDP). These developments amplify banks' credit risk, as households and firms may experience decline in income, impacting their ability to repay debts.

The global shift away from fossil fuels, in line with the climate goals of the Paris Agreement, could have adverse implications for government finances, potentially hindering their debt servicing capabilities, impacting sovereign credit ratings and hence lowering the rating ceiling under which individuals and corporates function.

Market Risk

The uncertainty surrounding the intensity and location of future severe weather events can have a significant impact on financial markets. As climate change unfolds, the frequency and severity of extreme weather events are expected to increase. The uncertainty surrounding the timing and severity of such events can make it challenging for financial actors to accurately assess risks and make informed investment decisions. As a result, financial markets may experience higher volatility.

Market risks can also result from volatility in energy and commodities markets due to shifts in demand and supply conditions. The energy market in Jamaica is particularly susceptible to such volatility as the island is predominantly an energy importer. Fossil fuel prices play an important role in the cost of other

goods, ranging from tourist flights to the island to basic goods such as plastics. As the world decarbonizes, volatility in fossil fuel prices is likely to increase.

Furthermore, transition-related changes in policy, technology and investor sentiment can create market risks for financial actors. As the world transitions towards a low-carbon economy, governments are implementing new policies and regulations aimed at reducing greenhouse gas emissions and promoting sustainable practices. Changes in policy can lead to shifts in borrowing costs, as companies may face higher financing costs if they fail to align with new environmental standards. Moreover, abrupt repricing of financial assets can occur as investor sentiment changes. This favours companies and assets with strong performance, whereas those with high carbon exposure may face penalization. For individual property owners, shifts in preferences towards lower carbon buildings may have implications for the value and saleability of their assets.

Liquidity Risk

Climate risk drivers can have both direct and indirect impacts on liquidity. While research on this channel is limited, there is evidence suggesting that natural disasters can lead to liquidity risk within banks (BIS, 2021a). Natural disasters can trigger an increase in precautionary demand for liquidity by financial institutions, households, and corporates, negatively affecting liquidity buffers. The Bank of Japan, for example, provided record amounts of liquidity to Japanese banks after the 2011 earthquake. Counterparties affected by climate-related events can withdraw deposits or utilize credit lines, putting pressure on liquidity. This is also potentially the case for households who may confront emergency expenditures following a climate-related event or a delay in payments from employers due to the disruption of business activities.

Legal and Operational Risk

Operational risks in the context of climate change and transition factors encompass a range of challenges faced by businesses. One such challenge is the impact of physical hazards which disrupt transportation and telecommunications infrastructure, leading to disruptions in supply chains and communication networks. These disruptions can result in delays, increased costs and reduced productivity for businesses.

Increasing legal and regulatory compliance requirements related to climate change also create operational risks for counterparties. As governments and international bodies introduce stricter regulations and policies to address climate issues, businesses may face compliance challenges and associated costs. Non-compliance with these regulations can also lead to legal repercussions, fines, and reputational damage. In addition, stakeholders – including investors, customers, and communities – are increasingly holding companies accountable for their environmental impacts. Lawsuits and legal actions related to climate change impacts, such as property damage or health consequences, can also result in substantial financial liabilities and reputational harm.

Underwriting Risk

Climate risk drivers can also impact underwriting risk (the risk of losses being borne by the underwriter and not by the collective client). The direct effects of climate change on underwriting risk have not yet been extensively studied but the uncertainties surrounding the frequency and severity of climate events can make underwriting risk assessment more challenging. Climate-related events can lead to significant property damage and losses, resulting in increased insurance claims. This can strain insurers, particularly

if they have concentrated exposures to regions prone to climate-related risks. For individual borrowers, disruptions in the insurance market may have impacts on the costs they pay for insurance or their ability to receive coverage for their property. These changes can negatively affect their financial health (via higher premiums) or reduce the value of their assets (due to the lower desirability of uninsured assets).

5.1.1 Cross-cutting transmission channels

Certain CRFR transmission channels will impact multiple sectors. This work builds on the hazards identified in the prior sections by considering their economic implications for Jamaica. They are divided into physical and transition risks below, although the interaction between CRFRs is emphasised. Table 6 shows transmission channels to financial impacts driven by physical risks and Table 7 shows transmission channels to financial impacts driven by transition risks.

Table 6: Physical risks and transmission channels

Physical risks	Transmission channels
Hurricanes and flooding	• Direct damage to real estate and insurance losses • Reduction in asset values • Business and supply chain disruptions
Coastal erosion and sea level rise	• Reduction in desirability of tourism assets • Increased costs to insure and adapt coastal properties • Biodiversity loss and destruction of ecosystem services
Changing rainfall patterns	• Decreased crop yields and increased insurance claims • Potential hazards from landslides • Greater costs from reliance on irrigation
Extreme heat	• Rising healthcare and insurance costs • Increased energy costs and burden on energy systems • Reduced worker productivity • Reduced agricultural and animal yield
Water scarcity	• Increased water costs • Curtailment of economic activities dependent on water • Potential health consequences • Reduced agricultural and animal yield
Spread of disease vectors	• Increase in health burden from infectious diseases • Reduced agricultural yields due to pests • Increase insurance health and life claims

Source: CGS and BOJ analysis, 2023

Table 7: Transition risks and transmission channels

Transition risks	Transmission channels
Policy risks	• Increased operating costs for carbon-intensive firms and activities • Increases in costs of abatement of environmentally harmful activities

Transition risks	Transmission channels
Market risks	• Energy import price volatility • Increased costs for international tourism due to carbon intensity of flights • Impacts on overseas investments and international investment in Jamaica
Technology risks	• Changing economics of high-carbon incumbents vs. low-carbon new entrants in energy and other sectors • Disruption in carbon-intensive industries from new technologies
Legal and reputational risks	• Costs from legal judgements against firms found to be responsible for climate disruption or environmental degradation • Decreased market values for companies whose reputations are negatively impacted by their association with high emitting activities

Source: CGS and BOJ analysis, 2023

Three areas where CRFRs may have outsized effects on economies and the state are: (i) through effects on social stability, (ii) on the government's financial position, and (iii) on public health. The relevant transmission channels that might impact those areas were considered and are noted below as amplifiers to other transmission channels.

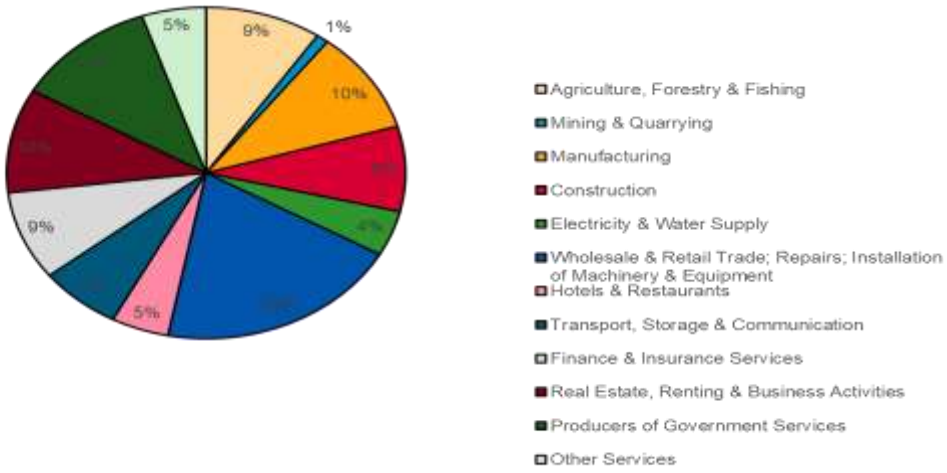
- Social stability
    - Internal displacement due to climate-related events and security issues
    - Immigration due to climate-related events in neighbouring islands
- Government financial position
    - Decreased government revenues due to climate-related losses, decreased remittances, decreased foreign investment
    - Potential new liabilities for government due to contraction or default of firms in high-carbon sectors
    - Increased indebtedness due to borrowing for adaptation and resilience projects, especially in an environment of rising rates
- Public health
    - Health risks due to new disease vectors or post-disaster disruption of health infrastructure

6 Jamaica's climate risk transmission channels

6.1 Sectoral risks and opportunities

An effective assessment of transmission channels in Jamaica requires an evaluation of the risks faced by the major sectors of the economy. First, to consider the materiality of the sectors, the contribution of different sectors to GDP in 2022 is shown in Figure 9 below. As the chart demonstrates, the Jamaican economy shows meaningful diversity, with a significant number of small/medium enterprises in the whole & retail trade. In addition, significant contribution to output comes from tourism related business such as hotels & restaurants, construction, and real estate. Additionally, agriculture is a meaningful contributor to overall GDP, and a significant employer.

Figure 7: Contribution to Jamaica's GDP in 2022

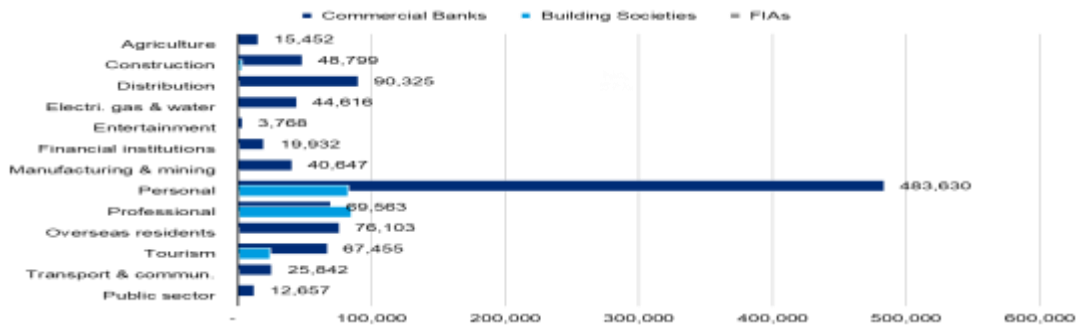


Source: CGS and BOJ analysis, 2023

In relation to the exposure of deposit-taking institutions to the sectors of the economy, the figure below indicates that a large share of the loans in Jamaica are made to individual borrowers, both personal (including mortgages) and professional loans (including small business). For corporate loans, exposures to distribution, tourism, construction, electricity, and manufacturing are all sizable as well.

Granular data for the general insurance sector and for credit unions is not immediately available, but a commitment to enhance data collection processes by BOJ and other supervisors is made in section 11.

Figure 8: Average loans to each sector 2020 – 2022, in JMD millions



Source: CGS analysis, 2023

The paper considers the risk framework created by the Intergovernmental Panel on Climate Change (IPCC) that covered hazards, exposures and vulnerabilities (IPCC, 2012). This framework is useful in determining which transmission channels and CRFRs might be most impactful for Jamaica and which may warrant further investigation. The framework, along with explanations of its component parts, is shown below.

Figure 9: IPCC risk framework

Source: IPCC, 2012

The total level of risk will be a composite of the hazards, exposures, and vulnerabilities for a given sector. For example, a severe hazard that Jamaica has little exposure to may present limited risks (consider desertification, which has major negative consequences, but is not a hazard that Jamaica is particularly exposed to). By contrast, a hazard that Jamaica may be highly vulnerable to (such as floods that disrupt fragile infrastructure) might be more of a concern.

The IPCC framework above was used to help define the relevant sectors requiring further investigation in the rest of section 6 by exploring each sector with a series of questions as described below.

Hazard

- How likely are climate-related or transition-related hazards to affect this sector?
- What are the different hazards likely to have negative financial consequences on this sector?
- Are there potential tail-risk events that this hazard might create?

Exposure

- How large is this sector in the Jamaican economy?
- How linked is this sector to other sectors of the Jamaican economy? Could other sectors be disrupted by disruptions in this sector?
- How much of the sector is potentially impacted by the hazards identified?

Vulnerability

- What vulnerabilities does this sector have to climate-related or transition-related hazards?
- To what extent is this sector adapting to potential challenges it might face?
- Are vulnerable people or communities impacted by disruptions in this sector?

This paper also considered climate sensitive sectors as defined by other indices[2] and initiatives such as the Taskforce on Climate-Related Financial Disclosures (TCFD).

Based on the questions above and the consultation with external evaluations of climate sensitive sectors, a deeper exploration was conducted into sectors that are intuitively sensitive to climate risks and might have relevance for financial stability. In the sections that follow, there are details on the CRFRs, transmission channels, and climate opportunities for the following sectors[3]:

- Agriculture
- Tourism
- Real estate (including mortgages)
- Mining and manufacturing (industrials)
- Distribution
- Energy (power production, generation, and transmission)
- Transportation

6.1.1 Agriculture

The Jamaican agricultural sector plays a vital role in the country's economy, contributing to employment, food security, and rural development. Agriculture in Jamaica encompasses a diverse range of crops, including fruits, vegetables, root crops, and traditional export commodities like sugar and coffee. Small-scale farmers make up a significant portion of the sector. The sector however faces challenges, ranging from market volatility and vulnerability to limited access to financing and the worsening impacts of climate change.

Table 8: Agriculture's climate risks, transmission channels, and climate opportunities

Climate risks	Transmission/amplification channels	Climate opportunities
• Increased temperature and drought: rising temperatures and more frequent droughts could lead to declining crop yields, with estimates suggesting major crop yields could fall 30 percent by 2050.	• Significant agricultural insurance losses from crop failures. • Revaluation of agricultural assets and inability to cover debt payments. • Cost of food can drive price increases across the economy	• Sustainable farming[4] may improve yields and resilience. • Potential production of biofuels or carbon-

[2] The indices consulted included those of MSCI and Moody's as well as SASB and UNEP FI's climate sensitive sectors
[3] The last two of these sectors were combined for purposes of analysis as both are presently fossil fuel dependent and have significant infrastructure that is critical to the Jamaican economy.
[4] Sustainable farming includes regenerative agriculture, low and no till farming, use of low-chemical input practices, consideration of the suitability of different crops and other elements designed to manage the environmental impact of farming.

Climate risks	Transmission/amplification channels	Climate opportunities
• Flooding and soil erosion: more intense rainfall events could lead to increased flooding and soil erosion, which can damage crops and reduce soil fertility. • Pests and diseases: climate change may increase the spread of pests and diseases that affect crops, reducing yields and increasing costs for farmers. • Water availability: climate change could affect the availability of water for irrigation, which is critical for many crops. By 2050, it is estimated that Jamaica could experience a water deficit (where demand on water resources exceeds sustainable resources) of up to 30 percent. • Declining productivity of fisheries and aquaculture due to warming seas, ocean acidification, and overfishing. • Market volatility: climate-related risks could affect global demand and prices for agricultural products, leading to increased volatility in commodity prices.	– driven both by local climate events and global markets. • Food prices can trigger social issues and cost of living crises, increasing financial risks. • International investments in Jamaican agriculture may decline in the face of climate risks.	neutral chemical feedstocks.

Source: CGS and BOJ analysis, 2023

6.1.2 Tourism

The tourism sector is a major engine for the Jamaican economy. The industry is a significant source of employment, benefiting local communities and contributing to the country's overall economic growth. The government and private sector have been increasingly collaborating to promote sustainable tourism practices, preserving the environment and supporting community development. However, the sector faces challenges, such as competition from other destinations, shifts in global travel trends, and risks to infrastructure from climate change.

Table 9: Tourism's climate risks, transmission channels, and climate opportunities

Climate risks	Transmission/amplification channels	Climate opportunities
• Sea level rise and beach erosion could hurt the viability of coastal assets. • Increased hurricane activity may increase damages and also increase perceptions of risk. • Heat stress: rising temperatures could lead to increased energy costs and potential health and safety consequences both to workers and to visitors. • Coral and marine life destruction: coral reefs are a major attraction for tourists in Jamaica. In 2019, Jamaica experienced a coral bleaching event that affected up to 60 percent of the coral in some areas. • Water scarcity: climate change could affect the availability of water for tourism activities, such as swimming pools and golf courses. • Changing tourism patterns: carbon prices and taxation may discourage air travel. • Beach pollution and erosion could impact the reputation of Jamaica's beaches.	• Most tourism loans are syndicated[5] so many institutions have exposure. • Tourism is a key source of foreign direct investment, which may be reduced if assets are damaged or preferences change. • Tourism reduction could lead to job losses and adversely affect mortgage affordability and reduce the value of assets by reducing demand.	• Sustainable tourism or eco-tourism is increasingly in demand. • Higher resiliency of Jamaica may attract tourists who would visit other Caribbean islands instead.

Source: CGS and BOJ analysis, 2023

6.1.3 Real estate

The Jamaican real estate sector is a primary driver of investment and economic growth in the country. However, challenges such as limited access to financing, land ownership issues, and the need for

[5] Based on conversations with FISD

infrastructure development persist. Efforts are underway to address these challenges[6] and further develop the real estate sector to meet the growing demand for quality properties. The Jamaican real estate sector (including construction) is sensitive to the physical climate change risks and the costs that carbon pricing may impose on buildings.

Table 10: Real estate's climate risks, transmission channels, and climate opportunities

Climate risks	Transmission/amplification channels	Climate opportunities
• Sea level rise and coastal flooding: sea level rise and increased storm surges could lead to coastal flooding, which could impact some of the real estate stock in Jamaica. There is often also a lack of flood insurance. • Landslides: Jamaica is prone to landslides, especially in hilly areas. In 2017, landslides caused significant damage to roads and buildings in eastern Jamaica. • Extreme weather events: hurricanes and heavy rainfall are a direct threat to real estate assets both from direct damages and business disruptions. • Heat stress poses a risk to physical structures and to the health of construction workers. • Increased costs to real estate owners and operators to meet higher efficiency standards, energy volatility, and potential impacts of climate policies abroad on foreign investors in Jamaica. Risks especially high for low energy-efficiency assets.	• Potential major insurance losses and higher future insurance prices, reducing values and ability to repay. • Potential for asset valuations to fall due to un-insurability. • Asset price volatility driven by shifting market preferences and perceptions of risk. • Spill over effects from job losses into real estate defaults due to income loss making mortgage repayment more difficult.	• Low-carbon buildings can save money on energy. • Low-carbon buildings and building materials may become more desirable, presenting opportunities for a green premium in the value of low-emitting buildings. • Further development of programmes to support low-income housing can limit financial risks and boost resilience.

Source: CGS and BOJ analysis, 2023

[6] More Affordable Housing Coming for Jamaicans, July 2023 news release by the National Housing Trust

6.1.4 Mining and manufacturing

The mining and manufacturing sectors in Jamaica contribute to investment, employment and export earnings. However, the sectors also faces various challenges due to its environmental impact. Jamaica's susceptibility to climate-related hazards, such as hurricanes, flooding, and droughts, can disrupt mining operations, damage manufacturing facilities, and impact supply chains. Additionally, the transition to a low-carbon economy and the adoption of carbon pricing policies may impose costs on the sector, requiring investment in cleaner and more sustainable production processes.

Table 11: Mining and manufacturing's climate risks, transmission channels, and climate opportunities

Climate risks	Transmission/amplification channels	Climate opportunities
• Water scarcity: metals, mining, and manufacturing activities are heavily water dependent. Water scarcity and decreased water quality could curtail operations or affect production processes and costs. • Extreme weather events: hurricanes, floods, and other extreme weather events could damage infrastructure and disrupt supply chains, affecting the viability of metals, mining, and manufacturing activities. • Energy supply: these sectors are significant consumers of energy, and any climate-related event or decarbonization disruptions to the energy supply or changes in prices could affect production and competitiveness and lead to stranded assets. • Environmental protection concerns and indigenous rights are potential sources of liability and reputational risk due to historic issues.	• Potential insurance losses and credit impacts due to extreme weather events. • Capital intensive sector with long-lived assets that may be stranded and require write-downs • Energy price volatility may make credit repayments difficult.	• Sustainable production of aluminium could see increased demand in the transition. • Local low-carbon manufacturing may be able to compete with international imports depending on trade and carbon policies.

Source: CGS and BOJ analysis, 2023

6.1.5 Distribution

The distribution sector is a sizable contributor to the Jamaican economy and includes a variety of economic activities often conducted by small businesses. These can include the distribution of imported goods, the delivery of finished goods to consumers, and other related services. Due to the small size of

many of the operators in this sector, they may lack a significant financial buffer when dealing with climate-related and transition-related challenges. Furthermore, distribution plays an important connecting role in the Jamaican economy between different producers and consumers and so its disruption may have spill over effects into other economic sectors.

Table 12: Distribution's climate risks, transmission channels, and climate opportunities

Climate risks	Transmission/amplification channels	Climate opportunities
• Sea level rise and coastal flooding: sea level rise and increased storm surges could lead to coastal flooding, which could disrupt distribution in coastal areas. • Heat stress: higher temperatures may increase costs and put stress on infrastructure such as buildings and vehicles. • Energy needs: as the shift to a net-zero world accelerates, distributors with high energy or high emissions may experience energy price volatility or higher costs .	• Disruptions to distribution networks due to climate impacts. • Disruptions in distribution might increase costs in other sectors or drive up prices due to inadequate supply to meet consumer demand, creating negative consequences for consumer cash flow. • Energy price volatility may cause potential defaults in small distributors and lead to financial losses.	• Shifting distribution models to lower carbon and lower energy sources may provide an advantage to distributors . • Improved resiliency in distribution and supply chains can help protect Jamaica against the harms of climate change.

Source: CGS and BOJ analysis, 2023

6.1.6 Transportation and energy

Jamaica's transportation and energy sectors are core to the island's continued development. The island serves as a crucial link for trade and regional connectivity. Significant investments have been made in new highways.

Jamaica's transportation and energy sectors are vulnerable to global fluctuations in energy markets, while its physical transportation and energy infrastructure are at risk from climate change. Efforts are underway to promote sustainable transportation solutions, as well as to diversify the energy mix with renewables and enhance infrastructure resilience. The transition to a low-carbon economy presents both challenges and opportunities, with investments in renewable energy and energy efficiency playing a crucial role.

Table 13: Transportation and energy's climate risks, transmission channels, and climate opportunities

Climate risks	Transmission channels	Climate opportunities
• Sea level rise and coastal flooding: sea level rise and increased storm surges could lead to coastal flooding, which could disrupt transportation and energy systems. • Heat stress: higher temperatures may increase the burden on energy systems and increase energy costs for consumers and businesses. • Energy transition: the high dependency on imported fossil fuels creates potential price volatility as other nations decarbonize. Jamaica's own efforts to decarbonize will require significant capital investment that may increase energy and transportation prices.	• Disruptions to energy and transportation may reduce GDP and government revenues • Energy price volatility may lead to inflation and a cost-of-living crisis that produces credit risk. Increased energy costs may reduce the desirability of Jamaican assets to foreign investors, weakening the market and demand for these assets. • Fossil energy assets may be stranded and create risks for their financiers.	• Opportunities to develop new low-carbon public transportation networks; • New wind and solar power generation could improve energy access and promote national energy independence. • Improved local generation capacity could increase resilience in the face of climate risks.

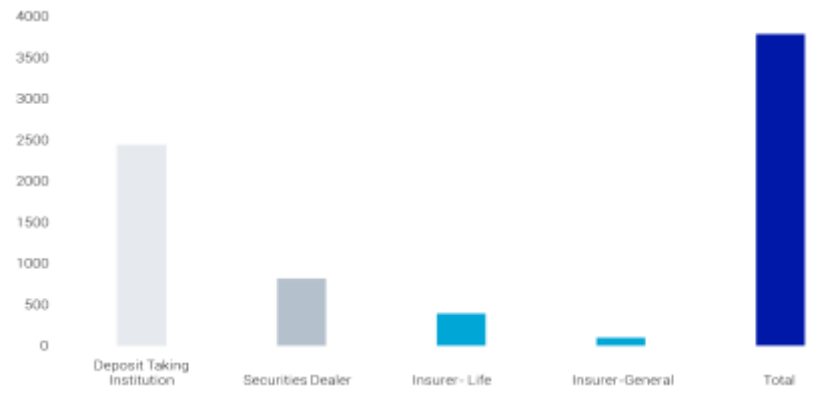
Source: CGS and BOJ analysis, 2023

7 Jamaica's Financial and Policy Landscape for Climate Transition

7.1 Structure of the Jamaican financial system

Jamaica has a diversified financial system, comprising domestic and international institutions with branches or subsidiaries. The largest component of the sector is comprised of deposit-taking institutions, which include commercial banks, building societies and merchant banks. There is also a robust securities market and securities dealers support both retail and commercial clients. In the insurance sector, multiple companies provide life and health insurance and a smaller number provide general insurance. A breakdown of these components of the financial industry are detailed in figure 10 below.

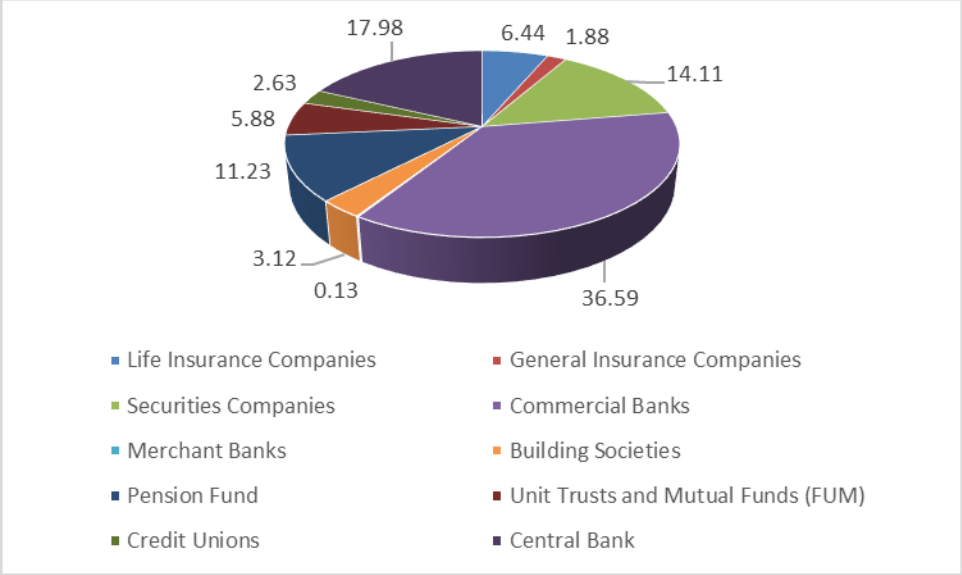
Figure 10: Core Jamaican financial sector assets in JMD billions



Source: BOJ data, CGS analysis, 2023

Eleven (11) Deposit Taking Institutions (DTIs), 18 insurance companies, and 29 securities dealers operated in the Jamaican financial system at the end of 2022. Collectively, these institutions hold assets amounting to 90.9%, 18.3%, and 31.9% of GDP, respectively. Deposit-taking institutions (DTIs) account for 73% of the risk-weighted assets (RWA) of the financial system. The DTI sector is highly concentrated, with systemically important financial groups estimated to account for 57.5% of total system assets as of March 2023.

Figure 11: Distribution of Financial system assets

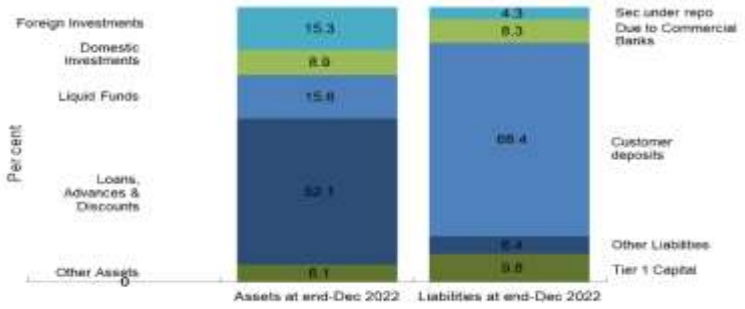


Source BOJ data, CGS analysis, 2023

Deposit Taking Institutions

The DTI sector is highly concentrated. The 3 largest institutions reported assets amounting to 71.0 per cent of overall DTI assets at the end of December 2022. Loans, Advances and Discounts accounted for the largest share of DTI's assets while deposits, accounting for 78.3 per cent of total liabilities at end-2022, are the primary source of funding.

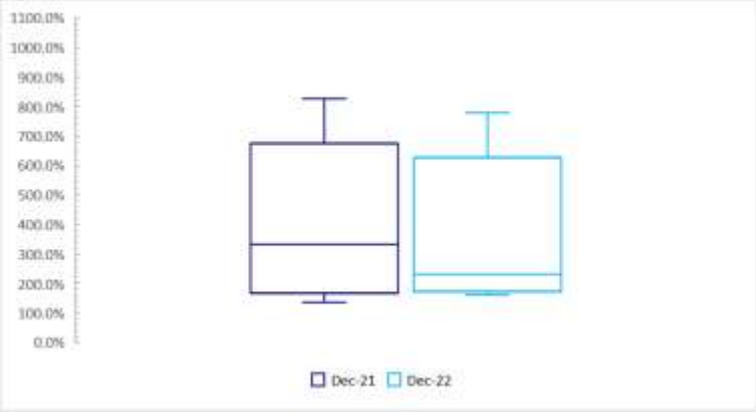
Figure 12: Major Components of DTIs' aggregate Balance sheet.



Source BOJ data, CGS analysis, 2023

At end 2022, DTIs maintained liquidity levels in excess of their LCR requirement.

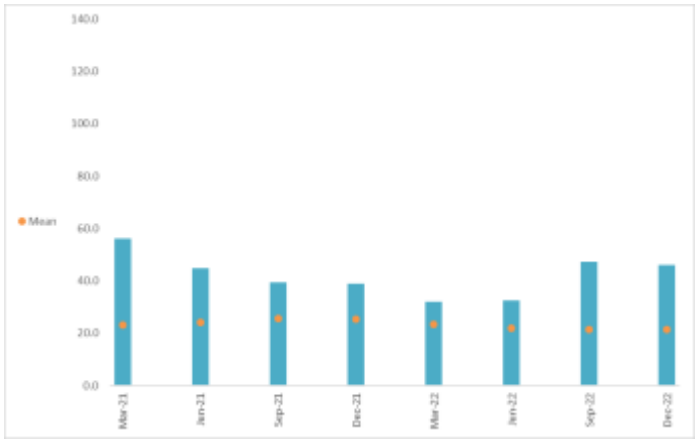
Figure 13: Liquidity Condition in the DTI Sector



Source BOJ data, CGS analysis, 2023

All DTIs maintained strong capital positions during 2022, relative to regulatory capital requirements. In particular, the average CAR for DTIs remained above the regulatory benchmark of 10.0 per cent.

Figure 14: DTIs Capital adequacy ratio



Source BOJ data, CGS analysis, 2023

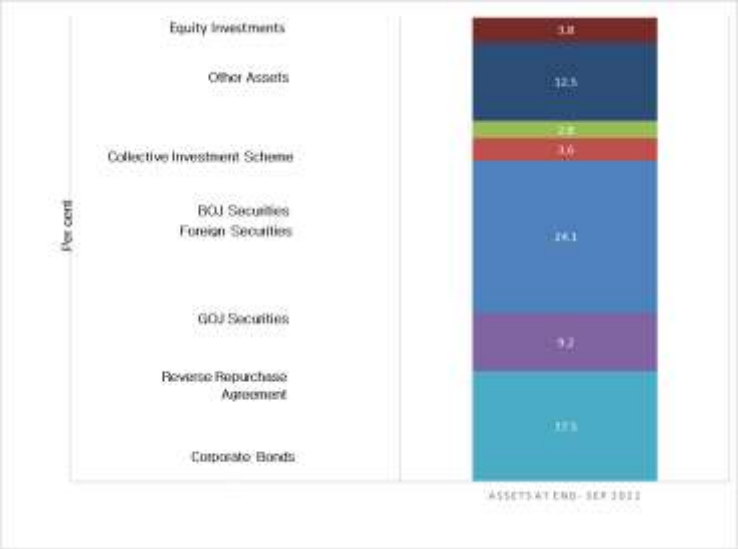
Non-Deposit Taking Financial Institutions

Securities dealers recorded the highest market share within the NDTFI sector. At end-September 2022, the core securities dealers represented 41.9 per cent of non-deposit taking financial institution's (NDTFIs) total assets.[7] Pension funds accounted for 33.4 per cent of NDTFIs' total assets while life insurance and general insurance companies' proportions of NDTFI's total assets were 19.1 per cent and 5.6 per cent, respectively.

Securities Dealers

Core securities dealers' on- and off-balance sheet funds under management (FUM) amounted to $1,562.3 billion (237 per cent of GDP) at end-2022.[8]

Figure 15: Major components of securities dealers' fund under management (FUM) assets

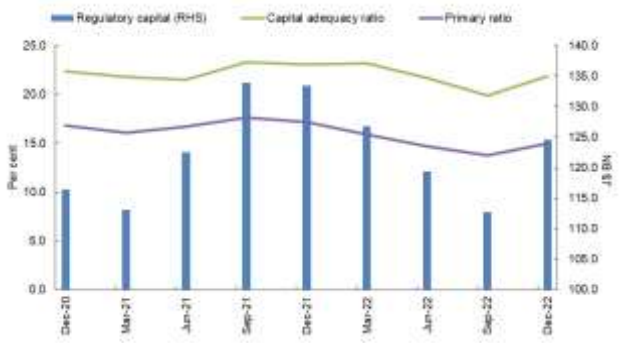


Source BOJ data, CGS analysis, 2023

[7] Core securities dealers represent the top 10 dealers by asset size

[8] This figure includes off balance sheet funds under management, which are not a part of the asset base of the entities. It represents client funds with securities firms in instruments such as units trust, mutual funds or other securities such as stocks and bonds.

Figure 16: Securities dealers' regulatory capital, capital adequacy and primary ratios



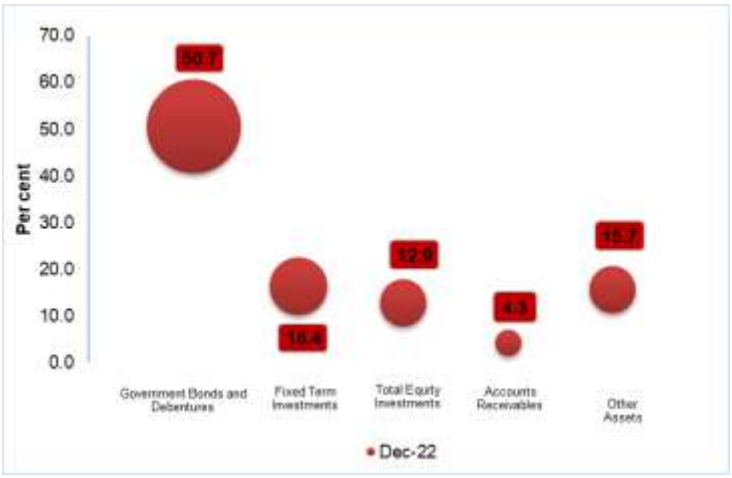
Source BOJ data, CGS analysis, 2023

The CAR of the core securities dealers remained well above the prudential minimum of 10.0 per cent.

Insurance

The insurance sector's asset base amounted to $516.0 billion (19.7 per cent of GDP) at end-December 2022 with Life insurance companies accounting for 78.1 per cent of the insurance sector's assets. Within the life insurance sub-sector, the assets of the two largest companies accounted for 82.5 per cent of the asset base. As it relates to general insurance companies, the two largest institutions accounted for approximately 38.2 per cent of the sub-sector's asset base.

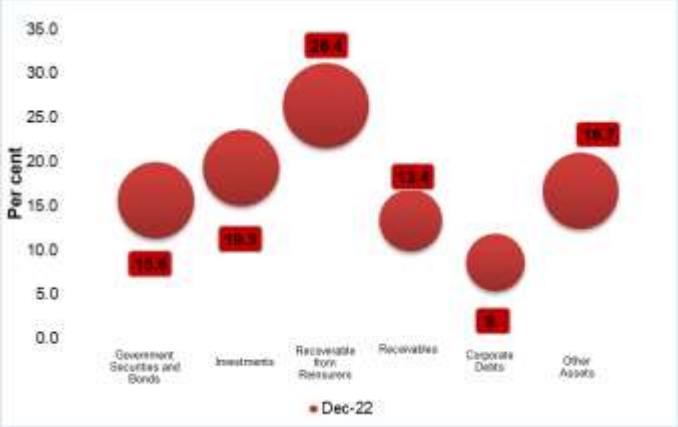
Figure 17: Distribution of assets of life insurance companies



Source BOJ data, CGS analysis, 2023

Government securities dominate the asset portfolio of the life insurance sub-sector, while the general insurance sub-sector's investments are more diversified. Government securities accounted for 50.7 per cent of the life insurance sub-sector's total assets at end-2022. For general insurance companies, Recoverables from Reinsurers accounted for the largest share (26.4 per cent) of total assets. Investments was the second highest share of the asset base of the general insurance companies at end 2022.

Figure 18: Distribution of assets of general insurance companies



Source BOJ data, CGS analysis, 2023

Pension Funds

The private pension sector's asset base was $703.2 billion (26 per cent of GDP) at end December 2022. Investment arrangements dominate the asset portfolio of the industry, relative to other investment classes (see table below).[9] Equities and government securities represent the second and third largest share of total assets respectively.

Table 14: Investment classes as a per cent of total assets pensions industry

	Dec-21	Dec-22
Investments in Governments Securities to Assets (%)[1/]	21.2	20.8
Investments in Equities to Assets (%)	22.3	21.5
Investments in Real Estate to Assets (%)	4.4	4.8
Investment Arrangements to Assets (%)[2/]	38.3	39.0
Other Investments to Assets (%)	0.5	0.5
Total Asset values (J$BN)	713.4	703.2

Notes
[1/] Government securities includes Government of Jamaica securities

Source BOJ, 2022

7.2 Current Legislative and Policy Frameworks

Jamaica's financial sector is currently overseen by two regulatory agencies: Bank of Jamaica (BOJ) and the Financial Services Commission (FSC). The FSC's oversees licensees operating in the insurance sector, securities, collective investment schemes, trusts, corporate service providers, and pensions.

[9] These investment arrangements consist of a pool of various investments including Deposits, Commercial Paper, Securities of Governments, Repurchase Agreements, Bonds and Debentures, Mortgage, Other Loans, Promissory Notes, Stocks and Shares, Real Estate, Derivatives, and other investments. Based on data availability, only the assets of the private pensions industry are represented in the table.

Under the Bank of Jamaica (Amendment) Act, 2020, "The principal objectives of the Bank is the maintenance of price stability and financial system stability with the primary objective being the maintenance of price stability." BOJ in this context is responsible for the implementation of micro-prudential and macro-prudential policies, the latter responsibility been accorded by the Bank of Jamaica (Amendment) Act, 2015. The BOJ Act, 2015 states that BOJ should, "ensure overall stability of the financial system, the bank shall exercise oversight powers for the purpose of preventing or controlling systemic risk" (BOJ, 2019).[10] These responsibilities include the power to issue rules and standards to address systemic risks and conduct assessments .[11] Bank of Jamaica interprets these powers to include prescribing climate-related financial disclosures and conducting top-down climate-related stress tests so as to address systemic risks associated with climate change. BOJ therefore has the authority to evaluate climate-related financial risks and ensure that financial institutions consider, disclose and mitigate these risks.

The role of oversight for system stability is undertaken in collaboration with the Financial Services Commission (FSC) and the Jamaica Deposit Insurance Corporation (JDIC) (BOJ, 2023).

The Banking Services Act (BSA) (BOJ, 2015) brought about other notable enhancements. The BSA promoted supervisory autonomy by transferring critical supervisory functions from the Ministry of Finance and the Public Service to the Supervisor and Supervisory Committee. Moreover, it established a consolidated supervision framework to maintain regulatory compliance across all group members.[12]

Additionally, the BSA fostered compliance with international supervisory principles embodied in the Basel Committee on Banking Supervision's Core Principles for Effective Banking Supervision. In 2018, BOJ launched its Basel III implementation programme, which is planned to be executed in three phases.

These provisions within the Banking Services Act and the Basel III Framework will be instrumental in managing and mitigating the financial risks associated with climate change. Capital requirements could be expanded to encompass climate risks.

The implications of this regulatory structure for assessing climate risks to financial system stability are far-reaching. By placing BOJ at the forefront of supervisory responsibilities and granting it the authority to set standards, Jamaica positions itself as a proactive player in addressing climate-related risks within the financial sector. The inclusion of climate-related stress tests and the integration of climate-related financial disclosures into the regulatory framework ensure that financial institutions prioritize and disclose climate risks in their operations, promoting transparency and enabling informed decision-making by market participants.

Furthermore, Jamaica's commitment to strengthening financial supervision and addressing emerging risks is demonstrated through the phased establishment of a "twin peaks" regulatory regime. This regulatory structure will designate BOJ with prudential supervisory responsibilities over both DTIs and Non-Deposit Taking Financial Institutions (NDTFIs), while the FSC will focus on market conduct and consumer protection for these entities.

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[10] Pursuant to section 34L(3) of the Bank of Jamaica (Amendment) Act, 2015 ("the Act"), the Bank has the responsibility for conducting "macro-prudential oversight of the financial institutions specified in subsection for the purpose of maintaining the stability of the financial system."

[11] Pursuant to section 34P(2) of the Bank of Jamaica (Amendment) Act, 2015 ("the Act"), the Bank may issue rules, standards and codes, which shall be applicable to any financial institution or a category thereof, and which rules, standards and codes shall relate to macro-prudential oversight. The rules, standards and codes referred to above shall be for the purpose of among other things preserving and maintaining stability in the financial system

7.3 Current GOJ climate-related policies/actions

The following are the main climate-related policies and actions undertaken in Jamaica:

Vision 2030 Jamaica – National Development Plan:

In 2009, Jamaica launched its long-term strategic development plan, Vision 2030, which outlines the country's path towards achieving a sustainable, inclusive, and prosperous future for its people by 2030. This plan recognizes the significance of climate change, aligns with 91% of the 115 UN Sustainable Development Goal targets (UNFCCC, 2022), and includes the adoption of climate change as a pillar for success. In this context, Jamaica has made noteworthy progress in climate-related governance over the past few years. Key developments include:

Nationally Determined Contribution (NDC) of Jamaica:

Jamaica ratified the Paris Agreement in 2017, subsequently submitting its national communications and intended Nationally Determined Contribution (NDC) to the UN Framework Convention on Climate Change (UNFCCC), as part of the broader UNFCCC and Paris Agreement transparency and reporting system.[13] In June 2020, Jamaica became the first Caribbean nation to submit an updated and more robust climate action plan under the Paris Agreement. This update substantially increased its greenhouse gas emissions reduction target from an initial 7.8% to 25.4% unconditionally and from 10% to 28.5% conditionally by 2030, compared to a business-as-usual scenario. Additionally, Jamaica expanded its sectoral mitigation coverage to include the land use, land use change and forestry sector, augmenting the previously included energy sector (UNDP, 2023).

National Adaptation Plan development:

Jamaica is in the preliminary stages of developing its first National Adaptation Plan (NAP), having received approval from the Green Climate Fund (GCF) readiness and preparatory support programme in April 2021. The NAP project aims to create an inclusive, systematic, and participatory national adaptation planning and implementation framework for Jamaica by 2025. Complementing the NAP, a financing strategy, an investment plan, and a private sector engagement strategy are being developed. Efforts are also underway to integrate the NAP with local level planning mechanisms, including local governments and municipal corporations (GCF, 2021).

Financing and Coordination:

The Government of Jamaica has adopted a has adopted a risk layering approach to financing risks from natural disasters. This strategy includes maintaining the National Disaster Fund and Contingencies Fund to cover regular occurrences like floods and heavy rainfall. For rarer, more severe events like major hurricanes and earthquakes, the government transfers risks through insurance facilities, including an IDB Contingent Line of Credit. The government also maintains an insurance policy with the Caribbean Catastrophe Risk Insurance Facility Segregated Portfolio Company (CCRIF-SPC), providing protection against tropical cyclones, earthquakes, and excess rainfall.

Additionally, the government launched a Catastrophe Bond (CAT bond) in 2021, offering financial protection against potential losses from named storms. The government is also in the process of

[13] The NDC is highly relevant to Jamaica's energy transition discussed in a subsequent section.

establishing the National Natural Disaster Reserve Fund (NNDRF) to supplement existing risk financing tools. The NNDRF aims to provide financial resources for relief, recovery, and reconstruction costs resulting from natural disasters. Access to the fund will require a national disaster impacting the budget by at least 1.5 percent of GDP. Capitalization will involve annual budget allocations, and additional funding sources may include insurance proceeds, cash surpluses, grants, and returns on investments. Legislative amendments are proposed to formalize the NNDRF's establishment and associated procedures within the Financial Administration and Audit (FAA) Act.

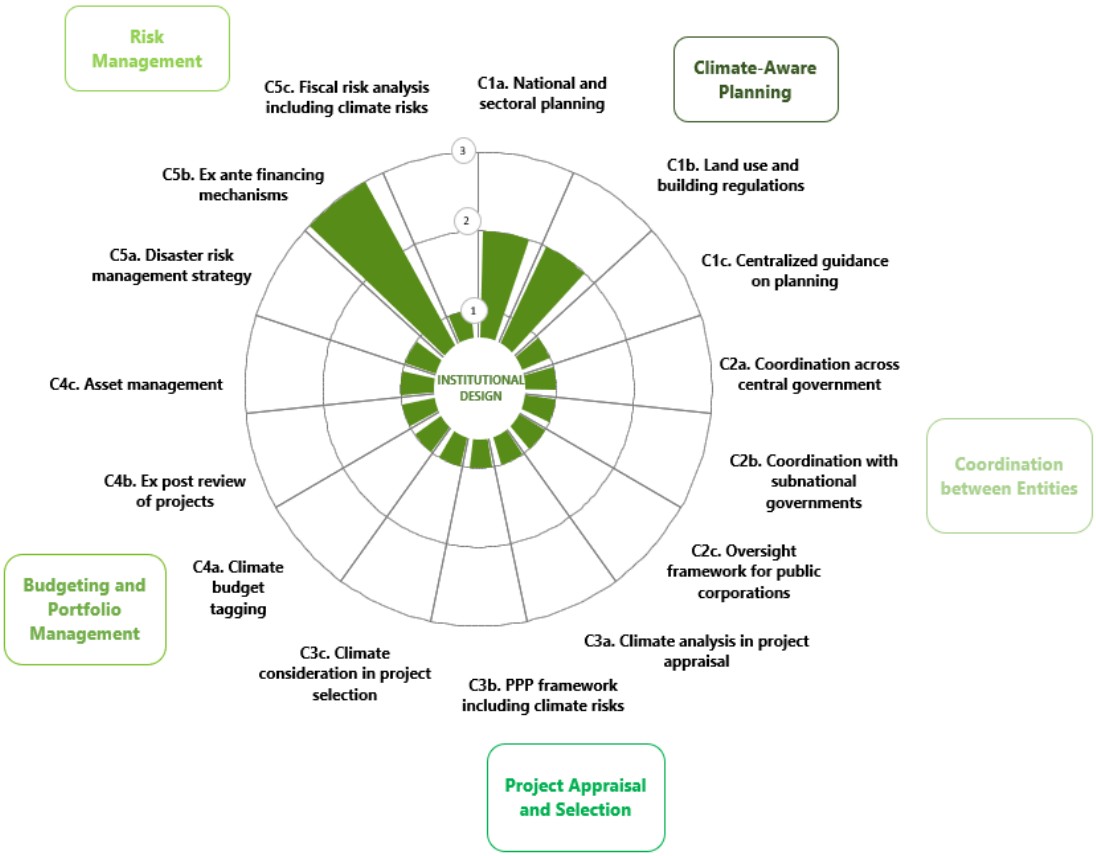
In December 2022, the International Monetary Fund (IMF) reached agreement on Jamaica's request for a Precautionary and Liquidity Line and the Resilience and Sustainability Facility (RSF). This provides a combined access of US$1.7 billion that provides insurance against downside risks faced by Jamaica, including extreme weather events (IMF, 2023). This financial cushion represents a crucial component of the country's climate resilience strategy in that it provides financial resources to support low-carbon and climate-resilient development.

A major element of that international collaboration is the Resilience and Sustainability Facility (RSF) agreed between Jamaica and the International Monetary Fund (IMF). The RSF is designed to support Jamaica in its efforts to address climate change, build resilience, and promote sustainable development. The RSF encourages the prioritization of sustainable practices in various sectors, such as energy, transportation, agriculture, and infrastructure. The facility also aims to foster economic growth while minimizing negative environmental impacts, promoting social inclusion, and enhancing governance standards.

While the RSF provides significant benefits, there are also potential challenges associated with its implementation. One challenge is ensuring ongoing coordination and alignment with existing national strategies and development plans.

In June 2023, the IMF published its Technical Assistance Report– Climate Public Investment Management Assessment (C-PIMA). This study identified and evaluated five key public investment institutions from a climate change perspective in the context of the existing PIMA framework and identified the strengths and areas for improvements in Jamaica’s climate risk management practices. Key perspectives from the analysis are illustrated by Figure 1, and some key findings are presented by Table 1 below.

Figure 19: Institutional Strength of C-PIMA Institutions in Jamaica (IMF, 2023)



The report indicated that progress has been made in the development of a comprehensive climate change policy framework and in planning for disaster risk financing, with some of latest progresses mentioned in the previous sections.

However, the assessment revealed gaps in the current strategy. There is a notable lack of robust coordination within the central government and between it and municipal corporations. Despite individual public bodies being identified as contributors to the Nationally Determined Contribution (NDC), the existing regulatory and oversight frameworks do not ensure alignment of their climate-related investments with national climate policies.

Table 15: Climate Public Investment Management Assessment result summary (IMF, 2023)

Phase/ Institution			Institutional Strength	Reform priority
PIMA Climate Change	C1	Climate-aware planning	Medium. MTF 2021-2024 and some sectoral plans are consistent with NDC. National Building Code explicitly addresses climate risks to public infrastructure while land use and physical planning regulations do not. Centralized guidance is not provided through guidelines or other resources	Medium
	C2	Coordination between entities	Low. The institutional framework for climate change is fragmented. No coordination between central and local governments for climate-sensitive investment planning. Oversight framework does not promote consistency between public bodies' climate-related investments and climate policies.	Medium
	C3	Project appraisal and selection	Low. Project appraisal and selection do not integrate climate-related analysis based on a standardized methodology. Climate impacts are not required to be reflected in PPP contracts.	High
	C4	Budgeting and portfolio management	Low. Climate spending is not identified in the budget. There is no requirement to undertake ex post reviews or external audits of the impact of projects on climate adaptation or mitigation. Asset registers do not require identification of climate vulnerability.	Medium
	C5	Risk Management	Medium. A national disaster risk management strategy is not in place. A handful of ex ante financing mechanisms to drawn on to respond to natural disasters are in place. Fiscal risk analysis does not incorporate assessment of climate change risks to public infrastructure assets over the medium term.	High

To enhance Jamaica's climate risk management and support green and sustainable economic growth, the country may need to address and improve these areas. Addressing these gaps will be essential for making significant headway in climate risk management and facilitating the transition to renewable energy sources.

7.4 Energy transition Initiatives in Jamaica

Jamaica's energy transition is underway as the country embraces the need for a more sustainable and greener future. With an ambitious vision to reduce its dependence on fossil fuels and increase the share of renewable energy in its energy mix, Jamaica has implemented various policies and initiatives to encourage the transition to green energy.

The National Energy Policy sets out a roadmap for achieving a diversified and sustainable energy sector, with specific targets for renewable energy penetration. It includes provisions for feed-in tariffs, net metering and tax incentives to attract investments in renewable energy projects (Ministry of Energy and Mining, 2019). These policies create a favourable environment for renewable energy developers and promote private sector participation in the energy transition.

One of the main areas of progress in Jamaica's energy transition is the increased deployment of renewable energy sources. Projects such as the Wigton Windfarm and the Paradise Park Solar Project demonstrate Jamaica's commitment to expanding renewable energy capacity.

Energy efficiency is another crucial aspect of Jamaica's energy transition. The government has recognized the importance of reducing energy consumption and improving energy efficiency across various sectors. Policies and programmes have been implemented to promote energy conservation, such as energy audits, energy efficiency standards for appliances, and public awareness campaigns. By adopting energy-efficient technologies and practices, Jamaica aims to reduce energy demand, lower greenhouse gas emissions, and improve energy affordability.

Jamaica is also actively engaging in international partnerships and collaborations to leverage expertise and secure financing for its energy transition. The country has benefited from support from the Inter-American Development Bank (IDB), the World Bank, and the International Renewable Energy Agency (IRENA) to develop renewable energy projects and strengthen institutional capacity.

8 Global Antecedents in Managing Climate-related Financial Risks

8.1 Global development of climate-related finance risk practices

Two important tools that financial supervisors are applying to understand and manage CRFRs are climate-related financial disclosures and climate stress tests. Climate-related financial disclosures provide perspectives on firms' climate risks and opportunities, key metrics, and preparations for different climate futures. The work of the Taskforce on Climate-Related Financial Disclosures (TCFD) has become the *de facto* standard for climate-related financial disclosures and a template for mandatory disclosures in many jurisdictions around the world. The TCFD features four pillars of Governance, Strategy, Risk Management, and Metrics & Targets, which collectively aspire to provide a detailed perspective on a firm's climate-related risks and opportunities (TCFD, 2017). Each of these pillars has a set of recommended disclosures that are outlined in the figure below.

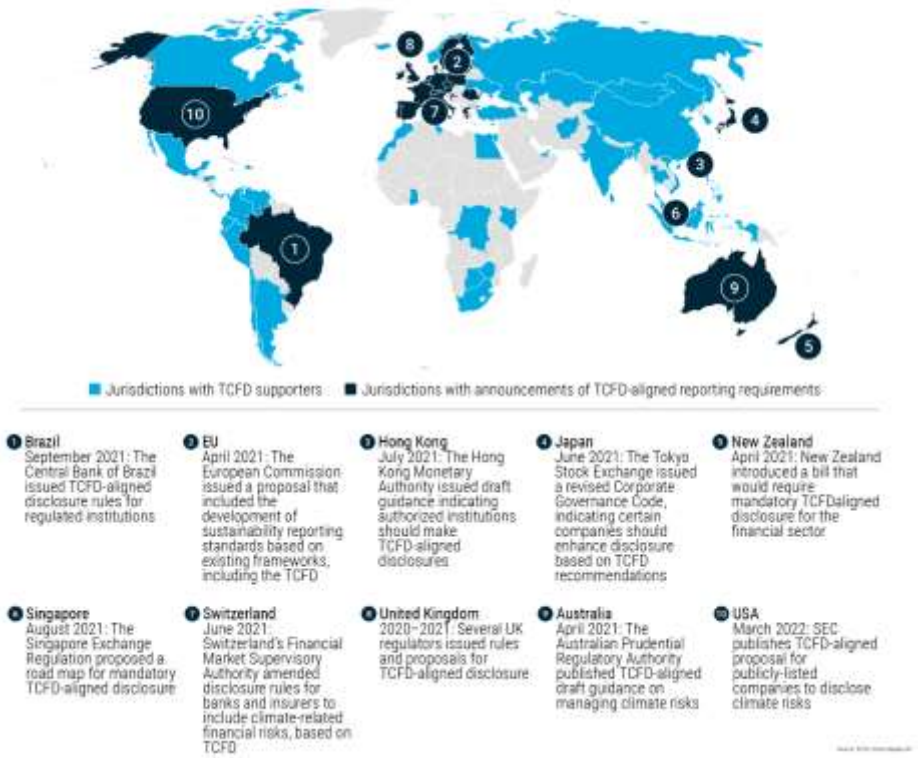
Figure 20: The 11 recommended disclosures of the TCFD

Source: TCFD, 2017

8.2 Supervisory activities around climate-related financial risks

Supervisors are increasingly using the TCFD as a template for mandatory climate disclosures. In addition, thousands of corporate and financial institutions now report under the TCFD framework, representing meaningful adoption of climate-related financial reporting. The figure below shows the penetration of TCFD reporting (both mandatory and voluntary) as of 2022 and features some specific instances of required disclosure by jurisdiction (Maplecroft, 2022).

Figure 21:TCFD disclosure mandates as of 2022



Source: [Maplecroft, 2022]

While the TCFD provides a sound framework for climate-related financial reporting, a number of important national, regional and global efforts are underway to provide greater prescriptiveness in the reporting of CRFRs. These efforts include the work of the IFRS foundation's International Sustainability Standards Board (ISSB), as well as initiatives by individual regulators to outline reporting expectations. The figure below provides additional context on some noteworthy examples that build on the TCFD framework.

Figure 22: Emerging international regulatory efforts on climate disclosure

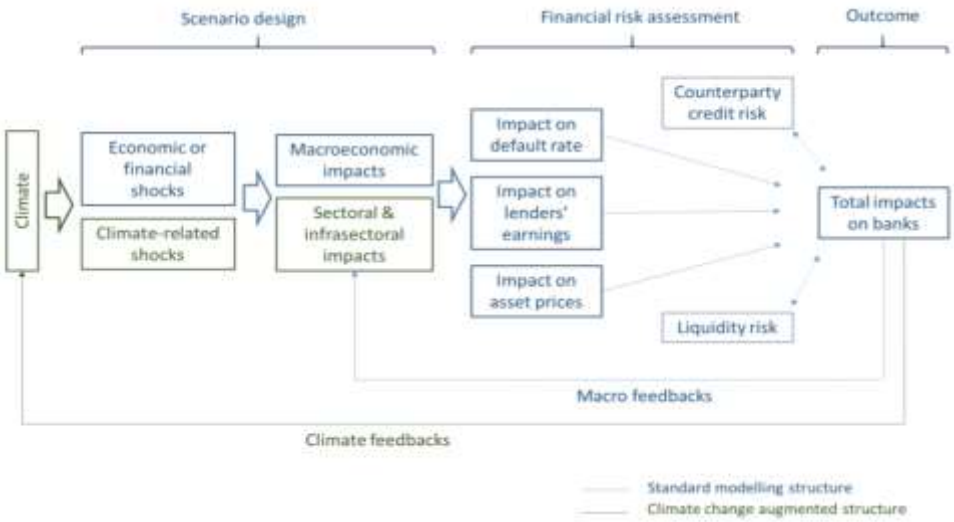
Source: CGS analysis, 2022

In addition to CRFR disclosure requirements, financial regulators are looking to assess the nature and magnitude of CRFRs within their financial systems. A popular tool for evaluating these risks has been climate scenario exercises. In particular, these scenario exercises have focused on economically stressful climate events and processes. These "climate stress tests" are forward-looking evaluations of a firm's (or financial system's) vulnerability to the effects of climate change and the low carbon transition. Climate stress tests have a number of objectives, including:

- Assessing and quantifying systemic risks to the financial system from climate change
- Determining potential areas of high climate risk
- Identifying new types of risks over new risk horizons
- Addressing existing gaps in climate risk assessment (including data quality) and increase awareness among firms of climate risk management
- Incorporating the results into an institution's risk management and risk appetite processes
- Improving the allocation of assets and assess business strategies and planning

Climate stress testing leverages many of the elements of traditional stress testing but incorporates new risk drivers, different scenarios and longer time periods. A comparison of the structure of traditional and climate stress testing can be seen in the figure below (UNEP FI, 2021).

Figure 23: Comparison between traditional stress testing and climate stress testing



Source: UNEP FI, 2021

To execute climate stress tests, a variety of approaches have been developed, but many of them leverage the scenarios created for the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) by leading climate modelers at the Potsdam Institute (PIK), the International Institute for Applied Systems Analysis (IIASA), and the Joint Global Change Research Institute (JGCRI). Among the most comprehensive of these climate stress tests has been the work of the Bank of England and its Climate Biennial Exploratory Scenario (CBES). The CBES exam explored both physical and transition risks as well as current and future CRFRs. It comprised two phases: an assessment phase, where firms were asked to quantify their risks, and a narrative phase, where firms were asked to describe how they would act to mitigate these risks in the future (Bank of England, 2021). The results of the CBES provided useful experience for financial firms in climate risk assessment. They also assisted the Bank of England to better understand the magnitude and emergence of CRFRs in the financial sector.

9 Financial Sector Perceptions of the Transmission Channels in Jamaica

Using a set of survey questions, BOJ held workshops with financial institutions operating in Jamaica and external climate experts to better understand their perspectives on the transmission channels discussed above and considering how CRFRs may materialize in Jamaica. The set of questions included:

- Which channels might be most significant in financial terms for the banking industry?
- Which real economy sectors might be impacted by this transmission channel?
- How might Jamaica be impacted by these transmission channels?
- Which transmission channels could lead to financial tipping points or activate other transmission channels?
- Which transmission channels have been seen before, due to different triggers?

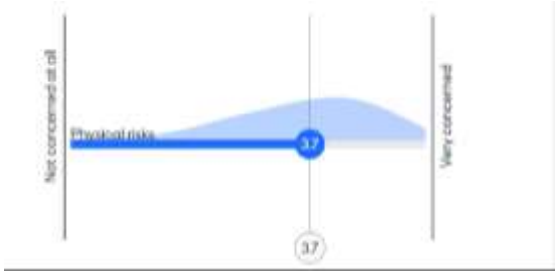
Nearly all major deposit-taking institutions, securities dealers, and insurers participated in the survey. BOJ asked these financial actors to rate their perceptions of physical and transition risks within these six major sectors. Respondents ranked their choices in order of risk from most to least. The results of the survey and their implications are discussed below.

9.1.1 Perceptions of climate risks by the financial sector

9.1.1.1 Perceptions of physical risks by financial actors

Financial institutions were asked about their perceptions of physical risks affecting the country in the next five years. The average rating was 3.7, with '5' being 'very concerned'. Of the potential physical risks cited by financial actors, the most commonly discussed were flooding, hurricanes, and droughts. Other less frequently discussed risks included heatwaves, erosion, and sea level rise.

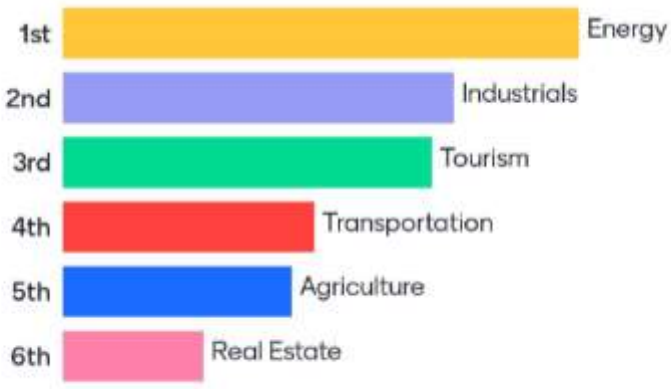
Figure 24: Level of concern about physical risks in the next five years (1 = lowest, 5 = highest)



Source: CGS analysis, 2023

Tourism, agriculture, and real estate were the three sectors considered most exposed to physical hazards.

Figure 25: Jamaican sectors most exposed to transition risks – as rated by financial institutions

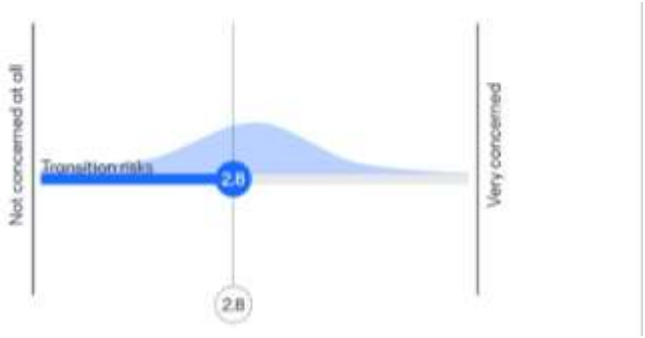


Source: CGS and BOJ analysis, 2023

9.1.1.2 Perceptions of transition risks by financial actors

The financial institutions were asked about their perceptions of the transition risks affecting the country over the next five years. The average rating was 2.8, with '5' indicating "very concerned". Of the potential transition risks cited by the sector, the most commonly discussed were energy prices, new technologies, carbon pricing, shifts in policies, and legal risks.

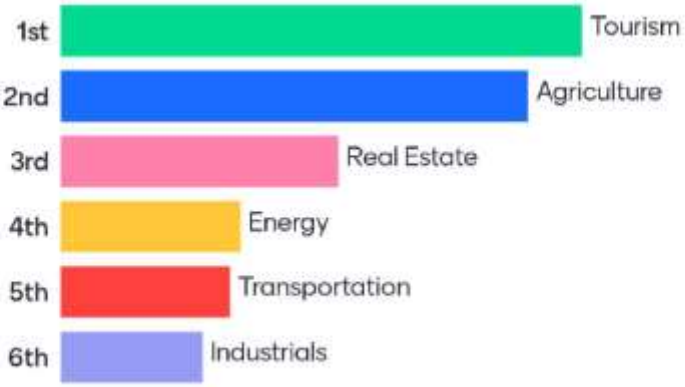
Figure 26: Level of concern about transition risks in the next five years (1 = lowest, 5 = highest)



Source: CGS analysis, 2023

The energy, industrials and tourism sectors were rated 1-3, respectively. The focus on tourism across both risk types reflects its significance to the Jamaican economy and also the relative financial exposure of the sector.

Figure 27: Jamaican sectors most exposed to physical risks – as rated by financial institutions



Source: CGS and BOJ analysis, 2023

9.1.2 Climate risk awareness

The survey also focused on institution's knowledge in three areas:

- Knowledge of CRFRs and reporting frameworks such as the TCFD

- Current climate-related activities and analysis being undertaken
- Areas where BOJ can support the industry in managing CRFRs

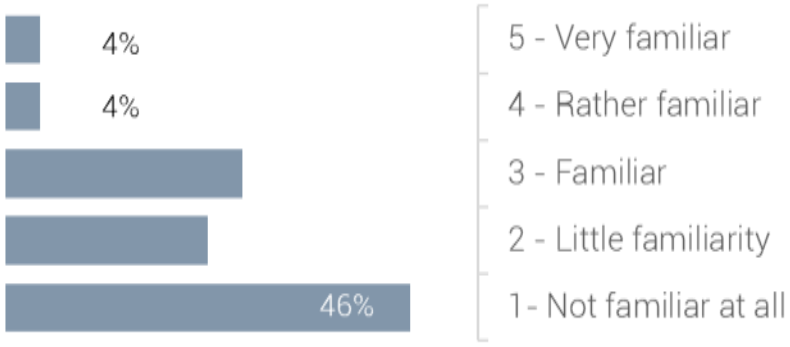
As expected, financial institutions in Jamaica appeared to have more knowledge of physical risks than transition risks. The level of knowledge varied significantly across firms, with the larger institutions typically having more knowledge of different CRFRs and more mature processes around their management. Differences were not as notable across the various sectors of the financial system.

Figure 28: Knowledge and action scores for physical and transition risks

1 = little knowledge, 5 = high knowledge

Few firms showed high awareness of the recommendations of the TCFD. Those that had better awareness were typically from organizations with international exposure where the framework has been mandated. This knowledge gap suggests a potential area for future capacity-building in the industry in advance of mandatory disclosure requirements.

Figure 29: Familiarity with TCFD recommendations (1-5)

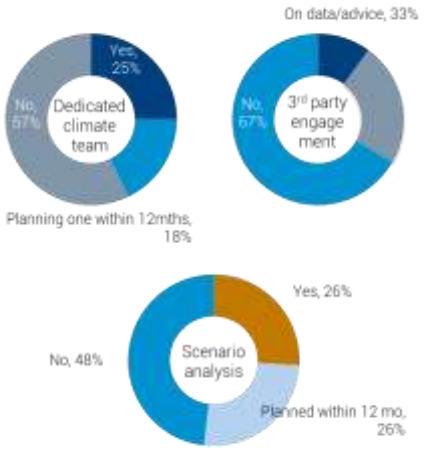


Source: CGS analysis, 2023

9.1.3 Climate risk actions

Beyond the assessment of climate risk knowledge, the survey explored the current level of activity around CRFRs among Jamaican financial institutions. Many institutions are at the beginning of their climate journeys, but a significant number plan to enhance their capabilities over the next 12 months. Few organizations have a dedicated climate team or have engaged third parties for climate support. On scenario analysis, around one-quarter of institutions have conducted some form a scenario analysis (usually qualitative), while another quarter plan to do so in the next year, as indicated below.

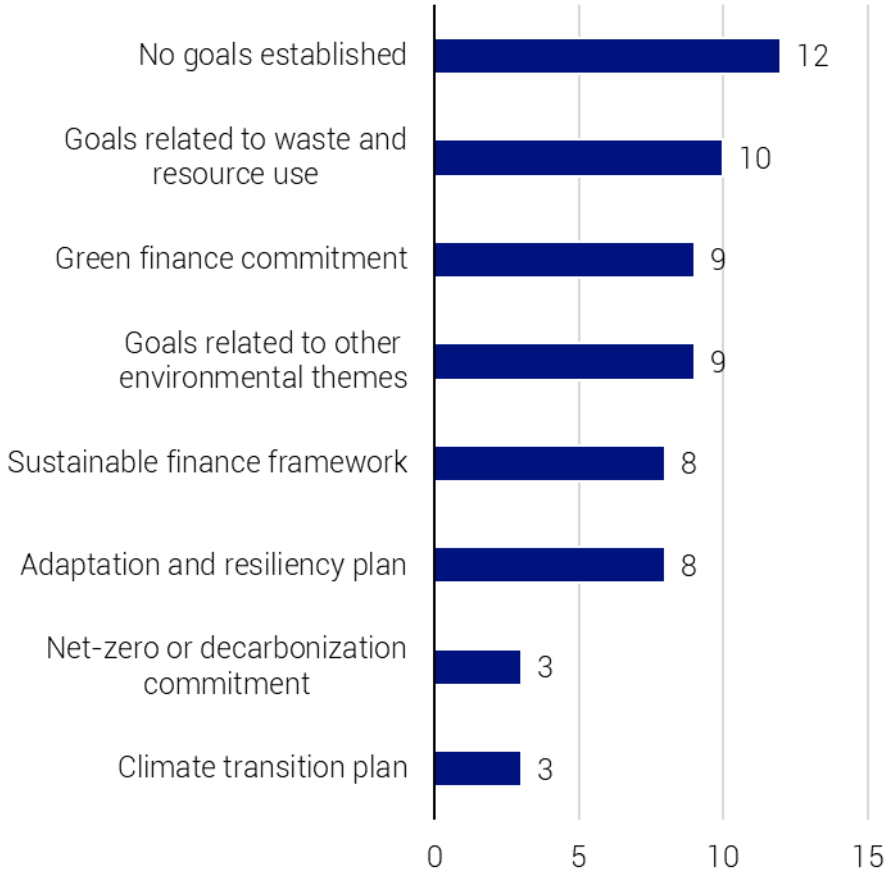
Figure 30: Experiences in climate risk management (1-5)



Source: CGS and BOJ analysis, 2023

About half of the firms have not established sustainability goals. For those that have, their goals are typically connected to their own operations rather than to their wider financial footprint. The presence of these sustainability goals is a promising sign. However, as climate practices in the sector mature, the focus will necessarily turn to financial exposures rather than direct operations. The few organizations that have developed transition plans or net-zero targets are those with international operations. In general, this work has been done on a firm-wide level rather than for Jamaica specifically. One area of further investigation for BOJ will be around the elements of firm adaptation and transition plans to better understand how these are being used to manage CRFRs by Jamaican financial institutions.

Figure 31: Established sustainability goals

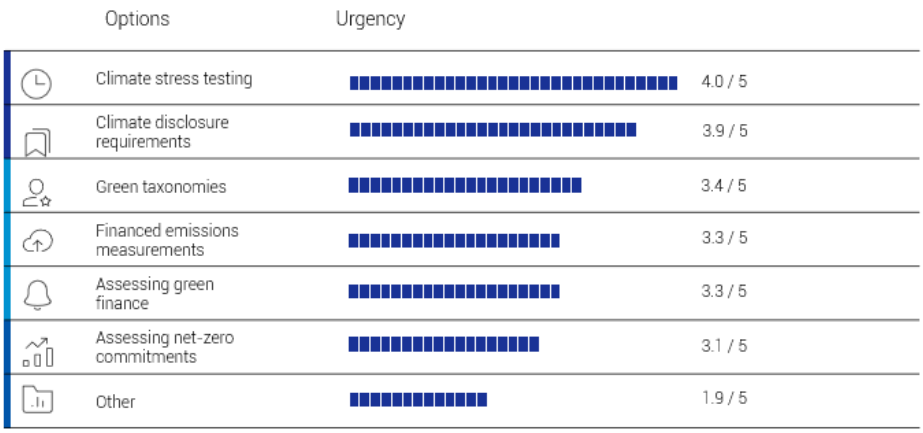


Source: CGS and BOJ analysis, 2023

9.1.4 Recommendations from financial actors

Financial institutions were asked about the areas where BOJ should prioritize its efforts on climate and the financial system. While there were a diverse range of responses, the top two items were consistently on climate stress testing and climate disclosure.

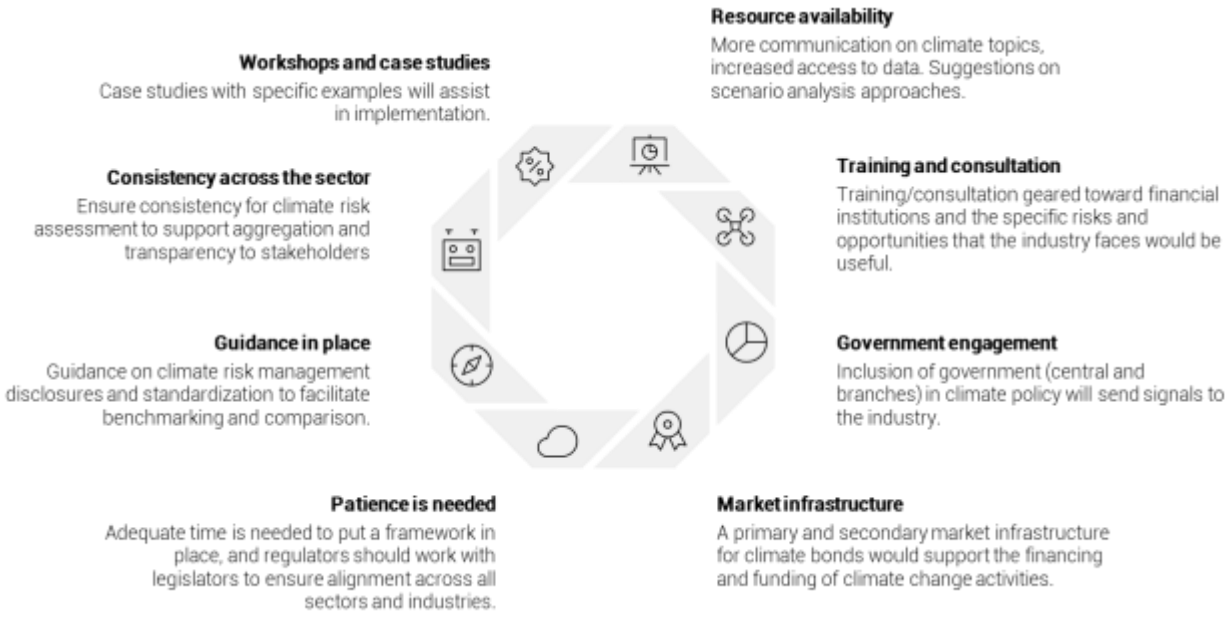
Figure 32: Weighted average score for BOJ priorities (1-5; 5 as most important)



Source: CGS analysis, 2023

Financial institutions also provided specific areas where support from BOJ on capacity-building would be particularly welcome (see below). Some of the most prominent themes include the development of workshops and tangible case studies, clarity of guidance and a level playing-field across the sector, and active engagement between BOJ and the financial sector on climate-related topics.

Figure 33: Recommendations for BOJ focus



Source: CGS analysis, 2023

10 Financial Sector Climate Resilience: BOJ's Commitments and Related Actions

10.1 Enhance availability and granularity of data collected

BOJ commits to enhancing its data collection and reporting frameworks relating to climate-related financial risks, commencing in early 2024. BOJ intends to improve the availability and granularity of data collected through two workstreams :- a workstream for data that already exists and a workstream for data that is not currently available. These workstreams will result in data flow to the central bank that allows it assess physical and transition risks, stakeholders' exposures to these risks and to generate scenarios around future risks and exposures.

BOJ has already conducted a data gap analysis outlining the current coverage of data required to conduct climate risk stress testing;

As a preparatory step, BOJ commits to adopting a monitoring framework that (1) improves data collection and (2) establishes the reporting requirements for financial institutions by end-June 2024. This will ensure that BOJ possesses data with sufficient granularity to gradually integrate climate risk into supervision and macroprudential policy formulation, with a view to conducting preliminary climate stress testing exercises by end-2025. To facilitate assessments of physical risks and exposures, BOJ will request that financial institutions provide detailed exposure of these breakdowns. These data enhancements will be incorporated into reporting templates to be developed by BOJ and the FSC.

10.2 Join climate-related regulatory initiatives

Over recent years, financial supervisors worldwide have been working to establish best practices for climate-related risk management and disclosure. In this context, Bank of Jamaica (BOJ) commits to actively participating in international initiatives, such as the NGFS. By doing so, BOJ will benefit from the shared experiences and expertise of its peers in areas like scenario development, climate risk supervision, and addressing data challenges related to climate risk. An example of this collective work is the NGFS' 2021 Scenarios in Action report (NGFS, 2021b), which provides numerous case studies on how member institutions are using climate scenarios to assess climate risks within their financial systems. In addition to the NGFS, BOJ acknowledges the efforts of the BIS and the Basel Committee on Banking Supervision (BCBS) to establish supervisory best practices for climate risk. Furthermore, BOJ recognizes initiatives like the Climate Financial Risk Forum (CFRF) in the United Kingdom, which fosters cooperation between regulators and major financial institutions. This engagement allows regulators to understand the challenges faced by the industry in managing climate-related financial risks, while also helping industry players enhance their knowledge in this critical area.

BOJ engaged with the NGFS secretariat in late October 2023 and committed to taking the necessary steps to become a full member by December 2024. BOJ will also arrange bilateral meetings with peer supervisors to discuss climate risk management, climate disclosures and climate stress testing by December 2024.

10.3 Build Capacity on Climate-Related Topics

Recognizing that climate change is a pervasive risk with implications for its various functions, BOJ commits to ensuring that its staff and the financial sector gain a deep understanding of global climate-related financial risk regulatory initiatives, and risk assessment methodologies. BOJ will take the lead in organizing capacity-building programmes, which will include seminars and conferences, where external experts in climate risk will be engaged to guide the industry towards best practices.

BOJ will also foster collaboration with other government Ministries, particularly the Ministries of Finance and the Public Service and Land, Environment & Climate Change. These interactions will be invaluable in assessing the physical risks arising from climate change in Jamaica and in developing strategies to mitigate these risks. Additionally, BOJ will engage in collaborations with peer supervisors on climate risk work and best practices.

10.4 Create a TCFD report

BOJ recognizes the significance of leading by example and, therefore, commits to preparing its own climate-related financial risk disclosures, in line with the TCFD framework. This practice, which is increasingly adopted by regulators worldwide, involves issuing a TCFD report that adheres to the same standards applied to other financial actors. In the past three years, a growing number of regulators have issued climate disclosures, beginning with the Bank of England's 2020 TCFD report (Bank of England, 2020).

In addition to enhancing regulatory credibility in addressing climate change, the exercise of creating a TCFD reports will provide invaluable insights into the nature of climate-related financial risks in Jamaica and the strategies available to mitigate them. The process of report development will also increase the awareness of BOJ staff regarding key areas to assess within financial institution disclosures and provide insights into the challenges institutions may encounter in collecting climate data and establishing climate scenarios.

BOJ will commence the development of its TCFD report in the second quarter of 2024, with plans for publication by end-2025.

10.5 Conduct Assessments of Climate-Related Systemic Risks

BOJ is committed to evaluating climate-related risks within Jamaica's financial system through climate stress test assessments. These assessments will explore the primary transition and physical risks facing the country's financial sector. It will also quantify the relative magnitudes of these risks and facilitate recommended mitigation measures to enhance resilience under various climate scenarios. Numerous regulators have already completed such assessments or are in the process of doing so. These scenario-based exercises often reflect the specific policy and physical realities of the regions where they are conducted. BOJ may choose to employ local scenarios or adapt global scenarios to Jamaica's circumstances when conducting these assessments.

BOJ aims to conduct the first internal, top-down climate stress test of the financial system by the end of 2026. Simultaneously, BOJ will develop guidance for the Jamaican financial sector to undertake scenario exercises by the third quarter of 2026. These actions reflect the BOJ's dedication to enhancing its preparedness for climate-related systemic risks.

10.6 Integrate Climate Related Risk Considerations into Prudential Supervision

Recognizing the potential impact of climate change on the financial sector and the broader economy, the BOJ commits to incorporating climate-related risk considerations into its prudential supervisory framework. This will enhance financial stability and resilience by equipping regulated entities with the necessary tools to navigate the complexities of climate risks.

Initiatives are underway in a number of jurisdictions to set these supervisory expectations, and these have typically covered the following five areas:

- *Governance*: To effectively manage climate-related and environmental risks, supervisors expect financial institutions to clearly define and assign responsibilities within existing governance arrangements.

- *Strategy*: Supervisors expect financial institutions to be aware of potential changes in their business environment and to adopt a strategic approach to cater to climate-related and environmental risks. For most financial institutions this requires a longer-term view than the typical business planning horizon of three to five years, while short- and medium-term risks, in particular stemming from the energy transition, also need to be duly considered.

- *Risk management*: Supervisors expect financial institutions to have policies and procedures in place to identify, assess, monitor, report and manage all material risks. Supervisors also expect financial institutions to incorporate climate-related and environmental risks in their processes and procedures for, for example, credit, market, liquidity, operational and insurance risks, to develop adequate metrics for their internal monitoring, external reporting, and management of their operations.

- *Scenario analysis and stress testing*: Given the forward-looking nature of the risks and the inherent uncertainty associated with climate-related and environmental risks, supervisors expect financial institutions to develop methodologies and tools (e.g. scenario analysis and stress testing) necessary to capture the size of climate related and environmental risks.

- *Disclosure*: Supervisors expect financial institutions to disclose information and metrics to them on the climate-related and environmental risks they are exposed to, their potential impact on the safety and soundness of the institutions and how they manage these risks. This commitment aligns with the best practices of financial system supervisors globally. These requirements generally adhere to the principles outlined in the Taskforce on Climate-related Financial Disclosures (TCFD). Furthermore, with the establishment of the International Sustainability Standards Board (ISSB) and its forthcoming guidance on global sustainability standards, BOJ will have an additional reference point for harmonizing disclosure standards.

The establishment of specific disclosure standards tailored for Jamaica's financial sector will yield numerous benefits. Firstly, it will provide BOJ with a comprehensive view of the sector's preparedness for climate change and enable comparisons between specific firms and the industry as a whole.

BOJ will also enhance climate readiness within the financial sector in Jamaica by encouraging climate-related financial *public* disclosures. These reporting frameworks will ultimately elevate the quality and consistency of disclosures made by financial institutions, ultimately making them more valuable to stakeholders.

The overall goal for this commitment is the preparation of a consultation paper by the end of 2026 and then a Standard Sound Practices related to the integration of Climate-Related Financial Risk (CRFR) into Financial Institutions risk management frameworks by the end of the third quarter of 2027.

Table 16: BOJ Commitments and associated timelines

Commitment	Related Actions	Start	Expected Completion
Enhance the availability and granularity of data collected	- BOJ will adopt a monitoring framework that (1) improves data collection and (2) establishes the [data] reporting requirements for financial institutions;	Dec 2023	Jun 2024
	- BOJ will complete the collection of data on physical risks;		Dec 2024
	- BOJ will engage in consultation with the financial industry towards improving the coverage of the data on climate risk exposure and complete the development of the relevant data forms and templates;		Mar 2025
	- FI Data Flow;		Sept 2025
	- BOJ will complete the collection of data on selected firm's exposure and emissions;		Dec 2025
Join climate-related regulatory initiatives	- BOJ will actively participate in climate-related regulatory initiatives, such as the NGFS. - BOJ will engage in bilateral meetings with peer supervisors on climate risk management, disclosures, and stress testing during 2024.	Dec 2023	Dec 2024
Building Capacity on Climate Related topics		Mar 2022	Mar 2026

	- BOJ will lead capacity-building programmes for its staff and the industry. - BOJ will continue to engage with other public sector bodies to exchange knowledge on climate risks.		
Create a TCFD Report	- BOJ will develop its own TCFD report, following the TCFD framework or its own proposed guidance.	Mar 2024	Dec 2025
Conduct top down assessments of the financial sector's climate-related systemic risks	- BOJ will conduct its first climate stress test of the financial system.	Dec 2024	Dec 2026
Integrate Climate Related Risk considerations into Prudential Supervision	- BOJ will publish a consultation paper on integrating climate risk into prudential supervision in Jamaica; - BOJ will disseminate standards of sound practices on climate risk management for the financial industry; - BOJ will encourage voluntary Task-force on Climate-related Financial Disclosures (TCFD), aligned with the International Sustainability Standards Board (ISSB), by participants in the financial industry;	Q1 2022	Dec 2026 Sept 2027 Dec 2027

11 Conclusion

This paper represents the first major output of the BOJ's initial phase of CRFR readiness, which is part of a multiyear effort to assess and improve responses to CRFR in the Jamaican financial system. The overall project involves the evaluation of CRFRs in the Jamaican financial system, plus the development and integration of guidelines for CRFR management across the financial system. The second phase of work will focus on conducting climate-related stress tests, developing a monitoring framework and building capacity at BOJ to continue further assessment of CRFRs.

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