

# Climate Change Adaptation Planning in Selected Caribbean Countries: Is Enough Being Done?

Christian Casey-Lee Virgil<sup>a,ψ</sup>, Marcia Nathai-Balkissoon<sup>b</sup> and Kit Fai Pun<sup>c</sup>

<sup>a,c</sup> Department of Mechanical and Manufacturing Engineering, Faculty of Engineering, The University of the West Indies, St. Augustine, Trinidad and Tobago, West Indies; Emails: ccleev@gmail.com; KitFai.Pun@sta.uwi.edu;

<sup>b</sup> Department of Management Studies, Faculty of Social Sciences, The University of the West Indies, St. Augustine, Trinidad and Tobago, West Indies; Email: marcia.nathai-balkissoon@sta.uwi.edu

<sup>ψ</sup> Corresponding Author

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**Abstract:** *The climate is changing, and sustainable adaptation measures are required to meet the resulting challenges. Several effects linked to climate change can be highly disruptive, such as rising sea levels and coastal reef destruction. The severity of the impact and capacity to adapt to the effects of climate change is unevenly distributed at various spatial levels. The Caribbean is more vulnerable to climate change than other regions. There is a need to plan strategically in managing the multiple consequences of climate change. This study evaluates the synergies between adaptation plans and policies and guidelines in climate change adaptation. It attempts to audit the national adaptation planning documents in climate change developed by government agencies to cope with the challenges of climate change among respective countries. The study explores the factors underlying observed discrepancies and performance shortcomings and utilises information from a review of research literature to contextualise critical findings in adaptation measures and research. Synthesising the determinants and barriers would aid with closing performance gaps. The study concludes by providing evidence-based recommendations that shed light on the design and planning for sustainable adaptation measures in developing nations of the Caribbean.*

**Keywords:** *Climate, adaptation, Caribbean*

## 1. Introduction

The terms ‘climate’ and ‘weather’ are often used interchangeably in many instances. This mistake is understandable as both describe the atmospheric conditions (such as temperature, barometric air pressure, humidity, and rainfall) at a particular geographical area (NOAA, 2018). However, ‘climate’ is distinct from ‘weather’ in that it describes average meteorological or weather conditions and variability over a long period (Walsh et al., 2014). A significant time frame of many years is needed to determine whether there is a distinct and lasting trend in the observed meteorological conditions instead of minor short-term variabilities.

The climate is an undoubtedly changing, and anthropogenic contribution to the phenomenon in the form of the excessive emission of greenhouse gases (GHG) such as carbon dioxide (CO<sub>2</sub>) is the primary driver of the observed changes (Betzold, 2015). Moreover, due to equilibrium climate sensitivity, current atmospheric CO<sub>2</sub> levels are projected to have a lasting effect on global surface temperatures over a long time (Knutti et al., 2017). The delayed impact of past and current CO<sub>2</sub> emissions means that adapting to climate change is necessary regardless of globally coordinated measures to reduce GHG emissions. Therefore, choosing to adapt to the effects of climate change is not an option; adaptation is mandatory (Rosales, 2019).

As it relates to human systems, climate change adaptation is the process by which individuals, organisations, communities, and entire countries adjust to the “actual or expected climate and its effects” as a means of moderating or avoiding harm or exploiting potential benefits (IPCC, 2014). This paper considers adaptation efforts to comprise two distinct but interconnected elements that must be executed effectively: strategic planning and implementation and monitoring. The focus of this study is on strategic planning.

Adaptation planning can be defined as a “general plan of action for addressing the impacts of climate change” (IPCC, 2014), which requires many measures that can reduce the risks created by climate change’s actual and projected effects (Mc Devitt, 2012). Adaptation planning is an iterative (Singh et al., 2021) and complicated process with several barriers (Birchall and Bonnett, 2021). IPCC (2014), however, identified policies as an essential element in the adaptation planning process. Policies provide an essential framework to guide, support and coordinate the strategic implementation of adaptation measures. Policies and overall strategic planning are crucial elements for ensuring that adaptation measures including those that are structural or physical (engineered solutions or adjustments to the built environment, technological, ecosystem-based, and services), social (educational, informational and

behavioural) and institutional (government policies and programs, laws and regulations and economic initiatives) (Noble et al., 2015), are implemented effectively, efficiently and systematically. Moreover, it is crucial that, once implemented, adaptation measures are monitored (IPCC, 2014).

Governments often use policies and strategic plans to articulate a coherent national strategy for adapting to climate change. A National Adaptation Plan (NAP) using the approach established in the Cancun Adaptation Framework (CAF) is the typical outcome of developing a national strategy for climate change adaptation. NAPs “provide an evidence-based, coordinated and systematic approach” to adapting to climate change (Woodruff and Regan, 2019) which includes requirements for setting goals, assessing vulnerabilities allocating resources, developing programs and policies and continuous evaluation of adaptation performance (INTOSAI Working Group on Environmental Auditing, 2010).

In the Caribbean, national adaptation planning and implementation efforts have primarily been driven by the need to conform with ratified accords and measures related to mitigating environmental challenges such as droughts, which arise seasonally. Generally, the region is particularly vulnerable to the effects of climate change (Nurse et al., 2014) for many reasons, including high average temperatures (Benjamin, 2010), exposure to high-intensity ultraviolet radiation (Torres-Pérez et al., 2014) and being generally comprised of small island-states with climate-sensitive ecosystems (Simpson et al., 2011). The small size of these states implies that climate change can potentially affect a more significant proportion of land space and result in greater economic costs per GDP than larger countries (Barros et al., 2014). In addition, the loss of tourism revenue and infrastructural damages associated with these effects have brought adverse economic impacts to many countries in the region (Scott et al., 2012). These losses are particularly daunting given that the tourism industry contributes approximately 15% of the GDP of the entire Caribbean region and has been the primary source of income and jobs for most countries in the area (WTTC, 2018).

Climate change is projected to impact the agriculture industry, which is as essential economically as some Caribbean islands’ tourism sector. Warmer temperatures affect the spatial and temporal distribution of weeds, insect pests, and pathogens and introduce new pests, all of which could alter the types and amounts of pesticides used (Levy and Roelofs, 2016). These changes could affect the health and safety of agricultural workers and other occupations that are frequently in contact with wildlife. Agricultural workers may also be affected by the health risks associated with climate-induced increases in insect-borne, rodent-borne, water-borne, food-borne, respiratory diseases, and heat-related illnesses in the Caribbean (Ebi et al. 2006). Not only would these illnesses increase morbidity and deaths, but they would also increase the burden on the healthcare system in the region.

The impact of climate change on healthcare is further complicated by a shift in the age demographic of people living in the Caribbean. The number of persons older than fifty-nine years in the Latin America and Caribbean (LAC) region is expected to increase by a factor of four to eventually outnumber the youth demographic (0 to 14 years) by the year 2050 (Saad, 2011). Older members of society are more vulnerable to heat stress (Kovats and Hajat 2008). Additionally, the onset of ‘immunosenescence’ or immune system degradation in the older demographic is expected to increase vulnerability to infectious diseases, including those that are projected to increase because of climate change (Pera et al., 2015).

This paper focuses on identifying several climate change adaptation policy documents and plans in eight Caribbean countries (Trinidad and Tobago, Antigua and Barbuda, Jamaica, St. Lucia, Grenada, St. Vincent and the Grenadines, Suriname, and Barbados) to review their adequacy and identify how they can be made more comprehensive and effective. These documents are examined to determine the extent to which they conform with best practices with the intention of making recommendations for improvements. Although many non-governmental actors are involved in the adaptation process, the study is restricted to national documents as a government-led adaptation approach is often necessary to effectively coordinate the adaptation process among diverse stakeholders (Cimato and Mullan, 2010).

## 2. Study Questions and Methodology

This study examines the adequacy of current climate change adaptation plans and policies in Trinidad and Tobago, Barbados, Jamaica, Suriname, Grenada, Saint Lucia, Saint Vincent and the Grenadines, Antigua and Barbuda. Two research questions were set as follows.

- 1) Are there country-specific and adequate sectoral plans or strategies for adapting to climate change?
- 2) How adequate are the governance structure and management practices outlined in these plans?

Literature searches for peer-reviewed articles were conducted using the ProQuest, Emerald, and Springer Link databases as outlined below:

- 1) The databases were searched using the terms “climate change”, “adapt” and “Caribbean”;
- 2) Selected articles were restricted to those published between 2010 and 2021 describing planned adaptation activities; and
- 3) Articles were restricted to those describing adaptation activities that directly impacted Trinidad and Tobago, Barbados, Jamaica, Suriname, Grenada, Saint Lucia, Saint Vincent and the Grenadines, Antigua and Barbuda and other CARICOM (Caribbean Community) members. Table 1 provides a list of these articles.

The NR Canada Report, INTOSAI Working Group Guidelines, UNFCCC (United Nations Framework Convention on Climate Change) framework and the UNDP Adaptation Policy Framework (APF) were used to develop a survey instrument (see Table 2).

**Table 1.** A list of Articles Reporting Adaptation Activities in the Caribbean

Code	Citation Information
A1	Waite, M. (2012), "Climate-change mitigation and adaptation in small island developing states. The case of rainwater harvesting in Jamaica", <i>Sustainability: Science, Practice and Policy</i> , Vol.8, No.2, pp. 81-87. DOI: 10.1080/15487733.2012.11908101.
A2	Mercer, J., Kelman, I., Alfthan, B., and Kurvits, T. (2012), "Ecosystem-Based Adaptation to Climate Change in Caribbean Small Island Developing States: Integrating Local and External Knowledge", <i>Sustainability</i> , Vol.4, No.8, pp.1908-1932.
A3	Reid, R.A. (2012), "Adaptation as a coping mechanism for climate change", M.A. In: <i>ProQuest Dissertations and Theses</i> (1517688), p.135.
A4	Mycoo, M., and Gobin, J. (2013), "Coastal management, climate change adaptation and sustainability in small coastal communities. Leatherback turtles and beach loss", <i>Sustainability Science</i> , Vol.8, No.3, pp. 441–453. DOI: 10.1007/s11625-013-0212-x.
A5	Middelbeek, L., Kolle, K. and Verrest, H. (2014), "Built to last? Local climate change adaptation and governance in the Caribbean – The case of an informal urban settlement in Trinidad and Tobago", <i>Urban Climate</i> , Vol.8, pp.138-154. DOI: 10.1016/j.uclim.2013.12.003.
A6	Pablo, I. (2014), "Climate-Smart Agriculture in Grenada", <i>CSA Country Profiles for Latin America Series</i> , The World Bank Group, Washington, DC, January
A7	McGee, J., Phelan, L., and Wenta, J. (2014), "Writing the fine print: Developing regional insurance for climate change adaptation in the Pacific", <i>Melbourne Journal of International Law</i> , Vol.15, No.2, pp.444 -472
A8	Linnerooth-Bayer, J., and Hochrainer-Stigler, S. (2015), "Financial instruments for disaster risk management and climate change adaptation", <i>Climatic Change</i> , Vol.133, No.1, pp.85-100. DOI: 10.1007/s10584-013-1035-6.
A9	Betzold, C. (2015), "Adapting to climate change in Small Island Developing States", <i>Climatic Change</i> , Vol.133, No.3, pp.481-489. DOI: 10.1007/s10584-015-1408-0.
A10	Shah, K., and Dulal, H. (2015), "Household capacity to adapt to climate change and implications for food security in Trinidad and Tobago", <i>Regional Environmental Change</i> , Vol.15, No.7, pp.1379-1391 DOI: 10.1007/s10113-015-0830-1.
A11	Popke, J., Curtis, S., and Gamble, D.W. (2016), "A social justice framing of climate change discourse and policy: Adaptation, resilience and vulnerability in a Jamaican agricultural landscape", <i>Geoforum</i> , Vol.73, pp.70-80. doi: <a href="https://doi.org/10.1016/j.geoforum.2014.11.003">https://doi.org/10.1016/j.geoforum.2014.11.003</a> .
A12	Robinson, S-A. (2017), "Climate change adaptation trends in small island developing states", <i>Mitigation and Adaptation Strategies for Global Change</i> , Vol.22, No.4, pp.669-691. DOI: 10.1007/s11027-015-9693-5.
A13	Robinson, S-A., and Dornan, M. (2017), "International financing for climate change adaptation in small island developing states", <i>Regional Environmental Change</i> , Vol.17, No.4, pp.1103-1115. DOI: 10.1007/s10113-016-1085-1.
A14	Schofield, H. (2017), "Sense of Place and Climate Change. Urban Poor Adaptation in the Dominican Republic", Ph.D. In: <i>PQDT - Global</i> (10869762), p. 311.
A15	Robinson, S.-A. and Gilfillan, D. (2017), "Regional organisations and climate change adaptation in small island developing states", <i>Regional Environmental Change</i> , Vol.17, No.4, pp.989-1004. doi: 10.1007/s10113-016-0991-6.
A16	Schnitter, R., Verret, M., Berry, P., Tiam Fook, T.C., Hales, S., Lal, A., and Edwards, S. (2018), "An assessment of climate change and health vulnerability and adaptation in Dominic", <i>International Journal of Environmental Research and Public Health</i> , Vol.16, No.1, p.70. DOI: 10.3390/ijerph16010070.
A17	Enríquez-de-Salamanca, Á. (2019), "Vulnerability reduction and adaptation to climate change through watershed management in St. Vincent and the Grenadine", <i>GeoJournal</i> , Vol.84, No.4, pp.1107-1119. doi: 10.1007/s10708-018-9914-z.
A18	Thomas, A., Shooya, O., Rokitzki, M., Bertrand, M., and Lissner, T. (2019), "Climate change adaptation planning in practice: insights from the Caribbean", <i>Regional Environmental Change</i> , Vol.19, No.7, pp.2013-2025. doi: 10.1007/s10113-019-01540-5.
A19	Townsend, D.A., Sušnik, J., and der Zaag, P.V. (2020), "Domestic water supply vulnerability to climate change and the role of alternative water sources in Kingston, Jamaica", <i>Atmosphere</i> , Vol.11, No.12, pp.1314.
A20	Karlsson, M., and Mclean, E.L. (2020), "Caribbean Small-Scale Fishers' Strategies for Extreme Weather Events: Lessons for Adaptive Capacity from the Dominican Republic and Belize", <i>Coastal Management</i> , Vol.48, No.5, pp.456-480.
A21	Robinson, S., and Wren, C. (2020), "Geographies of vulnerability: A research note on human system adaptations to climate change in the Caribbean", <i>Geografisk Tidsskrift-Danish Journal of Geography</i> , Vol.120, No.1, pp.79-86.

**Table 2:** Survey Instrument

<p><b>Policy effectiveness</b></p> <ol style="list-style-type: none"> <li>1. Was there an assessment of climate change-related threats/ vulnerability assessment?</li> <li>2. Is there an efficient overall country-specific plan or strategy for adapting to climate change? <ol style="list-style-type: none"> <li>a. Has the government developed a policy, plan or strategy for adaptation that responds to all significant impacts and vulnerabilities, both short- and long-term?</li> <li>b. Are there clear objectives and measurable outcomes?</li> </ol> </li> </ol> <p><b>Governance</b></p> <ol style="list-style-type: none"> <li>1. Are there effective systems for monitoring, coordination, integration, assigning clear responsibility, measurement, reporting and accountability?</li> <li>2. Are there clear, well defined, and documented roles and responsibilities for all climate change actors, including sector interests, local and regional levels of government, civil society and the private sector</li> <li>3. Are adaptation efforts coordinated across government agencies/ministries and other stakeholders to ensure they are complementary rather than conflicting</li> <li>4. Do channels for communication exist between stakeholders from different levels of government, the private sector and the various sectors involved and are they working properly?</li> <li>5. Does the appropriate government agency receive sufficient information in support of decision-making and performance management related to climate change activities and initiatives?</li> </ol>
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The survey instrument examined government adaptation policies and other adaptation planning documents (see Table 3).

## 2. Adaptation Policy Framework and Measures of Climate Change

As parties to the UNFCCC, Kyoto Protocol, and the Paris Agreement, the countries of Trinidad and Tobago, Antigua and Barbuda, Jamaica, St. Lucia, Grenada, St. Vincent and the Grenadines, Suriname and Barbados are committed to various climate change stipulations, including those related to the planning and implementation of adaptation measures. Since ratifying the UNFCCC treaty, several steps have been taken to meet the basic adaptation stipulations. An essential requirement for UNFCCC is the development and implementation of relevant climate change plans and policies (UNFCCC, 1992). Alongside the UNFCCC requirements, the United Nations Development Programme's Adaptation Policy Framework (APF) outlines the general requirements and characteristics of an effective adaptation policy. Generally, however, no international climate change adaptation commitments are as well-defined as those available to support mitigation efforts (INTOSAI Working Group on Environmental Auditing, 2010).

An improperly developed adaptation policy is less likely to achieve the desired objective of providing a suitable framework to guide the implementation of effective adaptation measures. Policy flaws include those attributed to gaps in the policy development process and the absence of critical policy elements. Essential policy development elements include:

- 1) An effective governance and management structure to manage adaptation efforts (INTOSAI Working Group on Environmental Auditing, 2010, Asselin, 2015),
- 2) A framework for creating appropriate policy instruments to transform adaptation policy into effective programs and activities (INTOSAI Working Group on Environmental Auditing, 2010),
- 3) Provisions to base adaptation policies on country-specific assessments of climate change vulnerabilities and impacts (INTOSAI Working Group on Environmental Auditing, 2010). A thorough assessment of climate change risks and vulnerabilities is required to develop effective adaptation policies and plans,
- 4) This assessment provides the information needed to develop solutions that are most suitable for the issues that exist in the country (INTOSAI Working Group on Environmental Auditing, 2010).

## 3. Climate Change and Adaptation Measures in the Caribbean

The vulnerability of the Caribbean region to climate change (Nurse et al., 2014) is exacerbated by the relative smallness of the many islands with climate-sensitive ecosystems that are found in the area (Simpson et al.,

2011). The situation is dire. As indicated by the Her Excellency Ms Mia Amor Mottley, Prime Minister of Barbados, in her address to the United Nations Climate Change Conference (COP26) in November 2021, the Caribbean is on the "frontline" of the battle against the effects of climate change with "loss of lives and livelihoods" being the outcome of poor adaptation financing (Motley, 2021).

Although the countries throughout the Caribbean region experience similar effects of climate change, climate-related policies, including national adaptation plans, should be based on impact assessments carried out in individual countries. Country-specific assessments are necessary because vulnerabilities and impacts can be heterogeneous at national and intranational levels. For example, as it relates to rainfall, there are predictions that there might be increases in some tropical regions and polar latitudes and decreases in some parts of the subtropics (Collins et al., 2013). On an intranational scale, coastal erosion rates may vary at different locations within a country for many reasons, including the influence of non-climate related factors (Nurse et al., 2014). The availability of specific, high-resolution climatic impact and vulnerability data can lead to policies that address real issues affecting the country.

A suitable plan for meeting the challenges of climate change considers these country-specific vulnerabilities and provides the framework to ensure that climate change adaptation measures are developed and implemented systematically and efficiently. Furthermore, adaptation policies should reflect the need for adaptation efforts to occur within a broader societal and national framework. Policies must cover measures directly associated with broader sustainable development goals, including actions related to human development, poverty alleviation, livelihood security and disaster risk management (Pachauri et al., 2014).

Poor governance and management practices have been identified as barriers to implementing adaptation plans. Climate change adaptation governance is a process whereby stakeholders interact and make decisions on the steps that should be taken to mitigate the effects of climate change (Virgil, 2020). An audit of climate change adaptation governance and management practices approved by the Government of Canada for the Department of Natural Resources (Natural Resources Canada) identified the documentation of roles, responsibilities, and accountabilities, the existence of strategic and operational objectives, and the reporting practices of agencies with climate change adaptation oversight as crucial elements of governance (Asselin, 2015). Additionally, INTOSAI Working Group on Environmental Auditing (2010) identified transparency in decision-making, engaging with stakeholders and involving public participation in the adaptation decision-making process as additional critical elements of governance.

In the Caribbean, most adaptation measures require the involvement of the government (Popke et al., 2016; Pablo, 2014). Governance, oversight, and overall

management of the national response to climate change in Trinidad and Tobago, Barbados, Jamaica, Suriname, Grenada, Saint Vincent and the Grenadines, Antigua and Barbuda are traditionally held by the government ministries that hold the portfolio for managing environmental issues. These ministries, however, have other responsibilities such as housing (Trinidad and Tobago and Jamaica), national beautification (Barbados), health (Antigua and Barbuda and Saint Vincent and the Grenadines), education and human development (Grenada), and urban renewal (Jamaica). Jamaica, however, is the only country out of the group that included climate change in the description of the ministry (Ministry of Housing, Urban Renewal, Environment and Climate Change). Managing climate change is typically the purview of committees or specialised divisions or units within the respective ministries. For example, the Sustainable Development and Environment Division manages climate change issues in St. Lucia within the Ministry of Education, Innovation, Gender Relations and Sustainable Development. Joint committees such as the national Climate Change Advisory Board (CCAB) in Jamaica and the National Climate Change Committee (NCCC) in Saint Lucia play an essential role in governing climate change responses.

The activities of these ministries, units and committees related to adapting to climate change are often guided by a NAP. Various other policies, guidance instruments, plans, and documents describe the overall approach to adapting to climate change in the absence of a NAP. For example, Trinidad and Tobago's National Climate Change Policy identified critical sectoral vulnerabilities, provided insight into the climate change governance structure, and outlined broad mitigation and adaptation strategies. Additionally, communications to the UNFCCC from member states typically describe

adaptation plans. Communications submitted by Trinidad and Tobago, Barbados, Jamaica, Suriname, Grenada, Saint Lucia, Saint Vincent and the Grenadines, Antigua and Barbuda reference national policies and provide a holistic description of national climate change vulnerabilities, mitigation and adaptation strategies and plans.

Suriname, Grenada, St. Lucia, and St. Vincent and the Grenadines are the only countries from CARICOM (Caribbean Community) that submitted a National Adaptation Plan to the UNFCCC. Moreover, St. Lucia is the only country from CARICOM that submitted detailed sectoral plans separately (agriculture, fisheries, and water). Several Caribbean countries may also be in the process of developing NAPs. Antigua and Barbuda would have submitted a proposal to obtain three million USD from the United Nation's Green Climate Fund (GCF) towards developing a comprehensive NAP (Antigua and Barbuda, 2017).

Table 3 provides a list of relevant national climate change documents that were referenced in this study. The most recent communication to the UNFCCC is included in this study as they represent the most up-to-date description of existing adaptation plans and activities. Information from earlier reports and new developments are usually included in the most recent communication.

According to the UNFCCC (2021), as of March 2021, twenty-two developing countries completed and submitted NAPs, of which seven are Small Island Developing States (SIDS) (Suriname, Grenada, St. Lucia, and St. Vincent and the Grenadines, Timor-Leste, Fiji and, Kiribati). Except for Ukraine, all the countries classified as Annex I, which include countries with economies in transition (EIT) and industrialised states with membership in the OECD (Organisation for Economic Co-operation and Development) dating back

**Table 3.** Reviewed Climate Change Adaptation Documents

Country	Documents
Trinidad and Tobago	<ul style="list-style-type: none"> <li>National Climate Change Policy (NCCP)</li> <li>Vulnerability and Capacity Assessment (VCA) Report</li> <li>Second National Communication of the Republic of Trinidad and Tobago Under the UNFCCC</li> </ul>
Barbados	<ul style="list-style-type: none"> <li>Second National Communication Under the UNFCCC</li> <li>Barbados 2021 Update of The First Nationally Determined Contribution</li> </ul>
Antigua	<ul style="list-style-type: none"> <li>Antigua and Barbuda Updated Nationally Determined Contribution for the period 2020 – 2030</li> <li>Third National Communication Under the UNFCCC</li> </ul>
Jamaica	<ul style="list-style-type: none"> <li>Third National Communication of Jamaica to the UNFCCC</li> <li>Climate Change Policy Framework for Jamaica</li> <li>Jamaica's Vision 2030 Plan (Natural Resources and Environmental Management and Hazard Risk Reduction and Climate Change - 2009)</li> <li>State of the Jamaican Climate (2012): Information for Resilience Building', produced by the Climate Study Group, Mona (CSGM)</li> </ul>
St Lucia	<ul style="list-style-type: none"> <li>National Adaptation Plan (posted to the UNFCC website in September 2018)</li> <li>NAP Stocktaking, Climate and Vulnerability Report</li> <li>Sectoral Adaptation Plans (Agriculture, Fisheries, Water)</li> <li>Third National Communication on Climate Change for Saint Lucia</li> </ul>
St. Vincent and the Grenadines	<ul style="list-style-type: none"> <li>National Adaptation Plan (posted to the UNFCC website in November 2019)</li> <li>Second National Communication on Climate Change</li> </ul>
Grenada	<ul style="list-style-type: none"> <li>National Adaptation Plan (NAP) for Grenada, Carriacou and Petite Martinique (posted to the UNFCC website in November 2019)</li> <li>Grenada, Carriacou &amp; Petite Martinique Second National Communication to the United Nations Framework Convention on Climate Change</li> </ul>
Suriname	<ul style="list-style-type: none"> <li>National Adaptation Plan (posted to the UNFCC website in June 2020)</li> <li>Second National Communication to the United Nations Framework Convention on Climate Change</li> </ul>

to 1992 (UNFCCC, n.d), submitted their seventh national communication (NC7). Along with the other countries, Ukraine submitted previous national communications. Although separate adaptation communications were submitted by many of these Annex I countries, there was no specified repository of NAP submissions.

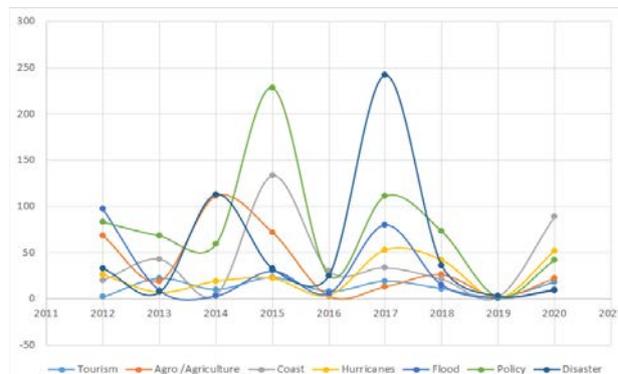
An objective determination of what constitutes a perfect climate change adaptation plan is complicated. The concept of ‘best practice’ related to climate change adaption depends on the framing of the adaptation issue. It is subjected to the addition of unknown adaptation processes that can improve the entire plan (Preston et al., 2011). Developing an adaptation policy is an iterative process. However, the audit approach provides us with the ability to use guidelines and a basic framework to evaluate the effectiveness of a policy. Significance is determined by examining how the policy and policy development process complies with standard requirements such as those previously highlighted. This approach utilises the basic principles of Logical Framework Analysis (LFA), which is a standard model for evaluating different types of policy (Preston et al., 2011).

**5. Analysis of Results and Discussion**

**5.1 Quantitative Analysis**

Examination of selected academic literature (see Table 1) that met the inclusion criteria identified ‘policy’ and ‘disaster’ as the two most frequently mentioned words found in articles published between 2010 and 2020 (no articles published in 2021 met the inclusion criteria). Figure 1 shows the word frequency variation in these articles during the period. Only 14% of the retrieved articles were written by authors based in a CARICOM member state. Environmental Science was the field of study for most (52.4%) of the authors in this literature review. Economics (14.3%) and Geography (14.3%) were tied in second place, followed by Water Management (9.5%). Agriculture and International Development tied in fourth place with 4.8%. Although half (50%) of the articles covered multiple adaptation topics, adaptation issues and measures in the

agricultural and tourism sectors were the main topics of research by Caribbean-based authors. The government was the sole stakeholder in approximately half (44.4%) of the adaptation measures evaluated in the review.



**Figure 1.** Word Frequency Variation in Publications/Articles Published Between 2010 and 2021

Vulnerable sectors were explicitly identified using a heading (or subheading) in the various climate policy and guidance documents (see Table 3). Adaptation documents for all countries included in the study considered vulnerabilities for water resources, human health, agriculture, and food security. Adaptation documents of only two countries considered vulnerabilities in the energy and socio-economic sector (Jamaica and Suriname). These were the least considered sectors (25%) in the study.

Overall, national climate change adaptation objectives were outlined in some form for all the countries included in this study. However, sectoral objectives were missing or inadequate in Trinidad and Tobago and Antigua. Although there was no identified assessment of biodiversity vulnerability for Barbados, the existence of the National Biodiversity Strategy and Action Plan (NBSAP) for Barbados to the United Nations Convention on Biological Diversity (CBD) provides a framework for assessing vulnerabilities and developing clear adaptation plans for this sector. Table 5 identifies the countries that developed sectoral plans.

**Table 4.** Vulnerabilities Identified in Policy Documents

Vulnerabilities addressed in Climate Change Adaptation Documents (identified in Table 3)	Country*								Total (%)
	TTO	BDS	ANU	JAM	SLU	GRE	SVG	SUR	
Coastal Resources	1	1	0	1	1	1	1	1	88
Agriculture and Food Security	1	1	1	1	1	1	1	1	100
Water Resources	1	1	1	1	1	1	1	1	100
Human Health	1	1	1	1	1	1	1	1	100
Biodiversity	1	0	1	1	1	0	0	1	63
Infrastructure and Human Settlements	1	1	0	1	1	1	0	1	75
Finance Sector	1	1	0	0	0	1	0	0	38
Tourism	1	1	0	1	1	1	1	1	88
Energy	0	0	0	1	0	0	0	1	25
Fisheries and/ or Coastal Ecosystem	0	1	0	1	0	1	0	1	50
Socio-economy	0	0	0	1	0	0	0	1	25

\* Keys: Trinidad and Tobago (TTO), Barbados (BDS), Antigua and Barbuda (ANU), Jamaica (JAM), Saint Lucia (SLU), Grenada (GRE), Saint Vincent and the Grenadines (SVG) and Suriname (SUR); 1 – sector vulnerability identified, 0 – sector vulnerability not identified.

**Table 5.** Sectoral Plans Developed

Vulnerabilities	Country*							
	TTO	BDS	ANU	JAM	SLU	GRE	SVG	SUR
Coastal Resources	1	1	N/A	0	1	1	0	1
Agriculture and Food Security	1	1	1	0	1	1	0	1
Water Resources	1	1	1	0	1	1	0	1
Human Health	1	1	1	0	1	1	0	1
Biodiversity	1	N/A	1	N/A	1	N/A	N/A	1
Infrastructure and Human Settlements	1	1	N/A	0	1	1	N/A	1
Finance Sector	1	1	N/A	N/A	N/A	1	N/A	N/A
Tourism	N/A	1	N/A	0	1	1	0	1
Energy	N/A	N/A	N/A	0	N/A	N/A	N/A	1
Fisheries and Coastal Ecosystem	N/A	1	N/A	N/A	N/A	1	N/A	1
Socio-economy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<b>Total (%)</b>	100	100	100	0	100	100	0	100

\* Keys: Trinidad and Tobago (TTO), Barbados (BDS), Antigua and Barbuda (ANU), Jamaica (JAM), Saint Lucia (SLU), Grenada (GRE), Saint Vincent and the Grenadines (SVG) and Suriname (SUR);  
 1 – Sector plan available, 0 – Sector plan not available. “N/A” is given when a sectoral plan is not expected to be available because the vulnerability was not identified (Table 4) in the adaptation documents. A “0” is given when the vulnerability was identified (Table 4), but a sectoral plan was not developed.

**Table 6.** Sectoral Plan Adequacy

Vulnerabilities	Country*							
	TTO	BDS	ANU	JAM	SLU	GRE	SVG	SUR
Coastal Resources	0	0	N/A	N/A	1	1	N/A	1
Agriculture and Food Security	0	0	0	N/A	1	1	N/A	1
Water Resources	1	0	0	N/A	1	1	N/A	1
Human Health	0	0	0	N/A	1	1	N/A	1
Biodiversity	0	N/A	0	N/A	1	N/A	N/A	1
Infrastructure and Human Settlements	0	0	N/A	N/A	1	1	N/A	1
Finance Sector	0	0	N/A	N/A	N/A	1	N/A	N/A
Tourism	N/A	0	N/A	N/A	1	1	N/A	1
Energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1
Fisheries and Coastal Ecosystem	N/A	0	N/A	N/A	N/A	1	N/A	1
Socio-economy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1
<b>Total (%)</b>	14	0	0	0	100	100	0	100

\* Keys: Trinidad and Tobago (TTO), Barbados (BDS), Antigua and Barbuda (ANU), Jamaica (JAM), Saint Lucia (SLU), Grenada (GRE), Saint Vincent and the Grenadines (SVG) and Suriname (SUR);  
 1 – Sector plan adequate, 0 – Sector plan inadequate. A sector plan is considered adequate if it meets two criteria: the sectoral plan contained long and short-term strategies for addressing the specific vulnerability, and there were measurable sectoral objectives. “N/A” is given when a sectoral plan is not expected to be available because the vulnerability was not identified (Table 4) in the adaptation documents.

Sectoral plans were available for the identified vulnerabilities in all the countries included in the study except for Jamaica, and St. Vincent and the Grenadines (see Table 5).

## 5.2 Qualitative Analysis

This paper does not seek to examine the translation of adaptation plans and policies into activities. An examination of the research literature, however, provided insight into the possible implementation of climate adaptation plans. The following describes a few examples of adaption activities occurring in the Caribbean as obtained in the literature search (see Table 1). An assessment of the framework guiding these and other adaptation activities is a research opportunity that can be explored in the future.

### 5.2.1 Rainwater Harvesting System (RHS)

Droughts can be devastating to communities and disruptive to extremely water-sensitive industries such as agriculture and tourism. Waite (2012) examined the feasibility of implementing an RHS to ensure a stable water supply during a drought. The study determined that RHS can meet 15% of the domestic water demands in the best situation.

### 5.2.2 Climate-Smart Agriculture

Although Grenada’s agriculture sector accounts for 5% of the GDP, it is the fastest-growing sector on the island. Pablo (2014) identified the CSA initiative in Grenada as a measure to ensure the viability of the agriculture industry during periods of decreased rainfall or droughts. This initiative focused explicitly on adapting the agriculture sector to droughts by providing guidelines and rules related to agricultural practices unsuitable for a changing climate. Farmers on the island

adapted to climate change by planting climate-friendly crops, prohibiting agricultural burning and diversifying crops.

### 5.2.3 Coastal Protection

A coastal setback policy was implemented at the Gran Riviere beach in Trinidad and Tobago to prevent future destruction of buildings, roads, and other infrastructure (Mycoo and Gobin, 2013). A coastal setback is an established area starting from the highest watermark of a shoreline to a specified distance where permanent constructions are not allowed (Sanò et al., 2011). Setback policies, although controversial, are created to protect infrastructure (such as roads and homes), natural resources and sensitive ecosystems.

## 5.3 Discussion

Most of the countries in this study did not develop NAPs. However, financing may be a significant issue as several countries would have obtained or are currently seeking external financing to develop their respective NAPs. For example, the three million dollars Antigua and Barbuda requested from the GCF is an example of the importance of external funding for adaptation projects in the region. The amount requested represents 0.2% of the 2020 GDP of the island. This is a significant amount of money to allocate simply to develop adaptation plans. Countries may be forced to prioritise other needs over climate change adaptation planning. As a means of comparison, the budgetary allocation for healthcare in Antigua and Barbuda in 2018, according to data obtained from the World Bank (n.d.), was 5% of the GDP.

Competing domestic needs coupled with limited financial resources may also affect adaptation efforts. The cost of crime in Jamaica is approximately 7.5% of the country's GDP compared to climate-related hazards such as hurricanes that cost 2% of the GDP every few years (Robinson, 2018).

These challenges underscore the importance of external financing as advocated by the Prime Minister of Barbados. The potential exorbitant cost of developing NAPs may be the factor preventing some of the countries included in this study from developing a NAP. Improvements in external funding are necessary. Although the Caribbean receives a significant amount of international climate adaptation funding, countries in a similar economic position, such as Small Island Developing States (SIDS) in the Pacific region, receive significantly larger financing (Hurley, 2015).

In the year 2015, there was a peak in the number of published articles on climate change and in the frequency of the appearance of the word 'policy' in these articles. This corresponds to the year in which the United Nation's Green Climate Fund was fully operationalised. The possibility exists that there is a relationship between the frequency and nature of adaptation literature and the availability of funding to implement suggested measures. Additionally, the adaptation projects funded by the Green Climate Fund were more aligned with the main topics covered by

literature (Table 1) published by authors not based in the Caribbean as compared to Caribbean-based authors. Although many studies have examined various factors that influence which climate projects receive funding, there was no evidence of research examining the impact of climate research on the flow of climate funding.

It is important, however, to indicate that other factors besides finance may be contributing to the discrepancy in NAP development. Trinidad and Tobago and Jamaica have higher GDPs per capita than some countries with a fully developed NAP. A lack of concern for climate change may be a factor. Only 10% of persons belonging to a high socio-economic bracket as compared to 29% in the middle and 61% in the low socio-economic bracket are very concerned about climate change in a survey carried out among 826 participants in Jamaica (Jamaica Consumer Pulse, 2019). The capacity to affect national change and influence governments is often consolidated among the wealthiest member of society. The relatively low concern for climate change among the powerful may affect the extent to which the government is motivated to pursue adaptation efforts and the degree of involvement of the private sector in meeting the challenges of adapting to climate change.

A review of the literature revealed that the government was the sole stakeholder in 44.4% of all adaptation measures identified. They were involved in 88.8% of all adaptation efforts. This indicates that private sector involvement in financing climate change adaptation may be lacking. Unfortunately, this governmental degree of participation in the adaptation process follows the concept that the socio-political nature of most Caribbean countries is such that there is a dependency culture (Robinson, 2018). Many communities absolve themselves of responsibility for solving problems with a near-total dependency on the government to plan and implement solutions. However, the possibility of the business community and the public going beyond simply providing technical and educational support to actively funding the development and implementation of adaptation plans should be explored in future studies.

Despite potential financial and other challenges, NAPs were available for St Lucia, St. Vincent and the Grenadines, Grenada, and Suriname. These plans were practical and generally outlined appropriate governance structure and management practices for handling the strategic implementation of adaptation measures. However, there were gaps in the communication framework for some countries, and cracks may also exist in the vulnerability assessment in that all vulnerabilities may not have been identified. A comprehensive audit of country-specific vulnerability assessments in future studies will shed light on the possible extent of these cracks.

### 5.3.1 Effectiveness

Grenada was the only country in this study that identified the financial sector as being vulnerable to climate change. The adaptation plan, however, only

described the impact of climate change on the insurance sector. A more holistic assessment is necessary. For example, although there was no evidence that Jamaica's plans addressed the impact of climate change on the financial sector, the Climate Change and Financial Stability Report by Robinson (2019) highlighted the relationship between climate risk and non-performing loans. Countries should consider the vulnerability of the entire financial system, including the banking sector.

More countries should evaluate climate change impacts on the energy sector, as Suriname and Jamaica did. Moreover, Jamaica examined the effects of climate change on parameters such as gender, development and poverty, elements which were underexplored or not explored at all in other assessments. It is also noteworthy that Jamaica evaluated these elements outside of having developed a NAP. Several other countries without a NAP also had many elements required for an effective policy scattered throughout various adaptation documents. However, most adaptation plans did not link adaptation efforts to achieving sustainable development goals. In some cases, there was an examination of the impact on critical economic sectors and biodiversity.

Although adaptation plans were not available for Jamaica, Trinidad and Tobago, Antigua and Barbuda and Barbados, the relevant adaptation documents identified the climate-related vulnerabilities that required adaptation measures. Sectoral plans were also available for all except for Jamaica. These sectoral plans, however, were not well developed as they did not have clear objectives. It is essential to highlight that the absence of sectoral plans or objectives does not mean that activities are not occurring. Jamaica's rainwater harvesting program and Trinidad and Tobago's coastal protection initiative are examples of adaptation activities occurring without having a sectoral plan.

However, it would not have been possible to evaluate performance or determine the most effective adaptation measures because clear sectoral objectives and comprehensive lists of implementation activities and outcomes were not accessible. There is a benefit for countries to create comprehensive sectoral plans separate from NAPs. The sectoral plans submitted by St. Lucia (to the UNFCCC) were more thorough than plans subsumed in national adaptation documents developed by Antigua, and Trinidad and Tobago. The comprehensive plan provided a clear description of sectoral objectives and detailed plans for the sector as opposed to a summary in subsumed sectoral plans. Separating sectoral plans from NAPs provide an opportunity to include all the elements that would increase the probability that the implementation of a sectoral plan would be successful.

Developing a database of adaptation case studies among the wider CARICOM region like the European Climate Adaptation Platform (Climate-ADAPT) would provide the opportunity to compare the performance and challenges associated with an adaptation measure. It can also facilitate sharing ideas and solutions for similar vulnerabilities and challenges among member states and the wider Caribbean region. The Caribbean

Community Climate Change Centre (CCCCC), of which all the countries included in this study hold membership, has a repository of adaptation measures. However, much can be done to improve the repository, including having more member states submit adaptation case studies and performance reports, organise the repository into categories by similarities, and summarise activities into frequently published reports similar to Climate-ADAPT.

### 5.3.2 Governance

The government is the leading agency responsible for implementing and managing adaptation efforts in the respective countries included in this study. From the reviewed literature, most adaptation measures having multiple stakeholders involved in that has a partnership between government agencies and the public. The government provided most of the financial and technical support to adaptation measures identified in the research literature. For example, although the major stakeholder in Grenada's CSA initiative was farmers, the government provided support by distributing climate change resilient crops, such as nutmeg, cocoa, and fruit plants (Article A6; Pablo, 2014). The government also provided equipment, loans, technical and financial assistance for irrigation installation.

Corruption may be affecting adaptation activity. Further research is needed to examine the effect of corruption and poor accountability practices on climate adaptation financing activities in several Caribbean countries.

According to the reviewed academic literature, the main issues affecting climate change governance in the Caribbean are lack of knowledge, ineffective communication channels between stakeholders, and inefficient government agencies. An evaluation of the adaptation documents also revealed that most plans did establish a communications framework for stakeholders but not necessarily to the body coordinating adaptation activities in the respective country (see Table 7).

In Jamaica, there was a clear requirement for the leading climate change agent(s) within all ministries and relevant departments and agencies (MDAs) to coordinate, monitor, evaluate and report on the development of individual sectoral plans to the Climate Change Division (CCD). A similar stipulation was also observed in Grenada's NAP, where communication between the National Climate Change Committee (NCCC), secretariat and other important actors was required. However, a proper framework was absent to gather and report data to these coordinating bodies.

Similarly, Trinidad and Tobago's National Climate Change Policy identified the Multilateral Environmental Agreements Unit of the Ministry of Housing and the Environment as the primary agent for coordination and communication between agencies and climate adaptation actors. Moreover, the absence of a proper framework for communicating critical performance data to the adaptation coordinating agency was a common issue that reduced the adequacy of many adaptation plans.

**Table 7.** Governance Framework in Adaptation Documents

Governance Parameters	Country*								Total (%)
	TTO	BDS	ANU	JAM	SLU	GRE	SVG	SUR	
Has the government put in place good and effective systems for monitoring and coordinating adaptation activity?	No	No	No	Yes	Yes	Yes	Yes	Yes	63
Are there clear, well defined and documented roles and responsibilities for climate change adaptation actors?	No	No	No	Yes	Yes	Yes	Yes	Yes	63
Are adaptation efforts coordinated across government agencies/ministries and other climate change adaptation actors?	No	No	No	Yes	Yes	Yes	Yes	Yes	63
Do channels for communication exist between climate change actors?	No	No	No	Yes	Yes	Yes	Yes	Yes	63
Are there processes to communicate important decision-making climate change information to the adaptation coordinating agency or committee?	No	No	No	Yes	Yes	No	Yes	No	25
<b>Total (%)</b>	0	0	0	80	100	80	100	80	

\* Keys: Trinidad and Tobago (TTO), Barbados (BDS), Antigua and Barbuda (ANU), Jamaica (JAM), Saint Lucia (SLU), Grenada (GRE), Saint Vincent and the Grenadines (SVG) and Suriname (SUR)

Lack of climate change technocrats and other skilled personnel to participate in climate change governance was also identified as a common barrier to climate change adaptation in the reviewed academic literature. Other major barriers to adaptation include lack of institutional articulation between climate change adaptation organisations, poor governance, and conflicting national and organisational objectives between climate change adaptation and other policies.

## 6. Conclusion

Although there was evidence of country-specific adaptation planning in all countries included in this study, only St Lucia, St. Vincent and the Grenadines, Grenada, and Suriname developed comprehensive adaptation planning documents in the form of NAPs that were submitted to the UNFCCC. Sectoral plans were available for all vulnerabilities identified by Trinidad and Tobago, Antigua and Barbuda, St. Lucia, Grenada, Suriname, and Barbados. However, only three countries sectoral plans were considered adequate: St. Lucia, Grenada, and Suriname. Only St. Lucia, however, would have submitted sectoral plans to the UNFCCC.

Governance among the group of countries had room for significant improvement. The adequacy of communication channels between stakeholders scored the lowest among all the governance elements included in this study. St. Lucia, and St. Vincent and the Grenadines were the only countries that had adaptation plans that met all the governance requirements indicated in this study.

## 7. Insights and Future Work

The Caribbean countries must establish a practical communication framework. This should also include systems for communicating adaptation performance metrics to the body coordinating national adaptation efforts. The necessary data should be submitted by established deadlines to facilitate adjustments in adaptation activities. This would support decision-making and foster transparency and accountability in

the implementation process. The sharing of information with stakeholders (including the public) would also allow more persons to participate in the monitoring, evaluation, and improvement of adaptation measures.

It may also be suitable to examine the relationship between the nature and structure of the Caribbean ministry with the overall responsibility for managing climate change and policy implementation. Future research can assess if the portfolio of the ministry influences the flow of adaptation resources. For example, is it possible that climate change and health are handled by the same ministry in Antigua and Barbuda and Saint Vincent and the Grenadines because the impact of climate change on health is the most significant concern for these countries and most of the resources are directed to health concerns? Would similar observations be made for ministries in other Caribbean countries with other portfolios, and does this lead to an uneven distribution of resources to address the different sectoral vulnerabilities? Research can examine budgetary allocations, department staffing, and bureaucratic systems within ministries responsible for climate change and the possible impact these factors may have on adaptation activity.

Although adaptation documents for all countries included in the study considered vulnerabilities for water resources, human health, agriculture, and food security, there is a need to examine the vulnerabilities in the least explored sectors (such as finance, energy, socio-economy). Considering these underexplored sectors would ensure that adaptation initiatives are occurring in vulnerable industries. This would further align adaptation policy and measures with achieving broader sustainable development goals. Effective sectoral plans (with clear objectives) are to be developed for these and other identified vulnerabilities. Adaptation measures such as the rainwater harvesting systems (Jamaica) should operate within a framework based on specific sectoral objectives that can be periodically evaluated and adjusted if desired performances are not being met.

There is evidence that the wider research literature contains data and considerations that can be used to develop effective NAPs. Policy developers need to scan relevant climate change academic literature when creating NAPs. Comparing the research literature and the adaptation policy documents suggests that future studies should examine the disparities between policy and implementation efforts. Policy implementation would be a problem that is not based on the suitability of the policy instrument itself. There is a need to align the research priorities with regional goals to formulate adaptation policies and develop feasible measures and interventions.

The safety and economic future of the Caribbean region would primarily be dependent on the implementation of viable climate change adaptation measures. Implementing, monitoring, evaluating, improving, and sustaining the projects and initiatives based on the NAP are just as important as developing a NAP. A policy is only effective if implemented. There is a need to align the research priorities with regional goals to formulate adaptation policies and develop feasible, sustainable measures and interventions.

Further research can involve increasing the scope of this study to include various sectors and nations across the Caribbean. It should also examine how the structure and portfolio of the adaptation coordinating body affect the distribution of adaptation resources.

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### Authors' Biographical Notes:

Christian Casey-Lee Virgil is an Industrial Engineering doctoral student at The University of the West Indies and a lecturer at the College of Science, Technology and Applied Arts of Trinidad and Tobago. As an educator, he is driven by the philosophy that education is a tool that bestows upon the user the ability to engage and interact with the world in an insightful and fulfilling manner. Mr. Virgil frequently utilises his other skills in graphic designing and videography to enhance the learning experience of his students. His research interests include the impact of climate change, occupational safety and public health on various aspects of organisational practices and performance.

Marcia Nathai-Balkissoon is a tenured Lecturer at the Department of Management Studies within The University of the West Indies, St. Augustine Campus. A Registered Professional Engineer whose research interests span business and personal strategy; health, safety, and wellness; systems improvement; and teaching and learning. As a special needs parent, Marcia also invests her time in assisting other special needs parents in establishing systems to improve support for their special needs children.

Kit Fai Pun is presently Professor of Industrial Engineering of the Faculty of Engineering at The University of the West Indies, St Augustine Campus, Trinidad and Tobago. He is a Registered Professional Engineer in Australia, Europe, Hong Kong, and The Republic of Trinidad and Tobago. His research interests and activities include industrial engineering, engineering management, quality systems, and performance measurement.

