CLIMATE CHANGE: RISKS AND RESPONSES IN THE CARIBBEAN

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ABSTRACT

Purpose: This paper identifies and analyses risks associated with climate change globally and in the Caribbean region, and proposes strategies to mitigate those risks in the context of green attitudes and initiatives at all levels. This paper focusses on the agrilculture and trade sectors.

Design/methodology/approach: The study has been conducted by analysing various secondary sources, including the 2014 World Economic Forum (WEF) Global Risk Report, which identified climate change and other interrelated effects such as extreme weather events, food and water crisis as four of the top ten global economic risks.

Findings: The warming of the Earth's climate system is unequivocal with the last three decades, in particular, being successively warmer at the Earth's surface than any preceding decade since 1850. Also, global governance failure is identified as a top ten global economic risk, with food security, global health or poverty reduction being undermined by climate change.

Research limitations/implications: The increased risk of extreme weather such as the 2012 heat wave and Hurricane Sandy in the United States or Typhoon Haiyan in the Philippines in 2013, is a reminder of the economic and social impact this challenge poses and its potential to be a significant drag on global growth prospect.

Practical implications: The study contributes to an understanding of the importance of green initiatives and attitudes on the economic and social impact of climate change globally and in the Caribbean region. The results will help in the mitigating of these risks, thus impacting on climate change.

Originality/value: Despite increasing awareness, the world has failed to act in a timely manner with the pressing concerns of climate change. There is mounting recognition that governments industry, civil society, international organisations and individual citizens can benefit from wider support in the task of addressing climate change and building a greener, cleaner, more efficient and resilient global economy, by drawing on the combined innovation, resources and effort from across the public, private and civil society sectors and through mobilising large-scale, practical collaboration and alliances.

***Keywords*:** climate change; global warming; extreme weather; economic impact; social impact; green attitudes; green initiatives; mitigating risk; Caribbean region and climate change.

INTRODUCTION

Though Trinidad and Tobago accounts for only 0.1% towards global warming, the per capita emission is higher than other Caribbean islands, but considered negligible as compared to the rest of the world. The effects of climate change from accelerated rate of global warming, increase the concerns of natural disasters with extreme weather conditions resulting in flooding and water crisis. This makes the Caribbean region vulnerable to the effects of food scarcity and infrastructural damage which ultimately affects the economy as well as tourism. Caribbean as a whole is also vulnerable to climate change effects due to their inter-dependence on regional players and international markets. With the arctic having shrunk by 2.7% in winter and 7.4% in summer and a projected temperature increase by 1.1C to 6.4C (National Climate Change Policy, 2011). It is evident that the last decade has been the warmest and therefore it is necessary to review how climate change will affect the region.

The link between trade and transport is important to review as it the mode of transport that emits greenhouse gases. Goods can be transported by air, road, rail and water or via pipelines in the case of oil. However, most international trade will involve more than one mode of transport. International trade involves emissions of greenhouse gases through the transportation of goods. However, most transportation is through maritime transport, which accounts for a relatively small share of the greenhouse gas emissions of the transport sector, and in terms of some indicators, is the most energy-efficient form of transport in terms of greenhouse gas emissions.

In this paper, we will explore the global outlook of climate change as well as in the Caribbean. This paper acknowledges the importance of the tourism industry to the Caribbean economy. However, the effects of agriculture and international trade will be examined to show how these two GDP contributors to Caribbean will be impacted by climate change. Due to the fact that businesses have a significant role to play in climate change in all aspects from emissions to mitigation and adaptation as well as influencing corporate strategies, it is important that this topic is reviewed.

CLIMATE CHANGE EFFECTS ON AGRICULTURE IN THE CARIBBEAN

Agricultural risk is a natural part of the industry, from market to price risks and production affected by weather, as well as variable costs. Therefore, agricultural risk strategies are important for long term food security for developing nations within CARICOM and the Caribbean region. Climate change can cause both extreme flooding and drought both of which can adversely affect agriculture production and account for economic losses due to the inability to meet export demands.

For example, banana exports from Dominica, St. Lucia an d St. Vincent account for a significant share of their earnings. Due to the banana crop requiring between 1300 and 1800 mm of rainfall per year, a reduction in precipitation can affect export volume to the European Union. Insufficient amount of water not only affect the size of produce grown, it is also associated with the increased risk of black sigatoka disease (CCCCC, 2009; Hosein, 2013). Table 1 below shows the price of bananas for the years 2000 to 2012 as it indicates how important the incomes from bananas are to these countries.

GLOBAL AGRICULTURE RISKS IMPACT TO THE CARIBBEAN

To emphasise the risk to Caribbean from agriculture, the product of wheat is examined. In 2010, the drought in Russia affected the agricultural exports of grains causing significant price increases in North Africa and Middle East. Research studies indicate a decrease in water availability can reduce grain production by 30% (Food and Agriculture organization of the United Nations (FAO), 2014). Therefore, this indicates that the risk of food scarcity can occur within the Caribbean region as

Table 1 Price of bananas

Year	*EU $/MT*	*US $/MT*
2000	712.43	424.00
2001	777.24	583.25
2002	759.40	528.58
2003	790.40	374.79
2004	891.99	524.58
2005	1171.58	602.84
2006	897.03	677.24
2007	1037.01	675.24
2008	1187.71	844.21
2009	1144.90	847.14
2010	1002.24	868.32
2011	1124.74	967.99
2012	1099.73	983.98

Source: World Bank (2013).

wheat is a major import for the Lesser Developed Countries (LDCs). Latin America and the Caribbean accounts for approximately 14 to 15% of world wheat imports (FAO, 2014). Other main exporters of wheat from the rest of the world are; USA, Canada, Australia, France and Argentina. Wheat is the lead commodity traded worldwide and as at 2001, US$18.2 billion worth of export was traded.

It should be noted that wheat is not produced in the Caribbean. The USA wheat price policy is oriented towards a reduction in the export price of wheat to the Caribbean. This can lead towards an increase to the wheat market share in the Caribbean notwithstanding any trade policies. For wheat and rice, no competition across countries exists. Instead, there exists a complimentarily relationship across source for each of the two products. In other words, the Caribbean distinguishes between the wheat or rice coming from the US and the wheat or rice coming from the rest of the World. Table 2 below illustrates the staples grown in the relevant Caribbean countries.

Even though the Caribbean has a low volume of wheat imports as compared to the rest of the world (ROW), worldwide trade of wheat have price differences based on demand and suppliers. This is regardless whether imports occur from the USA or the ROW. Consequentially this makes the Caribbean vulnerable to price elasticity of demand and supply.

At present the Caribbean imports the majority of wheat from US suppliers and as of 2013 the FAO has indicated a decline of 7% of wheat production in the USA. Also, 50% of the wheat from the

Table 2 Food staples in the Caribbean

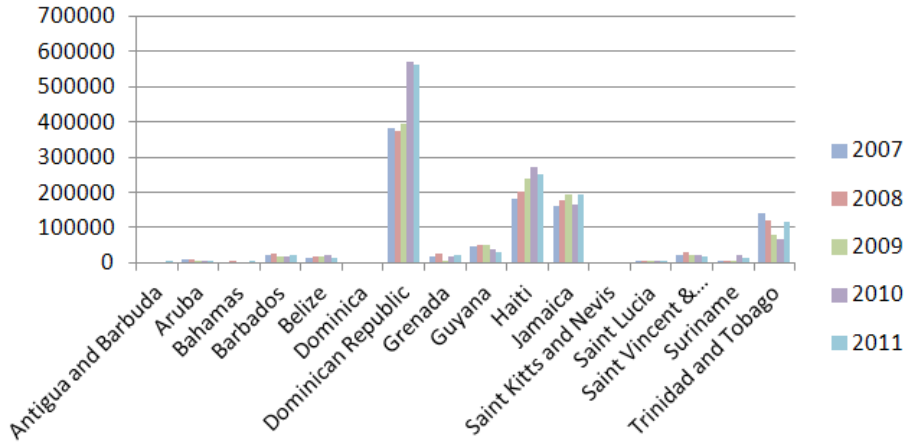
Food Staple	*Caribbean producer-countries*
Rice	Dominican Republic, Haiti, Jamaica, Puerto Rico, Trinidad and Tobago
Corn	Antigua, Barbados, Bahamas, Dom Rep, Grenada, Dominica, Guadeloupe, Haiti, Jamaica, Montserrat, Puerto Rico, St. Lucia, St. Vincent, Trinidad and Tobago
Potatoes	Bermuda, Dominica, Dominican Republic, Guadeloupe, Haiti, Jamaica, Montserrat, St. Kitts and Nevis
Wheat	None

USA is exported, while 36% accounts for food, 10% livestock feed and 4% seeds (National Wheat Growers Committee, 2013). The below Figure 1 illustrates the number of wheat imports to the Caribbean from 2007 to 2011.

The above table indicates that that the four dominant importers of wheat in the region are Dominica Republic, Jamaica, Haiti and Trinidad and Tobago. While the USA, is shown to dominate the export market as show in Figure 2 below.

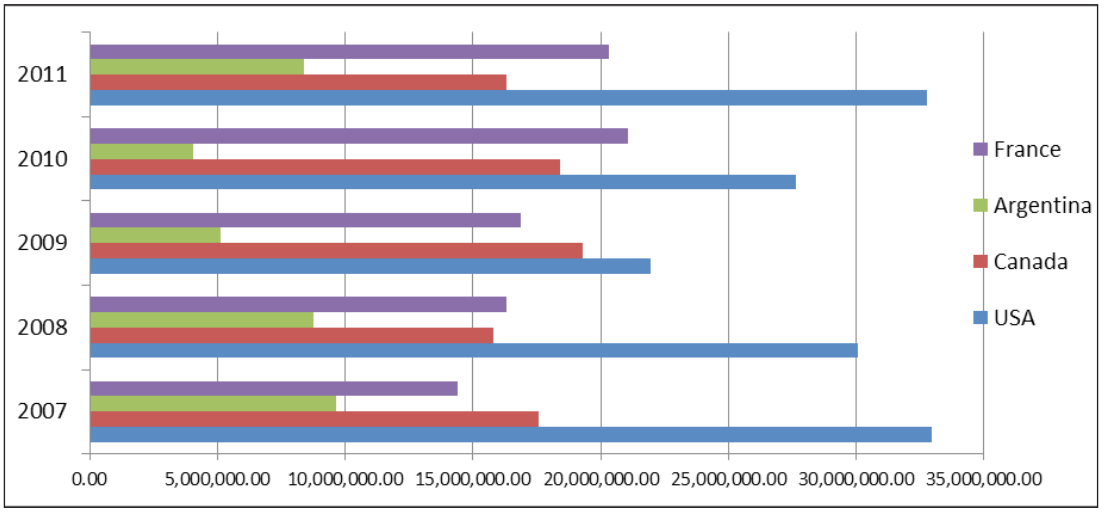
WELFARE RISKS

In the event that there should be a disruption in food supply, whether from locally grown or imported produce, the health disadvantages that would coincide with food shortages can affect already vulnerable developing economy. For example, wheat provides a vast number of nutritional benefits and if the Caribbean is unable to import the quantities demanded there would be a shift in the caloric sufficiency of diets as well as a decrease in the nutritional value of diets. The Lancet



Source: Food and Agriculture Organization of the United Nations (FAO) 2013.

Figure 1 Wheat Imports in the Caribbean 2007–2011



Source: Food and Agriculture organization of the United Nations (FAO) 2013.

Figure 2 Wheat Export 2007–2011

Commission report (2008) describes climate change as the main impendence to health of this century. Other related risks that cause health concerns are air pollution and increase incidence of water-borne diseases.

WATER-ENERGY-FOOD NEXUS

This is the inextricable link between food, energy and water systems which is referred to as the 'nexus', where the use of and strains on one of these resourc es can affect the other. Water production, distribution and treatment are all energy intensive functions and can be affected by energy shortages and pricing. A further example is whereby a drought can lead to increasing food prices.

The nexus is being strained today due to climate change. Due to the fact that each item depends and impacts on each other makes it a complexity of a problem.

> "Energy is needed to treat and transport water; water is needed to produce electricity and transport fuels; while energy and water are needed to produce food and the quality of that water can be affected by food and energy production" (WEF, 2014).

In the United States in 2012, this country experiences a drought which led to the corn crops dying which resulted in reduction of food and livestock feed supplies and raised prices. Power plants were also affected as they had to shut down or reduce production because the water in rivers, lakes had got too hot for it to be used for cooling. Also, shortages of rainfall led to an increased demand for electricity to run water pumps.

The impacts that climate change will have on the agriculture sector are diverse and will vary significantly by region and all research and projections indicate a negative effect in the long term. Agriculture will not only be impacted in terms of the capacity to produce more food to meet ever-increasing demand but in the stability and access to the utilisation of food products. The agro-ecological conditions will directly affect the suitability of land for agricultural use.

According to the World Economic Forum (WEF), mountain glaciers are melting and freshwater may disappear by the end of the century. Once water supplies are affected this will adversely affect food prices as well due to climate and weather variability. It should be noted from research the rapid changes in population and socio-economic development over will also have a much stronger and immediate effect on water and food security than the climate change.

Due to energy needed to deal with higher temperatures, etc., consumption is expected to increase significantly. Research in the Caribbean for agriculture and food security is needed regarding sustainable practices, such as low till agriculture, organic farming, water harvesting, drip irrigation, greenhouse cultivation and mulching, agro forestry, perm culture and soil conservation in. Also, this research should be extended into the methods of processing agricultural products, which would add value and variety to output for food and other uses.

ADAPTATION POLICIES FOR AGRICULTURE

Due to the fact that climate change will impact agriculture and food security the following should be taken into consideration in order to reduce the risk by Caribbean countries:

1. Promoting best farming practices to reduce land degradation.
2. Identifying crops that are drought resistance that can yield more mass per unit of water consumed.
3. Developing risk mitigation strategies to identify the impacts over the short, medium and long term.

4. Constant research in the projected land use changes from climate change.
5. Undertaking specific vulnerability studies for agriculture in each Caribbean country.

The University of the West Indies (Mona Campus, Climate Studies Group) has been conducting a series of test projects to utilise climate and crop yield models to develop tools to combat effects of climate change conditions.

THE IMPORTANCE OF THE PRIVATE SECTOR AND ITS RELATIONSHIP WITH THE PUBLIC SECTOR

Currently, throughout the world most adaptation efforts have been provided by public funds a source which does not require returns on investment. Due to the number of adaptation projects these sources are limited to avoid catastrophic risk in climate change conditions. It should be noted that adaptation projects rarely generate investor returns.

In most cases, governments intervene by collecting taxes or create other fiscal measures that private sector will have to contribute to these measures. However, the government's role should be balanced.

According to the WEF in 2014, it has been suggested that for the private sector to work synergistically governments to create projects that generate a return on investment. Therefore, these types of investments and collaborations can enhance climate resilience of vulnerable populations and infrastructure.

ADAPTATION WITHIN CARIBBEAN

Due to the considerable negative impacts on Caribbean economies it is necessary that adaptation strategies are implemented to reduce the risks from such effects. It is imperative that countries act immediately on adaptation measures.

The below are some recommendations that the Caribbean region can implement in addressing climate change concerns in any sector:

1. Continuous empirical studies and reports on climate change for impacts both on a local and regional level.
2. Insurance schemes for sectors that would be very sensitive to climate change impacts such as agriculture in particular small-scale farmers and fishers.
3. Studies on climate change should take into consideration the effects from all events such as floods and drought that would have considerable damage to countries.
4. Countries should have access to adaptation fund to implement the necessary projects.
5. Common vision by all Caribbean countries in addressing climate change concerns.
6. Leadership and role of champions are critical in fast tracking and catalysing transformational change.
7. Clear roadmap that would have a strategic focus and allows the ability to be flexible allowing learning and realignment.

CLIMATE CHANGE ON MARITIME AND TRADE

There has been an expansion of trade within the last 60 years as the volume of world trade increased by 32 times greater than 1950 in 2008. This expansion in world trade is a result

of technological changes which reduced the cost of transportation and communications and also the main reason being the adoption of free trade and investment policies in various countries.

Countries are now participating in international trade than before which brings us to the questions 'Will trade opening lead to more greenhouse gas emissions?' and 'How much does trade change greenhouse gas emissions?'

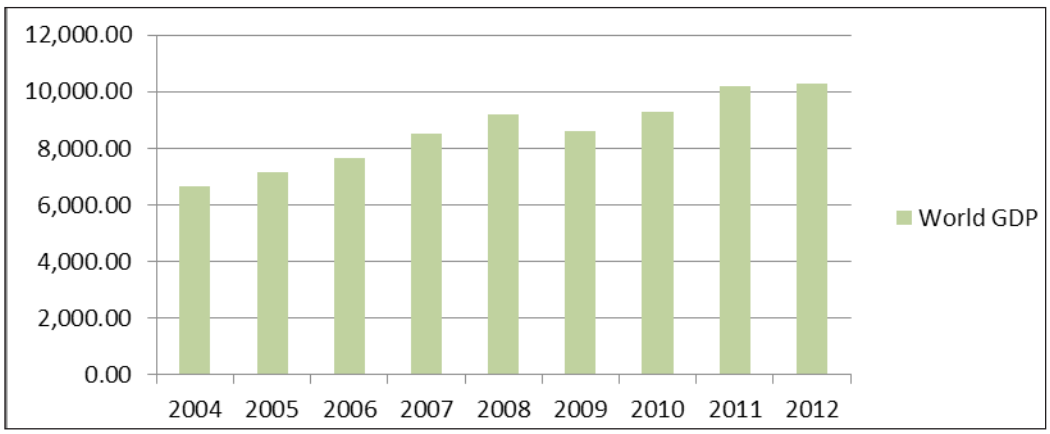
The coupling of increased trade and transport are synonymous with GDP growth and is increasingly regarded as a high impact cause of climate change. The effects of globalisation, has had a positive effect on trade and with developing countries accounting for 36% of world exports as reported by the World Trade Organization (WTO) the effects of climate change cannot be ignored. Figure 3 below shows that world GDP has been increasing throughout the years.

GLOBAL CLIMATE CHANGE FROM MARITIME AND TRADE

Trade infrastructure and routes such as port facilities, buildings, roads, railways, airports and bridges are at risks from climate change due to rising sea levels as well as increased occurrence of extreme weather, such as flooding and hurricanes. The IPCC report also revealed that projected changes in sea ice, particularly in the Arctic, will lead to the availability of new shipping routes (WTO and UNEP Report, 2009).

Trade is a process whereby goods are transported from the place of production to the place of consumption. The international trade expansion has led to an increased use of transportation services as merchandise trade can be transported by air, road, rail and water. It should be noted that maritime transport accounts for the majority of international trade for volume and value as seen in Figure 4 below.

According to the IPCC in 2006, international maritime shipping accounted for only 11.8% of the transport sector's total contribution to CO_2 emissions. Whereas, aviation represents 11.2% of CO_2 emissions, rail transport 2% and road transport was the biggest contributor to at 72.6% of the total CO_2 emissions from transport. It can be stated that from the different modes of transportation, shipping via sea is the most efficient means of transportation.



Source: The World Bank (2013).

Figure 3 World GDP for the years 2004 to 2012

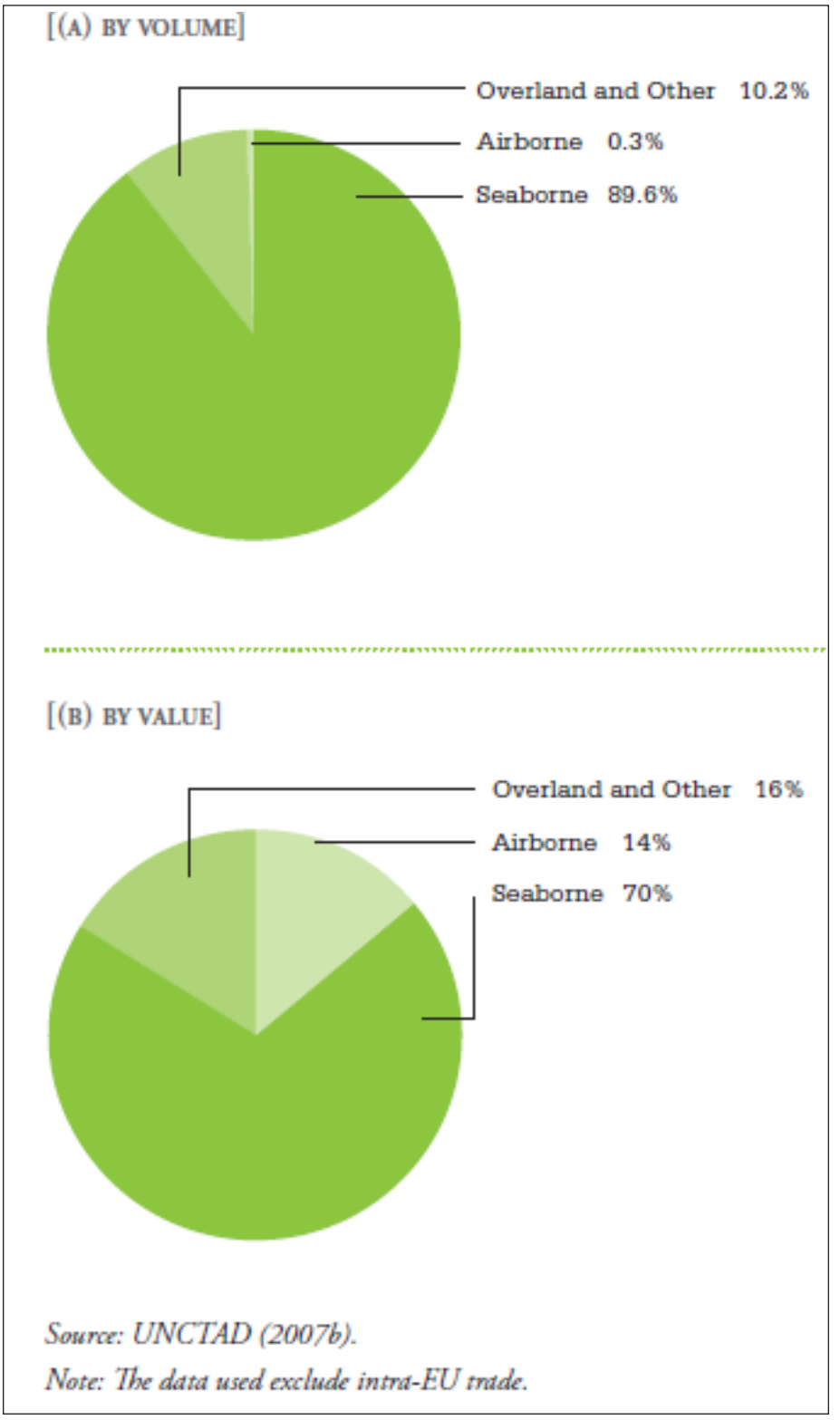


Figure 4 International trade movement by land, air and sea in both volume and value

MARITIME AND TRADE IN THE CARIBBEAN

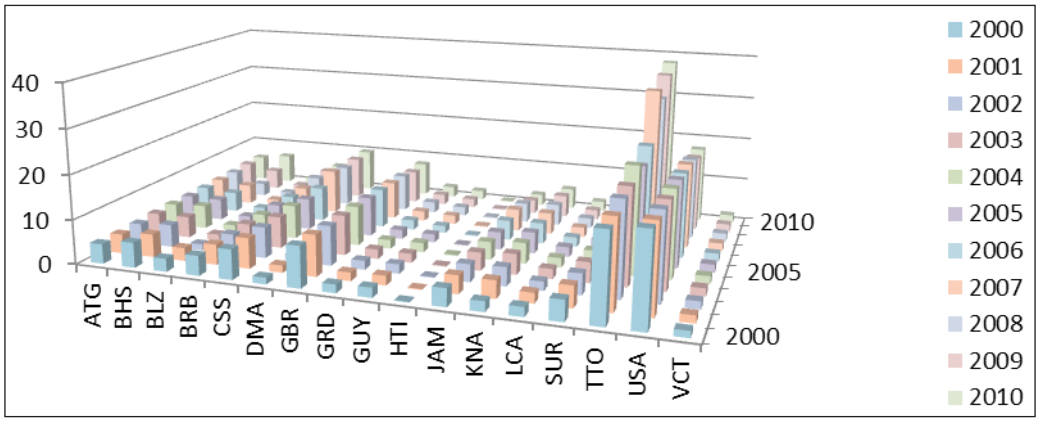
Trinidad's emission per capita is remarkably high compared to the Caribbean nations and the USA as seen in Table 3 and Figure 5 below. There is an increasing trend which would indicate that as industrialisation increases so does the CO_2 emissions and therefore this continues to act as a contributor to climate change in the Caribbean.

Shipping transports approximately 90% of global trade and it is important that the International Marine Organization (IMO) continue to monitor and measure the marine environment to achieve global targets. The IMO is the United Nations specialised agency set to develop global regulations for safety, security and the marine and atmospheric environment of the maritime sector. The Energy Efficient Design Index (EEDI) was implemented by IMO as the first global standard and applies to all ships and countries. The index stipulates the percentage range from 10% to 15% of energy efficient ships and upwards of 30% requirement for ships built after 2024. For developing countries of the Caribbean the index has been used to secure a process of technology transfer or technical assistance as needed.

In order for Caribbean countries to benefit from increased trade their ports must be expanded to receive higher vessel capacity ships. These larger vessels enable goods to be transported at lower costs and therefore lowering the volume of CO_2 emitted. However, if Caribbean countries do not invest in port expansions, they will essentially be committing to increased emissions in the future. In the last five years container port traffic has steadily increased between 2007 and 2011 as stated by The World Bank seen in Table 4 below.

As compared to road, rail and air transport, maritime transport remains the most sustainable mode of transport however with increasing fuel costs many shipping lines such as CMA CGM and Maersk have invested into innovative ways which would allow sailing to become both economically efficient and environmentally sustainable. Marine transports accounts for 3% of global CO_2 emissions and has increased by more than 90% since 1990 but by 2050 this figure is expected to triple.

With the Panama Canal expansion set to be completed by 2016 many ports around the world as well as in the Caribbean, such as in Trinidad and Jamaica, are posed to expand depth and berths in order to handle the larger vessels. These larger vessels not only have the capacity to ship 18,000 TEUs but with optimal hull design and waste heat recovery systems it has lowered emissions by 30% of CO_2 as well as lowered Nitrous Oxide (NO_x) and Sulphur Oxide (SO_x) particles on the Maersk line of ships.



Source: The World Bank (2011).

Figure 5 CO_2 Emissions per Capita for the period 2000–2010

Table 3 CO_2 emissions per capita for the period 2000–2010

Country Code	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ATG	4.43923862	4.36481285	4.53621142	4.80448433	4.98099562	4.97431115	5.09628955	5.25737882	5.37059602	5.77881808	5.88515814
BHS	5.60347462	5.17970331	5.102301	4.80995742	5.34581266	4.85831145	4.53428262	4.52412958	3.00021531	4.6342823	6.83561074
BLZ	2.88950735	2.90132057	1.42738098	1.44780256	1.43890733	1.45644307	1.45899242	1.4862961	1.37657467	1.36653219	
BRB	4.44667839	4.55135746	4.55783158	4.68454904	4.75542698	4.9462035	4.98851678	5.16316233	5.89078427	5.82238733	5.36195238
CSS	6.73944675	6.85290668	6.98547261	7.13965876	7.63995529	7.19460089	7.86464847	10.2100829	9.29429871	9.66198287	9.87885526
DMA	1.47355731	1.63188343	1.47087643	1.62261269	1.56430857	1.61147969	1.55623143	2.12369518	1.81065982	1.8077779	1.90648756
GBR	9.23142941	9.31435257	8.96639584	9.07628727	9.02670319	8.99946042	8.94522021	8.67248958	8.51012969	7.68645247	7.92509286
GRD	1.87644165	1.90822688	2.01130276	2.11346208	2.00040914	2.10151431	2.23727484	2.30103489	2.50507062	2.42600867	2.48724171
GUY	2.16235824	2.13352513	2.10553682	2.07773894	2.15096329	1.884507	1.68649027	2.03244389	2.00901979	1.99065111	2.16439604
HTI	0.15944902	0.17998068	0.20612204	0.19280201	0.21769207	0.22411717	0.22497311	0.25130922	0.25186655	0.23169519	0.21417142
JAM	3.98508675	4.07978057	3.93529008	4.0835998	4.06162541	4.01648845	4.51369682	5.03770536	4.44592364	3.18733529	2.64992744
KNA	2.25443527	3.96741247	4.21907359	4.31431021	4.69535945	4.77600277	4.71043494	4.93989461	4.87881041	5.03290097	4.7630654
LCA	2.10278498	2.28826347	2.03700606	2.2215175	2.17606142	2.21695575	2.18719059	2.26292837	2.2927507	2.19768836	2.2738265
SUR	4.55754412	4.78797495	4.68973691	4.60194879	4.64512134	4.76431115	4.83430261	4.78460836	4.73875569	4.74436582	4.54044118
TTO	19.3330297	19.6672826	21.0453369	21.572974	24.0188999	22.0370659	24.6665122	35.4652453	32.3148614	36.4282724	38.1611308
USA	20.2491892	19.6561932	19.6469218	19.5846574	19.7768452	19.7159606	19.2292287	19.3495772	18.6022727	17.3152972	17.564164
VCT	1.461403	1.66390095	1.72923717	1.79368361	1.79023047	1.82087192	1.85188416	1.84955752	1.84764287	1.84610385	1.91206228

Source: The World Bank (2011).

Table 4 Container port traffic (TEU: 20 foot equivalent units)

Country Name	Country Code	2007	2008	2009	2010	2011
Antigua and Barbuda	ATG	34,081	32,562	29,150	24,615	26,018
Bahamas, The	BHS	1,632,000	1,702,000	1,297,000	1,125,000	1,181,250
Belize	BLZ	39,191	38,211	31,344	31,919	34,200
Barbados	BRB	99,626	87,255	75,015	80,424	85,008
Caribbean small states	CSS	4,391,829	4,416,836	3,757,542	3,798,276	4,010,433
Jamaica	JAM	2,016,792	1,915,943	1,689,670	1,891,770	1,999,601
Trinidad and Tobago	TTO	514,557	554,093	567,183	573,217	605,890
St. Vincent and the Grenadines	VCT		16,570	16,238	18,852	19,927

Source: The World Bank.

Maersk has invested years in innovative ideas to cut bunker fuel by the use of slow steaming from 24 to 12 knots which saved them 22% of bunker fuel in 2010 and inadvertently continues to lower emissions therefore lessening the effects of climate change. Therefore, it would benefit the regional marine environment should port capacity be expanded to berth larger vessels at the Trinidad or Jamaica ports.

Developing countries within the Caribbean will continue to enjoy increased and easier methods of trade due to technological advancements in transportation and unilateral, bilateral and regional trade agreements which also encourage trade. Technology has also been integrated into the supply chain and many developing countries are now involved in the process by supplying components that create a final product which are assembled in other countries. Therefore the positive effects of trade that sustains developing countries can also impact negatively on the effects of climate change and can have detrimental long term impacts.

CAUSES FOR THE AMOUNT OF GREENHOUSE GASES FROM TRADE

The increase in trade affects the amount of emission in three main ways which are referred to as the scale, composition and technique effects.

Increased economic activity will require greater energy use which will lead to higher levels of greenhouse gas emissions. Therefore the *scale effect* refers to the expansion of economic activities arising from trade opening, and its effect on greenhouse gas emissions.

The *composition effect* illustrates the way that trade opening changes the structure of a country's production in response to changes in relative prices, and the consequences of this on emission levels. Comparative advantage will be the driver in the way changes in production will occur. Therefore, effects on greenhouse gas emissions will vary on the country's comparative advantage in emission-intensive sectors and whether these sectors are expanding or contracting.

The *technique effect* refers to improvements in the methods by which goods and services are produced, so that the emission intensity of output is reduced. This key method can mitigate climate change as a decline in greenhouse gas emission intensity can happen in two ways. Firstly, more trade can increase the availability and decrease cost of climate-friendly goods and services.

The demand in countries where these types of goods and services are not available and produced will now be available.

Increased trade increases the amount of economic activity and thus increases the level of Greenhouse Gas emissions associated with trade such as transport and production. Therefore the *scale* refers to the volume of increased emission levels. The energy sector industry for example, creates a *composition* of economic activity associated with increased levels of GHG emissions due to the type of production. Trinidad and Tobago has comparative advantage in the production of natural gas and oil, which would further explain their high CO_2 emissions per capita rating. In 2010, Trinidad and Tobago produced 42,380,000,000 cubic meters of natural gas and 144,900 barrels of oil per day, as per the Index Mundi report. *Technique* refers to the way in which a country may decide to trade for example, many countries in Europe demand 'green' products when importing goods. These are products which are produced and packaged in an environmentally safe way allowing return and recycling products at the end of their life cycle. It forces innovative production techniques which are demanded by society.

The link of trade to climate change within the Caribbean or around the world are similar with scale being opposite to technique but the composition of production depends on the strength of each effect and once countries continue to trade on what they have as comparative advantage, there will always be a challenge with prioritisation of economic activity over the increased effects on climate change.

MITIGATION AND ADAPTATION

Two major approaches to deal with climate change is mitigation and adaptation and these are no different for in dealing with effects from international trade.

IPCC (2007b) has defined mitigation as a "technological change and substitution that reduce resource inputs and emissions per unit of output". Adaptation refers to the responses from the impacts of climate change as defined by IPCC (2007b) as "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities".

International Trade can be a benefit by being a means of spreading technologies that mitigate climate change. Developing countries can learn from developed countries innovations in climate change technology which can be made possible by trade. The different ways in which the transfer of technology can occur is by the import of intermediate and capital goods which a country could not have produced on its own, increased communication between countries on topics such as production methods and design. International trade can also increase the opportunities for adapting foreign technologies to meet local conditions. This would then reduce a country's cost of future innovation and imitation as through trade have opened these opportunities.

The effects of climate change threats such as altered geographical patterns of production along with food and agricultural products can be adversely affected. However, trade can bridge these differences in demand and supply so that countries with these effects can be able to meet their needs. Countries that are affected can import from those countries that have surplus to export. While there have been studies on how these exports can happen, it was determined that the price of the agricultural products in times of scarcity or abundance will play a factor in trade.

Climate change can affect the volume of international trade flows and pattern as comparative advantage among countries may shift. International trade depends upon the supply, transport

and distribution chains and any disruptions to these chains can affect the costs of engaging in international trade as it would most likely increase.

WTO AND ENVIRONMENT NEGOTIATIONS

In the Doha Round of the WTO negotiations, various countries have called for the "the reduction, or as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services" (WTO, 2012) as the objective is to improve access to more efficient, diverse and less expensive environmental goods and services.

It is expected that climate-friendly technologies can work towards mitigating and adapting to climate change in diverse sectors. These include wind and hydropower turbines, solar water heaters, photovoltaic cells, tanks for the production of biogas and landfill liners for methane collection.

It is quite evident that the WTO environmental goods and services negotiations have a role to play in improving access to climate-friendly goods and technologies.

Reducing the tariffs and other trade-distorting measures in climate-friendly goods and technologies would reduce the price and access to these will be important for industries throughout the world. Liberalisation of trade in climate friendly goods will provide incentives and domestic expertise for producers to expand the production and export of these goods.

CONCLUSION

The Intergovernmental Panel on Climate Change's Fifth Assessment Report indicated that extreme events in climate changes are going to increase if there are irreversible environmental damages. It is not only about the natural environment as it also consist of changes in all aspects regarding the future since it is often referred to as a 'VUCA world' where it means 'Volatile, Uncertain, Complex and Ambiguous'.

Global climate change will continue to be a challenge and increasingly manifest itself throughout this century. Adaptation and migration efforts through international agreements have not slowed greenhouse gases emissions significantly on a global scale. However, this global issue of climate change has been recognised by the business and academic communities as they have increased their attention and began making efforts to adapt to the challenges that it poses to the planet. This would be a challenge where mitigation and adaptation efforts will have to continue.

Of course, with any of these strategies to combat climate change it will require the necessary funding as well as the appropriate metrics and methodologies.

Metrics will enable the identification of current and future vulnerabilities, risks and opportunities whereas methodology will enable decision-makers to systematically assess risks and identify the most cost-effective climate adaptation investments.

Private sector funding should be a tool to attract private sector investment in the aid of adaptation solutions. Any adaptation strategy must have holistic thinking that investments in one area may have effects on another similar to the food-energy nexus terminology.

On a global scale, accordingly to the WEF, investment in adaptation strategies has been miniscule and there is a greater need to have this increased in the fight against climate change.

On a regional level, Caribbean countries must quickly act on all the research that has been completed in the Caribbean on climate change and adapt the relevant measures and mitigation actions.

The effects of climate change as seen in the two sectors examined in this paper which were agriculture and trade shown that climate changes would definitely change the sectors in which they operate.

Caribbean businesses must also learn from international companies in how they protect their business from future risks such as climate change. By changing their corporate strategies to secure their supply chain needs as seen in the case study would enable business sustainability in the future besides the aspect of having a reputation of good corporate social responsibility.

Therefore, it is imperative that the Caribbean act quickly in adapting climate change polices to secure our future.

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BIOGRAPHICAL NOTES

Zaffar Khan is a Member of the Energy Institute of the UK. He completed the Executive Education Programme in Business Strategy at Harvard Business School. He holds a PhD in Energy Economics and Management. He was a Senior Instructor at UTT and lectured in various disciplines including energy. He spent approximately 20 years at BP both at the Corporate and Operations Management levels functioning mainly as an internal consultant to all departments. He was a consultant to Chevron Texaco on the Loran/Manatee Exploration Project and was highly commended by the Country Manager as well as the President of

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