This preliminary document dated 08/05/2014, is intended to present a general understanding of the concept of vulnerability within Trinidad and Tobago, based on the available resources at the time the study was undertaken. This document can be used but not reproduced in any way without the express permission of the Office of Disaster Preparedness and Management (ODPM).

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Executive Summary

Vulnerability is defined as the “conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community of the impact of hazards” (UNISDR 2004). The twin island republic of Trinidad and Tobago experiences multiple types of vulnerability, primarily environmental, socio-cultural and economic, which has a significant impact on the way in which the island interacts with natural and anthropogenic threats.

Environmental vulnerability refers to the inability of the built and natural environment to adequately cope with the impacts of hazards leading to their degradation. These elements can include critical facilities, buildings and infrastructure; natural resources, habitats, and ecosystems to name a few. Physical vulnerability may also be determined by aspects of the population such as “population density levels, remoteness of a settlement, location, the design and material used for critical infrastructure and for housing (UNISDR). Both the natural and built environment of Trinidad and Tobago showcase multiple vulnerabilities to the impact of hazards including insufficient and poorly enforced legislation, the inability to cope with rapid developmental changes, increased settlement in high risk zones, and widespread unsustainable activities which exacerbate hazard impacts.

Trinidad and Tobago is considered to be one of the most diverse countries in the Caribbean region with its own mix of culture and social values which make it truly unique. Unfortunately some of these inherent characteristics make the islands more susceptible to the impacts of natural and anthropogenic hazards. These factors include poverty and the growing dependency of the nation’s population; their skewed perception of risk, the way in which emergencies are managed, and the marginalization of special need populations. Additionally, Small Island States (SIDS) like Trinidad and Tobago are highly susceptible to economic vulnerability, which refers specifically to the way in which the nation’s economy responds to both internal and external shocks. In the twin island Republic of Trinidad and Tobago there are multiple factors which contribute to economic vulnerability such as: the proneness to natural and anthropogenic disasters; economic openness; export concentration; dependence of strategic imports and sectors; and inadequate coping mechanisms to name a few.

This report attempts to analyse these factors from the disaster management perspective and make recommendations for vulnerability reduction and resilience.
1.0 Introduction

1.1 Understanding the Key Concepts

This project deals intensely with the concept of vulnerability and the interaction with hazards to affect risk. Burton (1978) defines natural hazards as “those elements of the physical environment, harmful to man and caused by forces extraneous to him”, however it has been found that the causes of hazards can be either natural or anthropogenic, and at times a combination of both. Hazards can therefore be thought of as “potentially damaging events, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation” (UNISDR 2004).

Risk refers to the “probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environmentally damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions” (ISDR). The formula for risk is as follows:

\[ \text{Risk} = \text{Hazard} \times \text{Vulnerability} \]

This however does not comprehensively address the issue of risk, but rather only covers what is considered to be specific risk. To fully understand risk, we must consider it in its entirety. There are two major types of risk, specific risk and elemental risk, the product of which is total risk.

Specific Risk \((RS)\) means the expected degree of loss due to a particular natural phenomenon. It may be expressed by the product of \(H\) times \(V\).

Elements at risk \((E)\) means the population, properties, economic activities, including public services, etc., at risk in a given area.

Total Risk \((RT)\) means the expected number of lives lost, persons injured, damage to property, or disruption of economic activity due to a particular natural phenomenon, and is therefore a product of Specific Risk \((RS)\) and Elements at risk \((E)\). Thus: \(RT = (E) \times (RS)\) or \((E) \times (H \times V)\)

Additionally, risk is also affected by a persons or community’s capacity to cope, which is reflected in the modification to the equation:

\[ \text{Risk} = \frac{\text{Hazard} \times \text{Vulnerability}}{\text{Capacity}} \]

Vulnerability on the other hand is defined as the “conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community of the impact of hazards” (UNISDR 2004).

The distinction between the concepts of risk and vulnerability is clear. Risk deals with the probability of occurrence of disasters, while vulnerability deals with the elements (physical, social/political, economic, and cultural) which can affect this probability by either increasing or decreasing it. This is a clear indication that before a risk assessment can be made, the level of vulnerability of specific or multi-hazards must be known.
1.2 A Snapshot of Trinidad and Tobago

1.2.1 Environment and Hazard Profile

The twin island republic of Trinidad and Tobago is the most southerly nation of the West Indies, located just off the north coast of Venezuela, of which it shares similar geological characteristics. The country covers an area of approximately 5128 square kilometers and consists of two main islands, with several smaller landforms including Chacachacare, Monos, Huevos, Gaspar Grande, Little Tobago, and St. Giles Island. The island of Trinidad is 4,768 km$^2$ in area (comprising 93.0% of the country's total area) while Tobago has an area of about 300 km$^2$ or 5.8% of the country's area. The islands also feature vibrant terrestrial and marine ecosystems including coastal, forest, freshwater, and has been blessed with several valuable natural resources, the most notable being sizeable oil and gas reserves, which have been responsible for the country’s economic success.

Within the past 20 years, the country’s landscape has changed dramatically due to increased development, and the intensification of built infrastructure. Presently, much of the nation’s population is located along the Trinidad’s western coastline, which is also the location of Trinidad’s three largest cities, Port of Spain, San-Fernando and Chaguanas while Scarbrough is the largest city in Tobago. All of the 14 municipalities of Trinidad in addition to its sister island Tobago, are susceptible to a variety of natural and anthropogenic hazards, which can be grouped into the following categories: Seismic, Hydro-Meteorological, Biological, Industrial Technological, Social Organizational and Environmental examples of which are summarized in Figure 1.

Due to the country’s geographical location it experiences a tropical climate with a wet and dry season and is dominated by the northeast trade winds. However due to the issue of climate change, the weather has become quite unpredictable deviating from regular rainfall patterns. Lying just outside the Atlantic Hurricane Belt, the islands have escaped from major impacts of tropical cyclones, although the risk still exists, it is less than that of our Caribbean neighbors. With regard to seismic hazards however the country is considered to be high risk. In fact there are major fault lines running across the island of Trinidad. Of these numerous faults, the one that is the greatest cause for concern is the Central Range Fault shown in Figure 2. According to Weber et al 2009 “the Central Range fault is a Holocene fault capable of producing damaging earthquakes in Trinidad” this is echoed by experts at the University of the West Indies Seismic Research Centre, who state the country is in fact “overdue” for a major earthquake.
Figure 1: Summarized list of actual and potential hazards to which Trinidad and Tobago is exposed.
Figure 2: Logs of Paleoseismic excavations across the Central Range Fault, Trinidad. Source: Christopher J. Crosby, Carol S. Prentice, John Weber, and Daniel Ragons 2009.
In understanding the hazard profile of Trinidad and Tobago it is important to highlight the notions associated with hazard frequency vs. hazard potential. The natural and anthropogenic characteristics of Trinidad and Tobago make it prone to many high impact hazards, meaning that the country does indeed have the potential to experience high magnitude events such as earthquakes and tsunamis, as evidenced by historical data. Fortunately, however in recent years the nation's most prevalent hazards have been limited to hydro-meteorological events such as flooding, landslides and high wind events, in addition to fires arising from environmental, domestic and industrial causes. The distribution of these hazards over time is shown in figure 3.

One common misconception is the perception that the comparably low damage impact of historical events is an indication of a low hazard frequency. This is incorrect, as Trinidad and Tobago is in fact regularly subjected to hazards, but this at times goes unnoticed due to relatively short durations and minimal magnitude and impacts. Take for example seismic hazards, much of the population believes the country to be “immune” to earthquakes, primarily because the largest earthquake on record directly impacting Trinidad and Tobago took place in 1766 and since then there have been eight (8) events of magnitude 6.0 or greater between 1899 and 1952 occurring within 250 km of Trinidad and Tobago. The low frequency of high magnitude earthquakes does not indicate a low frequency of occurrence across the board, when in fact an earthquake may be felt as often as once per month, as seen in Figure 4.

Table 1: below highlights some of the major historical hazards which have occurred in Trinidad and Tobago.

<table>
<thead>
<tr>
<th>Year</th>
<th>Hazard</th>
<th>Brief Description of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>1766</td>
<td>7.9 Earthquake</td>
<td>Destroyed Trinidad’s then capital San Jose</td>
</tr>
<tr>
<td>1888</td>
<td>7.5 Earthquake</td>
<td>Damage occurring from Trinidad to St. Vincent.</td>
</tr>
<tr>
<td>1933</td>
<td>Trinidad Hurricane</td>
<td>$3 million in damage, 1000 people left homeless</td>
</tr>
<tr>
<td>1954</td>
<td>6.5 Earthquake</td>
<td>1 death, multiple injuries</td>
</tr>
<tr>
<td>1963</td>
<td>Hurricane Flora (Category 3)</td>
<td>7500 houses were destroyed; 3500 houses were damaged; 18 people killed in Trinidad; 2 people killed in Tobago; $30 million worth in damages to agricultural sector.</td>
</tr>
<tr>
<td>1968</td>
<td>7.0 Earthquake</td>
<td>Significant damage in Venezuela with some damages to Port of Spain, Trinidad.</td>
</tr>
<tr>
<td>Year</td>
<td>Event</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>-------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1974</td>
<td>Tropical Storm Alma</td>
<td>Damage to the Plum Mitan Strip in California; 1 person was killed.</td>
</tr>
<tr>
<td>1979</td>
<td>Oil Spill</td>
<td>Supertankers the Atlantic Empress, 288,000- deadweight-ton (dwt) and the Aegean Captain, 207000 dwt collided off Little Tobago. An estimated 90 million gallons (over 2.9 million barrels) were spilled</td>
</tr>
<tr>
<td>1981</td>
<td>Flooding</td>
<td>Extensive flooding throughout Trinidad, Caroni divides north from south</td>
</tr>
<tr>
<td>1982</td>
<td>5.2 Earthquake</td>
<td>Largest earthquake near Tobago up to that time.</td>
</tr>
<tr>
<td>1985</td>
<td>Flooding</td>
<td>Nationwide flooding, TT$15 mill cost incurred. 621 hect. Of agriculture lost.</td>
</tr>
<tr>
<td>1988</td>
<td>6.3 Earthquake</td>
<td>Occurred off east Coast Trinidad. No injuries reported.</td>
</tr>
<tr>
<td>1990</td>
<td>Tropical Storm Arthur</td>
<td>Severe Flooding</td>
</tr>
<tr>
<td>1993</td>
<td>Tropical Storm Bret</td>
<td>Severe flooding and damage to property</td>
</tr>
<tr>
<td>1996</td>
<td>5.2 Earthquake</td>
<td>North of Trinidad occurred New Year's Day. No reported injuries.</td>
</tr>
<tr>
<td>1997</td>
<td>6.1 Earthquake</td>
<td>6.1 US $25 million in damages to Tobago, 2 were injured and 15 were left homeless.</td>
</tr>
<tr>
<td>Year</td>
<td>Event</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>----------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2005</td>
<td>Flooding</td>
<td>Severe flooding leaves people marooned and crops and livestock destroyed</td>
</tr>
<tr>
<td>2006</td>
<td>5.8 Earthquake</td>
<td>Felt throughout Trinidad with 3 reported injuries in Point Lisas.</td>
</tr>
<tr>
<td>2007</td>
<td>7.3 Earthquake</td>
<td>Felt throughout the Eastern Caribbean from Puerto Rico to Guyana; damage reported in Martinique, St. Lucia, St. Vincent and Barbados. This is the fifth earthquake in the magnitude 7 range to occur near Martinique since 1727.</td>
</tr>
<tr>
<td>2007</td>
<td>5.6 Earthquake</td>
<td>Located on the East Coast and felt mainly in Galeota, no reported injuries.</td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td>Extensive damage to housing, transport. One person died.</td>
</tr>
<tr>
<td>2008</td>
<td>Flooding</td>
<td>In another event Extensive damage to housing, transportation, landslides blocks roads, Shelter at Bourg Mulatresse opened (20 ppl)</td>
</tr>
<tr>
<td>2009</td>
<td>4.8 Earthquake</td>
<td>Occurred on land and felt in Sangre Grande and Penal, no reported injuries.</td>
</tr>
<tr>
<td>2009</td>
<td>Flood</td>
<td>Severe flooding causing damage to property and the disruption of services.</td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td>4.7 felt throughout Trinidad, from Carenage to Moruga to Matura. No reported injuries or damages.</td>
</tr>
<tr>
<td>2010</td>
<td>Landslide</td>
<td>Boulders and debris brought down onto Western Main Road Cutting off access to Chaguaramas</td>
</tr>
<tr>
<td>2010</td>
<td>Flooding</td>
<td>Multiple severe flooding events throughout the year causing damage, 1 death, disruption of some services, traffic congestion, and associated secondary hazard impacts as well</td>
</tr>
<tr>
<td>2011</td>
<td>Landslides and Flooding</td>
<td>Multiple landslides throughout areas of North Trinidad, impacts included:</td>
</tr>
</tbody>
</table>
- Segment of North Coast Road blocked cutting off access to Maracas for a few hours.
- Damage to areas of upper La Seiva, Road Maraval.

<table>
<thead>
<tr>
<th>Year</th>
<th>Event Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>Landslide (Mudslide) and Flooding</td>
<td>Occurred in Diego Martin, 2 deaths, extensive damage to property. Estimated millions lost in damage.</td>
</tr>
<tr>
<td>2013</td>
<td>Oil Spills</td>
<td>A series of spills occurred between December 17th and 29th (2013) due to a rupture in a marine pipeline. Approximately 11 oil spills were confirmed and over 7,453 barrels of oil, spilled into the ocean causing both environmental and social impacts.</td>
</tr>
</tbody>
</table>

* Please note that this table does not represent a comprehensive listing. Major events were selected to depict the range of hazard impacts to which the country has been subjected in the past.
Figure 3: Trinidad Hazard Occurrences 2010-2011
Figure 4: Earthquake occurrences in and around Trinidad and Tobago (M2.5-10) for the period 2005-2013 (13/12/2013). Source: United States Geological Survey (USGS).
1.2.2 Economy

With regard to the Economic sector Trinidad and Tobago is considered to be a middle income, energy rich country with a relatively strong intuitions and political stability (Artana et al. 2007), with an estimated GDP of US$23.99 billion (World Bank 2012). The Republic displays the features of a dual economy, which is largely supported by the petroleum and manufacturing industries, services and to a lesser extent agriculture. Additional detailed of the percentage break down of annual GDP is depicted in Table 2 below. In fact, the islands are an important global provider of ammonia and methanol, as well as the largest supplier of Liquefied Natural Gas to the United States of America.

<table>
<thead>
<tr>
<th>SECTOR</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>*2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROSS DOMESTIC PRODUCT</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>PETROLEUM INDUSTRY</td>
<td>34.6</td>
<td>42.7</td>
<td>46.8</td>
<td>43.7</td>
<td>42.9</td>
</tr>
<tr>
<td>NON-PETROLEUM INDUSTRY</td>
<td>65.7</td>
<td>57.2</td>
<td>53.8</td>
<td>56.0</td>
<td>56.7</td>
</tr>
<tr>
<td>Agriculture and Sugar</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Manufacturing¹</td>
<td>5.8</td>
<td>5.4</td>
<td>5.8</td>
<td>6.0</td>
<td>6.3</td>
</tr>
<tr>
<td>Food, Beverages and Tobacco</td>
<td>3.2</td>
<td>3.1</td>
<td>3.1</td>
<td>3.6</td>
<td>3.5</td>
</tr>
<tr>
<td>Printing, Publishing etc.</td>
<td>0.6</td>
<td>0.4</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Wood &amp; Related Products</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Chemical &amp; Non-Metallic Minerals</td>
<td>1.3</td>
<td>1.1</td>
<td>0.9</td>
<td>0.9</td>
<td>1.0</td>
</tr>
<tr>
<td>Assembly Type and Related Industries</td>
<td>0.1</td>
<td>0.3</td>
<td>0.9</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Miscellaneous Manufacturing</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>Services</td>
<td>59.3</td>
<td>51.2</td>
<td>47.4</td>
<td>49.3</td>
<td>50.0</td>
</tr>
<tr>
<td>Electricity and Water</td>
<td>1.5</td>
<td>1.4</td>
<td>1.3</td>
<td>1.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Construction and Quarrying</td>
<td>11.3</td>
<td>7.2</td>
<td>5.8</td>
<td>5.0</td>
<td>5.1</td>
</tr>
<tr>
<td>Distribution and Restaurants²</td>
<td>14.8</td>
<td>13.7</td>
<td>12.9</td>
<td>13.8</td>
<td>13.8</td>
</tr>
<tr>
<td>Transport, Storage &amp; Communication</td>
<td>5.9</td>
<td>5.3</td>
<td>4.8</td>
<td>5.4</td>
<td>5.4</td>
</tr>
<tr>
<td>Finance, Insurance &amp; Real Estate etc.</td>
<td>11.9</td>
<td>11.3</td>
<td>11.1</td>
<td>11.0</td>
<td>11.5</td>
</tr>
<tr>
<td>Government</td>
<td>9.2</td>
<td>7.9</td>
<td>7.5</td>
<td>8.7</td>
<td>8.7</td>
</tr>
<tr>
<td>FISIM ³</td>
<td>(4.5 )</td>
<td>(4.4)</td>
<td>(3.8)</td>
<td>(3.9)</td>
<td>(3.9)</td>
</tr>
<tr>
<td>Add: VALUE ADDED TAX (VAT)</td>
<td>4.2</td>
<td>4.6</td>
<td>3.3</td>
<td>4.2</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Table 2: Percentage Contribution of Gross Domestic Product of Trinidad and Tobago at Market Prices (Current Prices, 2012). Source: Review of the Economy 2013

¹/Excludes oil refining and petrochemical industries
²/Excludes distribution of petroleum products
³/Financial Intermediation Services Indirectly Measured
p :provisional
e: estimate
Like most economies, Trinidad and Tobago is susceptible to shifts in global markets, in fact due to its heavy dependence on energy, the Trinidad and Tobago economy can be considered unstable at times, both in nominal and real terms. In fact “per capita real GDP in the last 50 years has been one of the most volatile among a set of comparable economies, only Kuwait and Saudi Arabia, other oil producer countries, are as volatile as Trinidad & Tobago” (Artana et al. 2007). The development of the gas industry, while proving strong economic support, is not strong enough to provide protection from energy price shocks. This is validated by the slow economic growth in the years following the global economic recession, as is evidenced by its fluctuating GDP growth rates. During the period 2000 and 2007, the country averaged a growth rate of over 8%, however in recent times this has slowed considerably, due to the decline in oil and gas prices and changing markets, with countries like Guyana, Suriname and Haiti now taking the lead in GDP growth. Figure 2 which depicts GDP growth rates (% annual) for 14 CARICOM member states from the period 2000 to 2012 clearly illustrates how dramatic these fluctuations can be.

Figure 5: Percentage annual GDP Growth for CARICOM States over the period 2000-2012
* Data for Montserrat unavailable
1.2.3 Culture and Society

Trinidad and Tobago is one of the most diverse countries in the Caribbean region often referred to as a ‘melting pot’ or a ‘rainbow country’. The country gained its independence from the United Kingdom in 1962 and officially became a republic within the commonwealth in 1976. The islands are the birthplace of Calypso, Soca, Chutney and Parang music as well as the Steelpan, which is regarded as the only acoustic musical instrument to be invented during the 20th century.

The islands original inhabitants were Amerindian tribes originating from the South American continent, of which very few remain today. In its history the islands were claimed at different times by Spain, France, and Britain, which accounts for some of the European influences seen today. Under colonial rule, African slaves were brought in to work in sugar cane plantations, and when slavery was officially abolished in 1834, East Indian and Chinese workers were brought in as indentured servants. The nation’s rich history therefore has created conditions for the settlement of a variety of ethnic groups as seen in Figure 1. Most recent studies (2011) indicate that East Indians (35.4%) and Africans (34.2%) were the two largest ethnic groups in Trinidad and Tobago followed by persons of Mixed race (22.8%) with smaller groups such as Chinese, Portuguese, Caucasian, indigenous people etc making up the rest of the population.

![Figure 6: Percentage Distribution of Total Population by Ethnic Group, for Trinidad and Tobago, 2011. Source: CSO 2013](image-url)
The same diversity can be seen in the island’s multi-religious community, with Roman Catholicism as “the largest religious denomination with 285,671 followers, having declined from a membership of 289,711 in 2000, a decrease of 1.4%. Other religious denominations that experienced decreases in their membership in 2011 were Hinduism, Anglican, Presbyterian/Congregational and Methodist” (CSO 2013). The nation’s religious distribution is illustrated in Figure 2.

The country is also showing progress within the education sector, as the 2011 census determined that approximately 29.8% of the population had attained primary-level education and “proportions amounting to 43.5% had attained secondary and post-secondary, with 6.2% attaining tertiary non-university level education and 8.4% tertiary university-level education” (CSO 2013). However, when disaggregated by sex, the research shows that males only outnumbered females up to the primary and secondary levels, with a high number of females receiving tertiary level education. The high level of education is reflected in the country’s adult literacy rate of 98.6% according to 2013 estimates (World Bank).

Figure 7: Percentage Distribution of Total Population by Religious Groups for Trinidad and Tobago (2011). Source: CSO 2013
Chapter Summary

- A hazard can be described as any potentially damaging event be it from a natural or anthropogenic origin
- Vulnerability refers to conditions which increase susceptibility of an element to hazard impacts
- Risk refers to the probability of harmful consequences or losses resulting from interactions between hazards and vulnerabilities
- The most frequently occurring hazards affecting Trinidad and Tobago are flooding, landslides, high wind events and fires
- Aside from the prevalent hazards listed above, the country is also susceptible to a plethora of additional threats including but not limited to earthquakes, industrial hazards, tsunamis etc.
- The culturally diverse islands have within the past 20 years experienced dramatic changes to both the built and natural environment particularly due to increased development
- With regard to the socio-economic conditions, the islands are quite diverse and while able to boast a vibrant economy, it is still susceptible to shocks as evidenced by its past fluctuations.
Environmental Vulnerability of Trinidad & Tobago
A Preliminary Study from the Disaster Management Perspective
Environmental vulnerability refers to the inability of the built and natural environment to adequately cope with the impacts of hazards leading to their degradation. These elements can include critical facilities, buildings and infrastructure; natural resources, habitats, and ecosystems to name a few. Physical vulnerability may also be determined by aspects of the population such as “population density levels, remoteness of a settlement, location, the design and material used for critical infrastructure and for housing (UNSIDR).

Due to man’s interaction with the environment there are very few places left that exist as purely natural or anthropogenic, the majority being integrated landscapes which underscores the need for man to be able to sync seamlessly with his environment and prevent imbalances in the system. This is of course easier said than done, as is evidenced by the staggeringly high levels of environmental vulnerability not just in Trinidad and Tobago but across the globe.

Factors Contributing to Environmental Vulnerability

2.1 Planning Policy and Legislation

In Trinidad and Tobago there are a variety of guidelines, regulations and governing documents relevant to the built and natural environment. These will be highlighted in sections 2.1.1 and 2.1.2.

2.1.1 Planning, Policy and Legislation for the Natural Environment

In this study the term ‘natural environment’ will be used to describe all naturally occurring living and non-living elements of Trinidad and Tobago such as geological formations, ecosystems, and natural resources.

2.1.1.1 Legislation

- The Environmentally Sensitive Areas (Matura National Park) Notice, 2004
- The Water Pollution (Fees) (Amendment) Regulations, 2007
- The Water Pollution (Fees) Regulations, 2001
- The water Pollution Rules, 2001
- Environmental Management Act, 2000
- Environmentally Sensitive Areas Rules 2001- Legal Notice No. 37
- Environmentally Sensitive Species Rules 2001 - Legal Notice No. 63
- The Certificate of Environmental Clearance Fees Charges Regulations 2001 Legal Notice No. 91
- The Certificate of Environmental Clearance Order 2001- Legal Notice No.103
- The Certificate of Environmental Clearance Rules 2001 - Legal Notice No. 104
- Noise Pollution Control Rules 2001- Legal Notice No. 60 : Download here
- The Noise Pollution Control (Fees) Regulations 2001- Legal Notice No. 51
- The Environmental Commission Rules of Practice and Procedure 2001
- Draft Air Pollution Rules, 2013
• Draft Air Pollution (Fees) Regulations, 2013

2.1.1.2 International Conventions and Treaties

• Basel Convention
The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, usually known as the Basel Convention, is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries (LDCs).

• Stockholm Convention
Stockholm Convention on Persistent Organic Pollutants is an international environmental treaty, signed in 2001 and effective from May 2004, that aims to eliminate or restrict the production and use of persistent organic pollutants (POPs).

• Ramsar Convention
The Ramsar Convention (formally, the Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilization of wetlands,[1] i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value.

• Convention on Biological Diversity
The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives:
1. The conservation of biological diversity
2. The sustainable use of the components of biological diversity
3. The fair and equitable sharing of the benefits arising out of the utilization of genetic resources

• Convention on International Trade in Endangered Species
CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

• Vienna Convention and Montreal Protocol
The Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol on Substances that Deplete the Ozone Layer are dedicated to the protection of the earth’s ozone layer. With 197 parties, they are the most widely ratified treaties in United Nations history, and have, to date, enabled reductions of over 97% of all global consumption of controlled ozone depleting substances (measured in ODP tonnes) (UNEP 2013).

• Kyoto Protocol
The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change, which commits its Parties by setting internationally binding emission reduction targets (UNFCCC 2013)

2.1.3 Plans and Policies
- National Environmental Policy (NEP) 2006
- Nationals Policy and Programmes on Wetland Conservation for Trinidad and Tobago 2002
- National Biodiversity Strategy and Action Plan
- National Forest Policy 2011
- National Protected Areas Policy 2011
- National Climate Change Policy 2011
- National Tourism Policy 2010
- Draft National Wildlife Policy

2.1.2 Planning, Policy and Legislation for the Built Environment

In this study the term built environment will be used to describe anthropogenic elements of Trinidad and Tobago specifically buildings, infrastructure, critical facilities etc.

2.1.2.1 Legislation

- Town and Country Planning Act 1960 (Updated 2012)
  An Act to make provision for the orderly and progressive development of land in both urban and rural areas and to preserve and improve the amenities thereof; for the grant of permission to develop land and for other powers of control over the use of land; to confer additional powers in respect of the acquisition and development of land for planning; and for purposes connected with the matters aforesaid.

- Planning and Development of Land Bill 2000
  An attempt to better unite the country’s citizenry and private sector resources to accomplish national development objectives by devolving significant responsibilities for development planning and control to local authorities. The instruments for this devolution are to be found in the Planning and Development of Land Bill 2000 (PADL). PADL is expected to make physical planning and development control more transparent and to encourage cooperation and coordination amongst Government Departments, local government and the private sector to make the national physical planning system efficient and effective.

- The Highways Act 1970 (Updated 2012)
  An Act to consolidate with amendments certain written laws relating to highways, streets and bridges in Trinidad and Tobago.

- The Housing Act 1962 (Updated 2012)
An Act to create the Trinidad and Tobago Housing Development Corporation to replace existing statutory bodies dealing with housing, and to revise, consolidate and extend the laws relating to the encouragement of construction of dwelling houses and home ownership, and for matters incidental thereto.

- **Trinidad and Tobago Small Building Guide**
- **Caribbean Building Code (in development)**
  Project initiated in 2004 and still incomplete. The primary object was described to be the production of an updated and comprehensive set of regional building standards and the expansion of their use in the Caribbean, thereby facilitating the safe and economical design of buildings in the region.
- **State Land Regularization of Tenure Act 1998**
  An Act to protect certain squatters from ejectment from State Land; to facilitate the acquisition of leasehold titles by both squatters and tenants in designated areas and to provide for the establishment of land settlement areas.

### 2.1.2.2 Plans, Policies and Guiding Documents

- **National Physical Development Plan 1984**
  This plan was scheduled to be updated every five years, which has not been done. At present the document is being reviewed and is expected to be updated with the development of the National Spatial Development Strategy.

- **Municipal Development Plans**
  Spatial Development Plans were created for each of Trinidad’s 14 Municipalities

- **The Land Acquisition Act 1994 (Updated 2012)**
  An Act to govern the acquisition of land for public purposes

- **Northern Range Hillside Development Policy**
  A policy to regulate development on slopes on the Northern Range Formation

Currently, no national building code exists. What is available however, is a small building guide that is not enforced in any way. In Trinidad and Tobago, there is a somewhat voluntary approach to safer building, needless to say as a result of this and given current public perception on the threat of hazards, a sizeable percentage of the population either do not see safer building as a priority, or do not have the means by which (resources and knowledge) to build better, or a combination of both.

This is exacerbated by the fact that there is no mandatory registration of building professionals, no licensing for building contractors, the persons who are actually responsible for construction.
2.1.3 Analysis of Regulations for the Built and Natural Environment

2.1.3.1 There is a need for greater guidance on the management of the built environment

As can be seen in the lists above (section 2.1.1 and 2.1.2) which are by no means comprehensive, there are several pieces of legislation, plans and policies and even international treaties and conventions which govern the built and natural environment. It is apparent however that there are significant disparities in the guidance available for the natural environment versus the built, which is quite reflective in the heightened physical vulnerability the islands continue to display.

2.1.3.2 Plans, Policies and Legislation need to be regularly updated

Firstly, it should be noted that many of these regulations are created on an Ad Hoc basis, indicating a definite need for updating and review to ensure that new data and major issues particularly disaster management and risk reduction be properly integrated into all plans, policies and legislation. This is important as the built and natural environment of Trinidad and Tobago continues to undergo rapid change.

2.1.3.3 Penalties are too minor to deter transgression

Another aspect that needs to be revised is that of penalties. Many of the penalties for offences are either nonexistent or too small, creating little or no impetus to deter transgression. In fact, individuals particularly businesses may find it more lucrative to break the law and accept the punishment, for example in situations where the penalties are small fines, when compared to the profit to be made.

2.1.3.4 Monitoring and Enforcement is weak

One common suggestion when addressing the inadequacies of existing policies and legislation is to create new regulations that deal specifically with the issue at hand, and while this is true in some cases, there is an urgent need is to enforce and properly monitor existing regulations. Many offences go unnoticed because the responsible agencies do not have adequate resources, such as the amount of qualified staff to properly monitor actions.

2.1.3.5 Ineffective Legislation

Unfortunately significant portions of the population are ignorant of the majority of laws governing Trinidad and Tobago, even more so the “less exciting” environmental legislation meaning that citizens may be unknowingly committing offences. On the other hand, there are those members of society who are aware of to the regulations and blatantly disregard them, usually for personal gain. One prevalent example of this is the issue of illegal quarrying in Trinidad and Tobago in areas such as Valencia, which is closely linked to the occurrence of flooding and landslides.

2.2 Increasing Settlement in High Risk Zones

Settlement in high risk zones is a major concern in Trinidad and Tobago. With internal migration issues such as the drive to live closer to urban centers for employment and convenience, limited access to land for home construction, and the desire for home ownership, settlement on marginal
lands such as hillsides, flood plains and even surrounding industrial areas, has increased significantly in the past 20 years.

The findings of the 2011 census indicated that that “1,322,546 persons lived in 401,382 private households as compared to the 2000 census which showed that 1,250,652 persons lived in 343,180 private households. The remaining 5,473 persons in the total population lived in institutions or were street dwellers. The total number of households increased 17% over the intercensal period” (CSO 2013).

This increase in the number of households was seen in all municipalities except for Port of Spain and San- Fernando, two major urban areas which already experience constraints due increasing building density and limited space. Increases in development (households) were most evident in the Chaguanas and Sangre Grande municipalities, both areas in which the urban centers have experienced significant growth, and Tobago. Table 3 shows the number of households for the period 2000 to 2011, indicating that the number of households in Trinidad increased by 16.2 % and in Tobago by 32.6%.

<table>
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<tr>
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<td>15,110</td>
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<td>9,779</td>
<td>8,400</td>
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<td>3.8</td>
<td>0.4%</td>
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<td>Borough of Chaguanas</td>
<td>83,489</td>
<td>67,248</td>
<td>24,644</td>
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<td>162,259</td>
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<td>Mayaro/Rio Claro</td>
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<td>21,779</td>
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<td>3.8</td>
<td>0.8%</td>
<td>1.7%</td>
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<tr>
<td>Princes Town</td>
<td>102,369</td>
<td>91,901</td>
<td>29,661</td>
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<td>3.9</td>
<td>1.0%</td>
<td>2.2%</td>
</tr>
<tr>
<td>San Juan/Laventille</td>
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<td>156,966</td>
<td>49,404</td>
<td>45,926</td>
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<td>3.4</td>
<td>0.0%</td>
<td>0.7%</td>
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<td>Sangre Grande</td>
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<td>64,187</td>
<td>22,706</td>
<td>16,622</td>
<td>3.3</td>
<td>3.9</td>
<td>1.5%</td>
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<td>81,825</td>
<td>26,125</td>
<td>22,393</td>
<td>3.3</td>
<td>3.7</td>
<td>0.6%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Tunapuna/Piarco</td>
<td>212,825</td>
<td>199,939</td>
<td>64,176</td>
<td>55,206</td>
<td>3.3</td>
<td>3.6</td>
<td>0.6%</td>
<td>1.4%</td>
</tr>
<tr>
<td>TOBAGO</td>
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<td>53,226</td>
<td>20,125</td>
<td>15,180</td>
<td>3.0</td>
<td>3.5</td>
<td>1.2%</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

Source: CSO 2013
Settlements in high risk zones experience heightened vulnerability due to the fact that they are more directly exposed certain risks. Take for example the Marabella fence line communities that surround the Petrotrin Oil Refinery, as well as the small community of staff homes which are situated within the compound itself. These communities have the potential to be directly and very heavily impacted should industrial hazards such as spills, leaks, fires or even explosions occur within the industrial site. This is why emergency plans for industrial sites typically include surrounding communities. There is also growing development on reclaimed land, in Port of Spain and Point Lisas which is at high risk for seismic hazards and particularly susceptible to the hazard of liquefaction.

Secondly, studies indicate that many of the settlements established on high risk zones have traditionally been low income squatter settlements, where homeowners have not received approval for building. In Trinidad and Tobago squatting has now become the ‘go to’ option for low income households facing the challenges of poverty, and competition for affordable government housing. The inability to legitimately find housing has led to illegal squatting on vacant parcels of state and even private parcels of land, many of which are considered to be environmentally unsafe.
Such communities typically feature poorly constructed buildings, little or no access to basic amenities such as pipe borne water, improper sewage facilities and very limited mechanisms for risk transfer. Squatter settlements are often unregulated and are continuing to grow, especially in light of the Squatter Regularization Act. It is estimated that “250 000 people in Trinidad and Tobago have been squatting along old train lines, on the banks of rivers and even along the coasts” (LSA 2011). As of 2011 there were approximately 187 squatter settlements, illustrated in Figure 9, registered with the Trinidad and Tobago Land Settlement Agency, which still does not account for total number, as there are many more communities which remain unregistered, and needless to say that more have developed in the past 2 years.

![Figure 9: Two squatters put the final touches on a house at Warden Road Extension, Point Fortin. Source: Guardian 2011](image)

Unfortunately another trend has emerged, locally referred to as “high class squatting”, which refers situations were individuals who already have homes, or can afford to purchase or rent property choose to occupy state or private lands illegally. They individuals usually join established squatter settlements, and quickly put up structures, most often more permanent concrete dwellings, in order to secure plots of land. This is driven by the desire to acquire state lands which in the past have been granted to landless squatters.
Figure 10: Informal Settlements registered with the Land Settlement Agency as of 2011. Source: ODPM 2011
2.3 Exacerbatory Factors

2.3.1 Unsustainable Practices

It is a well known fact that “hazards by themselves do not cause disasters- it is a combination of an exposed and ill-prepared population or community with a hazard event that results in a disaster” (UNISDR, 2004). In Trinidad and Tobago there are many, unsafe or unsustainable practices which exacerbate the impacts of hazards, which have in the past triggered a shift from an event such as short periods of intense rainfall, to become hazardous. In severe cases, this can be taken further to a point where anthropogenic actions can create conditions for the exacerbation of hazards to disasters.

Some of these activities include:

2.3.1.1 Quarrying

Quarrying is a term used to describe the excavation of earth materials such as stone, rock, construction aggregate, riprap, sand, gravel or slate from the ground. As mentioned previously both legal and illegal quarries exist in Trinidad and Tobago, and they way in which they are managed is quite a cause for concern.

At present in Trinidad there are 69 active quarries (both public and private), where thirty one (31) are sand and gravel quarries. Forty percent of these quarries are located on state lands. In Tobago the primary material quarried is andesite. The demand for construction aggregates increased considerably from fifteen (15) million cubic yards in 2006 to twenty (20) million cubic yards in 2007 to satisfy the heightened activity in the construction sector. This has led to an upsurge in quarrying activity, which has adversely affected the forests, wild life sanctuaries, water courses and communities. Quarrying can also contribute to slope instability, deforestation through the removal of vegetative cover, and abandoned quarries can collect water creating breeding grounds for mosquitoes.

Quarries need to receive approval before they can operate, and part of the application process entails that a detailed plan for rehabilitation of the site be submitted. However, once approval is granted, there is very little mentoring to ensure that rehabilitation is conducted. In situations where there approval has not been granted or sought, poses quite a challenge for responsible agencies to manage, as they are often not made aware of the operation until after it has stared. Additionally such agencies do not have the resources for constant monitoring, a fact that is take advantage of by illegal quarry operators.
2.3.1.2 Deforestation and Removal of Mangroves

Approximately 44.1% or about 2260.0 km² of Trinidad and Tobago is forested. Of this, 6.2% — or roughly 140.00 km² is classified as primary forest, the most biodiverse form of forest. During the period 1990 and 2000, Trinidad and Tobago lost an average of 7 km² of forest per year, which amounts to an average annual deforestation rate of 0.30%. Between 2000 and 2005, the rate of forest change decreased by 41.1% to 0.18% per annum. In total, between 1990 and 2005, Trinidad and Tobago lost 3.8% of its forest cover or around 90 km². Despite their importance and the relevant regulations in place for their protection, mangroves are also being threatened by encroaching development.

The degradation of elements of the environment can produce very negative impacts. Take for example the municipality of Diego Martin which was very heavily impacted, by the hydrological hazards of flooding and landslides in 2013. The flooding in particular was triggered a combination of intense rainfall, and the elimination of the huge mangrove delta—west of Cocorite, between Morne Coco Road, Four Roads and the Gulf of Paria. The permeable soil which would have allowed water to infiltrate was replaced with compacted earth fill, covered in concrete and asphalt, causing overland flow. The mitigation implemented in the form of box drains which empty into undersized drainage channels proved to be insufficient to carry the volume of water. Unplanned and unmitigated hillside developments contributed to slope instability which was only exacerbated by the intense rainfall and resultant flooding.

2.3.1.3 Capacity Natural and Manmade Drainage Channels

Drainage is handled by multiple agencies in Trinidad and Tobago, which in the past as caused several issues in coordination, as drainage channels are typically connected, meaning that if there
is an issue in one segment due to blockage or insufficient carrying capacity, the entire system can be compromised. There are two major issues with regard to drainage which directly contribute to flooding.

The first issue is that of drainage capacity, the rapidly changing landscape, the removal of permeable surfaces has increased the amount of overland flow, and the man made drains are unable to effectively drain the water away fast enough to prevent flooding. Secondly the already strained drainage system is further compromised by the dumping of garbage and debris, and in the case of natural waterways such as rivers and streams, the accumulation of sediment. Both natural and manmade water ways need to be regularly maintained particular prior to the rainy season.

![Figure 12: Debris washed from drains in Port of Spain. Source: ODPM 2012.](image)

2.3.2 Mitigation not keeping pace with Development

As mentioned previously in recent years the country’s physical landscape has changed dramatically. Major urban centers such as Port-of-Spain, San-Fernando and Scarborough have experienced increases in both building and population density, and towns such as Chaguanas and Sangre Grande are gradually gaining prominence as major urban areas attracting people and investment. Development has also increased in suburb and even rural areas, causing issues such as reduced vegetative cover and even competition for resources. Much of this growth was unplanned and not properly managed triggering problems in the long term and contributing significant to vulnerability.
Take for example the rapid increases in development of the city of San-Fernando in south Trinidad. With the removal of vegetation to make way for paved surfaced there is a greater overland flow from rainfall, with increases in buildings and population there is more waste water to be discharged, and the fact that the city has been gradual expanding with developments very close to a coastline the risk of flooding is quite high. When we add the factor of drainage which has not been updated to cope with this rapidly evolving city, it is apparent where the vulnerabilities lie.

Figure 13: High Street San-Fernando in 1880’s (a) and 2012 (b). Source: Guardian 2012 and ODPM 2012.
Chapter Summary

- Environmental vulnerability refers to the inability of the built and natural environment to adequately cope with the impacts of hazards leading to their degradation.

- There are a variety of regulations currently in place that dictate the way in which the natural and built environment is managed, however there are some constraints namely:
  - There is a need for greater guidance on the management of the built environment
  - Plans, Polices, and Legislation need to be regularly updated
  - Penalties are too minor to deter transgression
  - Monitoring and Enforcement is weak
  - Ineffective Legislation

- Changes in development patterns show an increased level of development in high risk zones such as floodplains, unstable slopes and industrial zones.

- A combination of unsustainable practices such as quarrying, deforestation including the destruction of mangroves, and the poor management of natural and manmade drainage has also contributed to environmental vulnerability.
Economic Vulnerability of Trinidad & Tobago
A Preliminary Study from the Disaster Management Perspective
3.0 Economic Vulnerability

Economic vulnerability refers to the “inherent proneness of an economy to exogenous shocks, arising out of economic openness” (Briguglio et al. 2008). For the purposes of this study however, the definition of economic vulnerability will be extended to include multiple factors including but not limited to economic openness. Understanding economic vulnerability is particularly important in the case of small island developing states such as the islands of the Caribbean region as studies indicate that such states are typically prone to exogenous shocks.

The importance of maintaining economic stability cannot be understated, as a robust economy plays a critical role in ensuring resilience in emergency situations, through the enhancement of arguably all phases of the Disaster Management Cycle (illustrated in Figure 14), be it directly or indirectly. It is important to note at this point, that the “Disaster Management Cycle” itself, is an outdated concept, as it implies a reactive, response centric system, which has largely been discarded, in lieu of a more comprehensive approach to disaster risk management. The main change being that several aspects of the cycle namely Prevention, Mitigation, and Preparedness are now considered to be continuous processes that should always be maintained, regardless of the threats being actual or potential.

![Figure 14: The Disaster Management Cycle.](image-url)
The long term savings that can be made through investing in incentives for prevention, mitigation and preparedness is well known and echoed in Honoree’s (2011) notion that “every dollar spent on preparedness, saves twelve dollars in recovery and rebuilding”. Maintaining a stable economy is arguably most important, during the response, recovery and rehabilitation phases. Having adequate emergency support functions can suppress the impacts of hazards, and at times prevent emergencies from escalating to disasters, while an analysis of historic disaster events, show that recovery and rehabilitation is no easy feat, one in which only the most robust economies are able to manage without external aid.

The benefits of economic stability with regard to disaster resilience can therefore, be felt at both the local and national level, ensuring that a higher percentage of citizens have the means by which to take precautions to protect themselves from the impact of hazards, for example through investing in mechanisms for risk transfer. The remaining segment of the population, and can benefit from grants and incentives to promote resilience, such as the Emergency Housing Repair Grant and the Home Improvement Grant. Additionally, being able to boast economic stability can create numerous opportunities for a nation, such as encouraging foreign investments, and basically acting as a catalyst for further development and increased economic activity.

Factors Contributing to Economic Vulnerability

This study, due to its scope, will address the overarching factors contributing to economic vulnerability, of which there are several, some originating within the economic sector, with others cutting across multiple sectors to indirectly heighten vulnerability, due to that fact that in small islands states such as Trinidad and Tobago, it is almost impossible to avoid linked systems.

3.1 Proneness to Disasters

The occurrence of major disasters in small island states has the potential to wipe out critical economy supporting sectors, particularly in Small Island Developing States (SIDs). The Caribbean is reputed as one of the most disaster prone regions in the world, evidenced by the plethora of natural and at times anthropogenic hazards it is exposed to as a region, resulting in billions of dollars worth of damage and numerous deaths. Trinidad however, and to a lesser extent, Tobago, has escaped the brunt of major disasters, that is when compared to our Caribbean neighbours, with recent hazard events being contained at the community or municipal level, rather than being nationwide. Additionally, the majority of hazards affecting Trinidad and Tobago do not escalate to disaster status, as the country is able to adequately respond to, absorb, and recover from impacts, without having to seek internal aid. Although disasters can threaten non-island countries as well, the impact on island economies is typically greater in terms of damage per unit area and cost per capita due to country size.

3.2 Size

The size of a country is typically determined by “its population, its land area or its gross national product” (Bruguglio, 1995). Small Island States (SIDs) therefore are often subjected to a variety of
disadvantages. Firstly, small states such as Trinidad and Tobago, with an area of 5,128 kilometres have limited natural resources, and when heavy dependence is placed on these resources, economic vulnerability is intensified. Additionally, SIDs are less able to fully utilise Economies of scale, in which goods or services can be produced on a larger scale but at a lower cost. Limits can also arise due to the availability of manpower, skilled labour etc, keeping in mind that major disasters can bring about a significant death toll, potentially crippling the work force which will be needed for recovery, and restoring normalcy.

3.3 Economic Openness

Economic openness refers to any situation in which economic activities take place both domestically and internationally, as is the case in Trinidad and Tobago, and is typically characterized by the ratio of international trade to GDP. High levels of economic openness can render a country susceptible to external economic conditions, over which it has little or no control. This was illustrated in the way the decline in oil prices affected GDP growth in 2008. Trinidad and Tobago has made quite an effort to participate in international trade. Take for example the adoption of the Economic Partnership Agreement (2007) which is a permanent instrument of trade partnership between CariForUM (CARICOM and Dominican Republic) and the European Community (EC) in an effort to negotiate the best opportunity for export expansion and economic development to aid the diversification thrust with Europe. Through active participation in international trade, while beneficial in terms of growth and development, the country exposes itself to a higher degree of shocks such as fluctuating prices and changes in demand.

3.4 Export Concentration and Dependence on Strategic Imports

Trinidad and Tobago's trade patterns have fluctuated in recent years experiencing both deficits and surpluses. The nation’s major export partners are the United States, Spain, Jamaica, Netherlands and Mexico, and key export commodities include petroleum and petroleum products, liquefied natural gas (LNG), methanol, ammonia, urea, steel products, beverages, cereal and cereal products, sugar, cocoa, coffee, citrus fruits, vegetables and flowers (CIA World Factbook, 2014).

Imports in Trinidad and Tobago increased to 2421.90 USD Million in the first quarter from 2013 from 2244.10 USD Million in the fourth quarter of 2012 (Central Bank, 2013). From 1995 until 2013, Trinidad and Tobago imports averaged 1318.8 USD Million reaching an all time high of 2740.4 USD Million in September of 2008 and a record low of 415.8 USD Million in March of 1995. Primary imports include oil, iron ore, fuel, vehicles, water heaters, ethyl alcohol, iron and steel pumps and catalysts. Trinidad and Tobago’s major import partners are the United States, Brazil, Colombia, Russia, Germany, China, Japan, Nigeria and Venezuela.

Dependence on a narrow or very specific range of exports heightens risk associated with a lack of diversification, which in turn exacerbates vulnerability associated with economic openness. On the other hand, heavy dependence on strategic imports highlight the exposure of the economy to shocks regarding the availability and potential cost of key imports such as energy, food and other
essential supplies. The significance of which can be measured by the ratio or exports and imports to GDP, illustrated in Figure 15 below.

With the most recent estimates indicating that approximately 54.1% (Central Bank, 2013) of the nation’s GDP is tied to exports, it apparent then that should export supporting sectors such as the energy industry, or even critical infrastructure such as ports be comprised, our economy will be compromised as well.

![Exports and Imports in relation to GDP](image)

Figure 15: Exports and Imports for Trinidad and Tobago (2009-2012). Source: Central Bank of Trinidad and Tobago (2013). Please note that data for 2012 is provisional (p)

### 3.5 Sector Dependence

Over half of the country’s GDP is derived from the Energy/Industrial Sector. Unfortunately however, these industrial centers are considered to be highly vulnerable, to due exogenous shocks from global economic patterns and physical threats due to its close proximity to high risk zones and shown in Figure 16.
Figure 16: Industrial Areas and Ports in Proximity to high risk zones. Source: ODPM 2012
Should these facilities become compromised due to the impacts of a major disaster, a valuable source of national revenue will be cut off, at a time when it will be needed the most. Another exacerbating factor is the time and cost required to bring such industries back online and producing, keeping in mind during this time, the market may experience several shifts.

Trinidad and Tobago’s development is characteristic of many oil and gas rich countries, in the sense that it faces problems such as elevated macro volatility, and off course the underdevelopment of the non-energy sector, which places the country in a precarious position should for some reason productivity of the industrial sector were to decline. Fluctuations in the price of crude oil alone, as illustrated in figure 17 shows just how susceptible to shifts the energy industry can be.

![Crude Oil Prices 1861-2011](image)

Figure 17: Fluctuations in Crude Oil Prices from 1861-2011 in US dollars per barrel. Source: BP WorkBook of Historical Data.

### 3.6 Inadequate Coping Mechanisms

The cost of damages from the impact of high magnitude disasters can run into the billions of dollars, and as mentioned before the impact in small islands states can be more intense. Private and public agencies such as “the Association of Trinidad and Tobago Insurance Companies
(ATTIC), Ministry of Food Production, Land and Marine Affairs, Ministry of People and Social Development, the Ministry of Housing and the Environment (MHE) and ODPM conducted analysis for claims made as a result of flooding for the period of 2006 to 2010” (ODPM, 2013).

Hazard Losses 2006-2010 in TT Dollars

![Hazard Losses 2006-2010 in TT Dollars](image)

Figure 18: Financial Losses in TT dollars over the period 2006-2010. Source: ODPM 2011.

As shown in figure 18, approximately a total of $47,859,301.00 TT dollars, was spent in 2010, recovering from losses due to hazards, a value which has continued to increase over time. The significance of this figure is felt when analyzing the fact that these damages resulted from hazard events and not disasters, from which the financial cost of damages would be much greater. It is therefore apparent that the country needs to ensure that financial coping mechanisms are available for disaster management, particularly recovery and rehabilitation.

At present the Republic of Trinidad and Tobago has implemented several financial mechanisms to cope with the economic impacts of a major disaster. They are as follows:

1. **The Heritage and Stabilization Fund**
   This fund was established by the Government or the Republic of Trinidad and Tobago (GORTT) in an effort to: cushion the impact or sustain public expenditure and create an alternative stream of income so as to support public expenditure capacity during period of
revenue downturn; and provide a heritage for future generations from savings and investment income derived from excess revenues. The Net Asset Value of the Heritage and Stabilization Fund as at December 2012 is US$4,780.1 Mn. While this fund speaks specifically to revenue downturns as a result of a decline in crude oil and natural gas prices and the depletion of non-renewable petroleum resources, it is still considered a potential source for disaster relief funding.

2. **The Caribbean Catastrophe Risk Insurance Facility (CCRIF)**
   Operated and owned by Caribbean governments, the Caribbean Catastrophe Risk Insurance Facility (CCRIF) is a risk pooling facility designed to limit the financial impact of catastrophic hurricanes and earthquakes. Trinidad and Tobago is insured with CCRIF in 2012 for a value of US$17,119 Mn for Hurricanes and US$99,554,000 Mn for Earthquakes.

3. **The United Nations Emergency Relief Fund**
   Relief by the United Nations requires a damage assessment within 72 hours of the event. However, unlike CCRIF, annual premiums are not required to access the funds in times of disaster (ODPM, 2012).

4. **The Inter-American Emergency Aid Fund (FONDEM)**
   The Inter-American Emergency Aid Fund, otherwise referred to as FONDEM, is dependent on member state contributions and other donations solicited by the Director General of the Organization of American States (OES). It provides up to USD25,000 in the event that Trinidad and Tobago has suffered a natural disaster impact (ODPM, 2012).

5. **The Caribbean Development Bank (CDB)**
   The Bank has made an Emergency Grant (limit of USD200,000), an Emergency Response Load (USD750,000) and a Rehabilitation Loan (USD 3 Million). Both the Emergency Grant and the Emergency Response Load can be utilized for infrastructural uses such as, road rehabilitation, restoration of electricity and telephone services. Whereas, the disbursement of the funds obtained from the Rehabilitation Facility is determined by the country’s discretion.

While it is commendable that multiple mechanisms are in place to assist in the event of financial need at a national level, the sad reality remains that these funds combined will still not be able to fully cover the cost of rebuilding and rehabilitation, towards a return to normalcy in post disaster scenarios, especially if critical revenue generating sectors such as the energy sector are disabled.

3.7 **Additional Factors**

There are a variety of additional factors aside from those listed above, which also contribute to economic vulnerability, but due to the scope of this study, there were not considered to be major factors, and as a result they could not be discussed in detail. Some of these factors include:
• **Insularity and Remoteness:** Traditionally island states were considered to be insular, but in modern times this has changed with advances in transport and the development of multiple routes and methods of travel. However this underscores the importance of ports and ensuring that multiples points of access and entry to a country are available and resilient.

• **Dependence on Foreign sources of Finance:** When compared to our foreign neighbors, Trinidad and Tobago is less reliant on external aid. In fact the Organization for Economic – Co-operation and Development (OECD), in 2011 removed the twin island republic from its list of developing nations.

• **Concentration of Economic Sectors:** In the aftermath of a disaster when recovery and rebuilding become an issue, having access to one’s finances is imperative, and any such delays in the process can bring about unnecessary chaos. Take for example the case in Jamaica; post Hurricane Ivan, where many locals were dependant on remittances for recovery and rebuilding. In Trinidad and Tobago many financial institutions are located in the capital city of Port-of-Spain.
Chapter Summary

- Economic vulnerability refers to the “inherent proneness of an economy to exogenous shocks, arising out of economic openness” (Briguglio et al. 2008). For the purposes of this study however, the definition of economic vulnerability will be extended to include multiple factors including but not limited to economic openness.

- The benefits of economic stability with regard to disaster resilience can be felt at both the local and national level.

- Major factors contributing to Economic Vulnerability include:
  - Proneness to Disasters
  - Size
  - Economic Openness
  - Sector Dependence
  - Export Concentration and Dependence on Strategic Imports
  - Sector Dependence
  - Inadequate Coping Mechanisms
Socio-Cultural Vulnerability of Trinidad & Tobago
A Preliminary Study from the Disaster Management Perspective
4.0 Socio-Cultural Vulnerability

Socio-Cultural Vulnerability refers to the inability of people, organizations and societies to withstand the adverse impacts of hazards due to the characteristics inherent in social interactions, institutions and systems of cultural values. It is linked to the level of well being of individuals, communities and society. It also includes aspects related to levels of literacy and education, the existence of peace and security, access to basic human rights, systems of good governance, social equity, positive traditional values, customs and ideological beliefs and overall collective organization systems (UNISDR 2004). Politics also plays a key role in the generation of this type of vulnerability.

Factors Contributing to Socio-Cultural Vulnerability

4.1 A Dependent Population

Overtime, fueled by the economic success of the Oil and Gas Industry, Trinidad and Tobago has evolved to a highly dependent society, so much so that researchers are beginning to draw comparisons to a “welfare state”. Unfortunately due to our economic status and fragility such assistance programmes cannot be realistically maintained in the long term, and in fact are currently placing quite a strain on national resources. The government however, is not the only source of assistance to citizens as there are a number of international and local Non-Governmental Organizations (NGOs) such as faith based organizations and private sector groups who make signification contributions be it fiscal or service oriented. Some such programmes that are relevant to disaster risk management are listed below:

1. **Emergency Cases Fund**

   The Ministry of the People and Social Development provides several grants designed to assist needy persons as well as persons who have been victims of natural disasters such as hurricanes, fires or floods. The Grants that are available under the Emergency Cases Fund include:

   - **Household Items Grant**
     The Household Items grant provides money for the purchase of beds, mattresses, appliances, kitchen utensils, etc. The maximum amount of the grant is TT$6,000.00 and is only available once every three (3) years. A one-time grant of TT$10,000 is available in the case of emergency or disasters.

   - **Pharmaceutical Grant**
     The Pharmaceutical Grant is provided for the purchase of prescriptive drugs only if unavailable at the Government Dispensary (Health Centre) or through the Chronic Disease Assistance Programme (CDAP). An application for prescription drugs must be accompanied by the doctor's prescription. The grant is designed to assist chronically ill persons who are clients of the Ministry of the People and Social Development, or
persons in dire need of assistance to purchase their prescribed medication. Eligible applicants can receive a maximum total amount of TT$2,500.00 for a three-month supply.

- **Clothing Grant**
The Clothing grant is provided to assist in the purchase of clothing, including school uniforms, shoes, pants, shirts, etc. The maximum amount of the grant is TT$500.00 per person, limited to the number of persons living in the household. This grant is only available once in every two (2) years. It is reserved for victims of disasters and necessitous persons.

- **Education Grant**
The Education grant is provided to assist in meeting a child's maintenance cost at secondary school, such as transportation and other school related expenses. The maximum amount you can receive is TT$500.00 per child per month, up to a maximum of four children. The grant is provided every month while the child is attending secondary school, and it is reviewed annually by the Local Social Welfare Board. This grant is usually provided to households receiving financial assistance from the state.

- **Housing Repair Grant**
The Housing Repair Grant is provided for the emergency repair or completion of a house. The grant provides a maximum of TT$5000.00 to purchase building materials.

- **School Textbooks Grant**
The School Textbooks Grant assists with the replacement of children's textbooks, stationary and school uniforms, solely in the event of a natural disaster (fire, floods and hurricanes) where the books and school supplies are destroyed during the school year. The maximum amount disbursed is TT$1000.00 per secondary child and TT$700.00 per primary school child.

- **Medical Equipment Grant**
The Medical Equipment grant is provided to assist needy persons in the purchase of medical aids such as hearing aids, wheelchairs, prosthetics, eyeglasses, colostomy bags, etc. The maximum amount of the grant is TT$7,500.00. An individual cannot apply for assistance to purchase the same item again within two years of receiving this grant.

- **Special Child Grant**
The Special Child grant is a new intervention of the Social Welfare Department and has been incorporated under the Public Assistance Act. It is a monthly grant for parents of children who have been certified as having a mental or physical disability. The parent can receive this grant until the child's 18th birthday. The grant is TT$800.00
per month per child for a maximum of four children per family. The grant is reviewed annually by the Local Social Welfare Board.

- **Home Help Grant**
  The Home Help grant provides short-term care for persons in urgent need of home care due to illness. The selected care-giver is paid TT$350.00 per month for three months.

- **Uniform Grant**
  The Uniform Grant assists with the purchase of school uniforms for the children of needy persons, persons already in receipt of assistance from the Ministry of the People and Social Development and victims of natural disasters. The maximum amount disbursed is TT$200.00 per child (up to four children per household).

- **Dietary Grant**
  The Dietary Grant is a monthly grant of TT$600.00 per person for the purchase of specific and prescribed dietary foods for persons suffering from diseases such as diabetes and heart disease.

- **Burial Order or Funeral Grant**
  Burial Assistance is a grant provided to pay burial costs when the relatives of a deceased person are unable to meet these costs, or when there is no one to take responsibility for the burial. The grant is paid directly to the funeral agency. The maximum payment is TT$7,000.00. A Burial Order is issued to a funeral agency to facilitate a pauper's burial.

2. **Home Improvement Grant**
   The Ministry of Housing, Land and Marine Affairs also provides a grant that has a maximum payout of TTD15,000 similar to the IDB Home Improvement Subsidy Programme. However, it differs to some extent. Citizens are not required to produce matching or greater amount of cash, materials on site or a percentage of the labour costs (ODPM, 2012).

3. **Minor Repairs Reconstruction Grant**
   The Minor Repairs Reconstruction Grant is accessible through the Ministry of the People and Social Development. The aim is to provide assistance in the form of building materials to impoverished persons whose homes are in dire need of repair. A maximum of TTD10,000.00 in materials may be made available (ODPM, 2012).

4. **Public Assistance**
   Public Assistance is a monthly subsistence grant designed to provide financial aid to adults who are unable to work because of ill health. Public Assistance may also be granted on
behalf of needy children whose father, mother or both parents are dead, incarcerated, disabled and unable to work, or has deserted the family and cannot be found.

Public Assistance provides the following monthly payments:
- One person - TT$470.00
- Two persons - TT$710.00
- Three persons - TT$920.00
- Four or more persons - TT$1,090.00

5. Inter-American Development Bank (IDB) Home Improvement Subsidy Programme

The IDB Home Improvement Subsidy Programme targets persons who wish to do improvement works to their home. The Ministry of Housing and Urban Development will provide a maximum of TT$20,000 to successful applicants. The applicant, however, must also be able to contribute a matching or greater amount, which may consist of:
- Cash
- Materials on site
- Improvement works done within a period not exceeding 6 months prior to applying for the subsidy

A percentage of labour cost (sweat equity) can be valued and counted as part of the applicant's contribution. "Sweat Equity" is the estimated dollar value of the actual physical labour contributed by the residents of the property to the improvement works. A percentage of the project's labour cost can be valued and counted as part of the applicant's contribution.

Although the above list is by no means comprehensive, it is still able to paint a clear picture of the wide range of assistance programmes available to the public. While it is commendable that state and non-government agencies alike, use available resources for the betterment of its citizens, if these programmes are not properly managed they can create conditions for vulnerability. For example, one of the most elementary roles of a functional government is to provide for its more vulnerable citizens or rather its 'special needs' populations, however, when aid is given to citizens existing outside the parameters of special needs, an imbalance is created and the model shifts from that of improving resilience to the creation of dependency.

Dependency in this context is used to describe situations where there is heavy reliance on external parties such as the state for assistance, and can exist in two dimensions. The first dimension represents dependency in its most basic form, and refers to members of society who do not have the means by which to recover from the impact of disasters or even severe hazards, this is therefore dependency through 'constraints'. On the other hand, the second type of dependency or rather 'choice' dependency is used to characterize the segment of the population who, based on their economic standing, knowledge and physical capacity, are well able to absorb and recover from the impact of disasters, yet choose to be reliant on external aid. This is illustrated in Figure 19.
While making assistance accessible to all citizens does have its merits, it is hard to ignore certain disadvantages that may arise in the long term, particularly in a country such as Trinidad and Tobago, where the frequency of disaster occurrence is quite low. Additionally, within the governance architecture of the nation, several citizen assistance schemes, such as food, clothing, and home improvement grants as well as gas and home construction subsidies, are available year round, regardless of the absence of a state of emergency. This places a huge financial burden on the economy, diverting funding away from developmental projects, which have the potential to provide greater returns on investment.

Arguably, one of the most significant disadvantages to heavily dependent societies is its impact on the mentality of the populace, as it fosters the perception that responsibility for recovery and more importantly preparedness lies externally. This not only encourages citizens to be lax with regard to taking necessary precautions for the safety of their home and family, but there is also the risk that such strong dependencies will be developed that should aid be withdrawn, it could create a crisis of its own.

It is important to note that no nation is safe from economic downfall, as illustrated in the recent decline of the United States (U.S) economy, and more apparently the way it affected the world due to the linkages in global trade. The fluctuation of global markets coupled with the
vulnerability of Trinidad's energy sector, is a clear indication of how unsustainable dependency can quickly become. Consider the scenario where a high magnitude earthquake strikes, destroying critical infrastructure within the energy sector, crippling downstream industries, and by extension wiping out a large percentage of the Gross Domestic Product (GDP). What would be left is a nation that is unable to maintain its regular services and a population with no experience in personal resilience.

In such situations, international aid becomes a feasible option, but unfortunately encompasses its own obstacles and constraints. International aid is often given under circumstances which limit its usage, such as conditions that “the recipient must use overpriced goods and services from donor countries” (Shah 2012), and even then there is no guarantee that aid will reach the ones who need it the most. Smilowitz (2012) stated that, “aid organizations see disasters as a huge fund raising opportunity and they will raise money whether than can deliver it or not, if they can’t deliver on services then they will take a nine or ten percent cut and pass the money to another organization, this can happen numerous times before it gets where it should be, so the amount they end up with is a fraction of what was actually raised”.

While this may not be true for all cases, the facts are still hard to ignore. Investigations into the relief operations for the catastrophic 2010 Haitian earthquake indicate that, “only 40% of the $5.6 billion pledged by foreign governments to be used in the first 18 months had been dispersed by September 2011” (Harvey, 2012) and of that, money granted to NGO’s were spent on “salaries, accommodation and transport for the NGO workers themselves” (Schwartz, 2012). Additionally, recent reductions in international aid, due to financial issues in even the wealthiest nations, namely the 3% decline in United States (US) foreign aid from 2010-2012, highlights the fact that there is no guaranteed consistency when it comes to aid in times of crisis.

The link between dependency and vulnerability is undeniable. It exposes and exacerbates weaknesses in society, and has far reaching implications heightening the level of risk. Aid dependent countries are less inclined to achieve first world status, and face greater challenges in creating a culture of preparedness, safety and resilience.

4.2 Band-Aid Approach and Political Will

Many of the issues contributing to vulnerability cannot be easily fixed, but require long term commitment to policy changes, the implementation of new or updated legislation, extensive structural retrofitting and redesign, altering of public perceptions and the restructuring of state programmes, just to name a few. In light of this, it is no surprise that management institutions in the past have opted for a ‘quick-fix’ or ‘band-aid’ approach, which essentially involves the implementation of short term solutions to appease victims or the public, which do not actively work to fix the problem and prevent recurrence.

Take for example instances where communities have been impacted by floods, resulting in damage to the personal property of residents. In response to the typical public outcry, which is often sensationalized by the media, responsible parties are quick to dole out relief in the form of
financial compensation or the replacement of damaged items. The method of dealing with hazard impact is favored because it leads to the instant gratification of victims, who consider this to be the proper way to manage the event, thus contributing to the dependency described in section 2.1. With the incident now considered to be ‘managed’ or ‘closed’ it is easy to forget that it ever occurred, especially in a country where severe hazard events are few and far between, keeping in mind that nothing has actually been done to reduce vulnerability or prevent reoccurrence.

Another major issue contributing to vulnerability is that such ‘band-aid’ strategies actually compete with and limit the success of actual vulnerability and risk reduction programmes. There is a distinct need to streamline assistance programmes both within the current governance architecture and non-governmental organizations alike as in some cases there is the chance of projects inadvertently sabotaging one another. For example, programmes targeting disaster preparedness, such as the Communities Organized and Ready for Emergencies (CORE) Programme, championed by the Office of Disaster Preparedness and Management (ODPM) having to compete with the many grants and subsidies, which promote dependency rather than resilience.

The success of most citizen aid programmes is hinged on the receptiveness of the population and their genuine desire for involvement. Often times, when community members are presented with the choice of knowledge or training to facilitate long term mitigation or preparedness versus monetary grants or physical items to assist in recovery, they tend to opt for the ‘quick fix’ or ‘band aid’ approach which require little effort or change on their part, leaving them just as if not more vulnerable than before.

Even charity based organizations need to begin to re-think the way in which they provide assistance, as it is no longer beneficial to actual or potential disaster victims to be given aid to simply replace what was lost or rebuild. These programmes should be coupled with initiatives to enhance resilience by delivering aid in the form of tools for planning, prevention and mitigation taking the focus away from just relief. Organizations such as the Red Cross have led the way in incorporating mixed methodology approaches to relief and recovery interventions, lending to the success of many assistance projects.

The same can be said of the way in which comprehensive disaster management is managed at the national level, which in the past has been largely reactive. In fact the founding of the Office of Disaster Preparedness and Management (ODPM) the national disaster office of Trinidad and Tobago, was in response to floods which affected the island as well as the 2004 Indian Ocean tsunami, which made disaster risk management a global issue. Unfortunately the low frequency of severe hazards in Trinidad and Tobago means that it is not considered to be a priority on the national agenda. There is also the issue of project longevity as many projects are abandoned prior to completion with changes in government, or in favor of a ‘hot topic’ or highly politicized issue.
4.3 Risk Perception, Hazard Awareness and Experience

4.3.1 Understanding Risk Perception

Knowledge, experience, values, attitudes and feelings all influence the thinking and judgment of people about the seriousness and acceptability of risks. Within the social sciences however the terminology of ‘risk perception’ has become the conventional standard (Slovic, 1987).

Risk perception involves the “process of collecting, selecting and interpreting signals about uncertain impacts of events, activities or technologies” (Wachinger et al. 2010). These signals can be the result of direct observation from other sources such as newspapers, word of mouth etc. Researchers Renn and Rohrmann (2000) developed a framework to illustrate the integrative and systematic perspective on risk perception which is shown in Figure 20. The framework suggests four distinct context levels: Cultural Background; Social-Political Institutions; Cognitive-Affective Factors; and Heuristics of Information Processing.

![Four Context Levels of Risk Perception](image)

Figure 20: Four context levels of risk perception. Source: Renn, 2008.

An understanding of all four levels of influence is important to obtain a more comprehensive grasp on the concept of risk perception.
Level 1: Heuristics of information processing
The first level includes the collective and individual heuristics that individuals apply during the process of forming judgments. These heuristics are independent of the nature of the risk in question or the personal beliefs, emotions or other conscious perception patterns of the individual. Heuristics represent common-sense reasoning strategies that have evolved over the course of biological and cultural evolution (Ross 1977; Kahneman and Tversky, 1979; Breakwell, 2007).

Level 2: Cognitive and Affective factors
This level refers to knowledge based (cognitive) and emotion-based (affective) factors which influence the perception of specific properties of the risk in question. Cognition about a risk source—what people believe to be true about a risk—governs the attribution of qualitative characteristics (psychometric variables) to specific risks (e.g. dread or personal control options) and determines the effectiveness of these qualitative risk characteristics on the perceived seriousness of risk and the judgment about acceptability (Slovic, 1992).

Emotions also play an important role in risk perception. People’s feelings about what is good or bad in terms of the causes and consequences of risks color their beliefs about the risk and, in addition, influence their process of balancing potential benefits and risks (Wachinger et al. 2010). Emotional or affective factors usually come to the forefront when there are difficult choices to be made such as relocating from high risk zones for safety, when it means leaving behind a cherished family home.

Level 3: Social and Political Institutions
The third level refers to the social and political institutions that individuals and groups associate with either the cause of the risk or the risk itself (Wachinger et al. 2010). This is where issues such as creditability, trust, organizational constraints, socio-economic status etc come into play. One important factor in evaluating risk is the perception of fairness and justice in allocating benefits and risks to different individuals and social groups (Linnerooth-Bayer and Fitzgerald, 1996).

Level 4: Cultural Background
The cultural background of an individual or group can govern or co-determine other levels of influence, and research indicates that “specific culture-based preferences and biases are, indeed, important factors in risk perception” (Wachinger et al. 2010).

4.3.2 The God is a Trini Mentality
Risk perception is therefore an important factor to consider when assessing vulnerability, as it dictates the way in which people respond to risks and is typically tied to the interaction of social and cultural factors and the personal reasoning of the individual. This is particularly true in Trinidad and Tobago as current perceptions of hazards, risks and disasters tend to be quite skewed.
One initiative implemented to alter perceptions in Trinidad and Tobago is through knowledge sharing and information dissemination. Multiple mechanisms have been used such as brochures, newspaper articles, television programmes, radio ads, awareness campaigns, community walkabouts, and social media. It is important to note that much of the information shared has been tailored in such a way as to be easily understood by a large percentage of the population. Unfortunately, as discussed previously, hazard awareness does not equate to appropriate risk perceptions due to the multiple influences involved.

The expression “God is a Trini” is a very popular saying amongst Trinbagonian citizens, and is used to describe any situation, and in this context potential risks or threats, from which they consider themselves and the country at large, to be immune. While such notions are supported in the eyes of many citizens by the fact that the islands have escaped from many seismic and atmospheric...
disasters, that have ravaged our Caribbean neighbors, it does not hold true. Trinidad and Tobago is in fact susceptible to, a plethora of hazards illustrated in figure 1.

Unfortunately this false sense of immunity has negatively impacted the way citizens respond to the threat of natural and anthropogenic hazards. One recent example occurred on August 17th, 2013, when the pleasure vessel The Harbour Master, known for hosting parties, ran aground after setting sail from Cocorite, Trinidad. The damage to the vessel was severe enough to warrant a distress call to the Trinidad and Tobago Coast Guard, who upon arrival and inspection determined that the vessel be evacuated. What was interesting of this incident, was a comment given by an evacuated passenger, which perfectly reflected her feelings when she stated that “the party continued and even when I left there were still people dancing on the boat but we never felt unsafe,” and then concluded her statement by stating that “this is Trinidad” (Express 2013) meaning that nothing was likely to happen.

![Figure 21: Passengers returned to shore assisted by the coast guard after the evacuation of The Harbour Master. Source: Express 2013](image)

Similar incidents have occurred in the past, typically linked to hazard warnings and public advisories such as with Hurricane Tomas. While the event did not directly impact Trinidad and Tobago a watch was still issued, and some businesses allowed their employees to leave work early in order to ensure the safety and security of their families and property. Unfortunately this was not the case for all as many citizens who dedicated the ‘day off’ for socializing or ‘liming’, and off course the hosting of ‘Hurricane Parties’. Hazard themed parties have become quite a common practice in Trinidad and Tobago, and numerous informal and organized events were held during the national state of Emergency which was issued in September 2011. The state of emergency
called for curfews to be set in several areas defined as “hot spots” in an effort to deal with rising criminal activities. Business owners and regular citizens alike responded by hosting day parties, and even lock down parties where in light of the curfew, party goers were to stay inside the party venue for the duration of the night, leaving only when the curfew ended the next day.

There are many conflicting streams of thought regarding such events. On one hand it is commendable that citizens are innovative enough to find ways to keep entertained during potentially difficult times, and consider it to be a favorable alternative over panic. On the other hand, such behavior does trivialize the severity of the situation, again resulting in citizens with no real grasp on how to appropriately interpret and respond to risk messages and hazard warnings.

4.3.3 Experience

It is a well known concept that experience brings expertise, which accurately explains why countries like Japan that lie in one of the most hazard prone regions of the world are at the forefront of the disaster management process, and have set the standard for multiple best practice methodologies. In Trinidad and to a lesser extent Tobago, the situation is quite the opposite. Only a small percentage of the nation’s population has actually experienced the impacts of truly severe hazards and even less an actual disaster. In fact many citizens are unable to differentiate between a hazard and a disaster and incorrectly use the terms interchangeably.

Despite the numerous negative impacts these events can trigger, they do act as learning experiences, though the identification of gaps and weaknesses, and provide the much needed motivation to implement initiatives for prevention and mitigation to ensure that such events do not reoccur. This is why the most resilient countries typically have a hazardous past.

Vulnerability is also heightened by the fact that national response and management teams also remain untested in the face of a major national disaster, as the majority of preparation and training are centered around table top exercises, drills, simulations and assisting sub-regional focal points Guyana, Grenada and Suriname, who are susceptible to similar threats. Fortunately however, these simulations and drills are designed using events which have a strong potential for occurrence. For example Exercise FA-Hum held in 2011, simulated a high magnitude earthquake impacting Trinidad. Specialists from the University of West Indies Seismic Centre state that the islands are “overdue” for such an event. The 2012 Exercise Omega on the other hand dealt with a tsunami generated by the eruption of the Kick’em Jenny Volcano, another scenario which can potentially occur.
4.4 Cultural Barriers

Culture and tradition are diverse in the sense that they can both heighten and reduce a community’s vulnerability to hazards. At present it is difficult to say with accuracy specifically what the impact of local culture will be in a major disaster, since there have been few major events in the past such as the earthquake of 1766, of which many aspects are undocumented, and the fact that the Trinbagonian culture has evolved significantly since then. This section will therefore seek to explore some aspects of local culture that has the potential to contribute to vulnerability.

Multiple religious faiths are recognized in Trinidad and Tobago. Some religions consider hazards and disasters to be acts of God, and as a result believe that there is either nothing that can be done to prevent its occurrence or that the most appropriate form of mitigation is through worship. In other instances religious beliefs and customs may pose problems for response and relief. For example, some religions such as the Hindu and Muslim faiths call for abstention from certain foods such as beef and pork products respectively, and as a result persons may be reluctant to accept relief packages of food, and in extreme cases medicine. Additionally cultural practices and customs can obstruct mitigation and response initiatives.

One glaring issue is that many disaster management policies and plans do not take into account the cultural characteristics of citizens they are designed to protect, which can lead to unnecessary confusion in actual emergency situations, as was illustrated in the management of the 2010 Haitian
Earthquake, where disaster managers and aid workers were particularly unprepared to deal with the strong superstitious culture of Haitians, and the Voodoo religion. Trinidad and Tobago is by no means exempt from superstition; in fact certain pockets of society still believe in and practice “Obeah” a term used to describe a type of religious sorcery or folk magic. Traditional values also come into play, such as the a reluctance among citizens to adopt new more sustainable methods, because they have become so used to practices that have been passed down from one generation to the other.

The fact that so little information exists, underscores the need for more detailed research to be carried out to better understand the way Trinbagonian culture interacts with vulnerability, as this data will be critical for capacity building and overall risk reduction.

4.5 Poverty

Poverty is the factor most often associated with vulnerability. People who face severe economic constraints are highly vulnerable and less able or inclined to invest in strategies for mitigation and preparedness. In fact some mechanisms for risk transfer such as insurance are removed from their list of options completely, as in the case of squatters. According to a 2007 estimate (CIA World Factbook, 2014) approximately 17% of the nation’s population falls below the poverty line, which is a gradual decline from 1992, as illustrated in Figure 23. The subgroups of which the poor are comprised include the “unemployed, those with low levels of education, and female-headed households” (World Bank 1995). Studies also indicate that poor households are more likely to be larger in terms of family size, with more children and display a non-nuclear family structure than non-poor households.

![Figure 23: Percentage of the Trinidad and Tobago Population below the poverty line 1992-2007. Source: CIA World Factbook.](image-url)
Poverty can heighten vulnerability at both the national and local level, but given the nation's current economic status, especially when compared to Caribbean neighbors, poverty seems to be concentrated at the community level as earnings from the oil and gas industry are not filtered down.

Poverty is distributed across both rural and urban areas, although the severity of poverty has traditionally been worse in urban areas. The growing pressure on the poor has contributed significantly to the problems of crime, illegal substance usage particularly within male youths. With so many issues to contend with, and given the low frequency of hazard occurrences within the nation, the concept disaster risk management remains very far from the minds of poor.

Poorer communities are less able to bounce back from the impact of disaster, which in severe cases can destroy not just physical possessions but livelihoods as well. There are several predominantly agricultural communities in Trinidad and Tobago located in areas such as Penal and Aranguez, which have been impacted by floods in the past resulting in farmers losing much of their annual income. In such situations it is not just the destruction of fruit and vegetables for harvest which trigger losses but the crops themselves, while at the same time decreasing the returns of cultivated land. Incidents such as these can also go on to impact the wider population as they can cause a rise in local food prices, and even trigger food shortages which can compromise food security.

Figure 24: An Aranguez farmer surveys the flood damage to his Melongene crops.
Source: Guardian 2006
Additionally the linkages between poverty and lower levels of education also indicated that many low income households may not be aware of cost-effective mitigation methods that can be used to increase safety, such as the utilization of hurricane straps or emergency planning.

The displaced poor are more likely to settle informally or squat on marginal lands or rather high risk zones such as river banks, flood plains or unstable slopes. This coupled with the fact that they do not have the income and resources to build properly, equates to conditions for heightened physical vulnerability. In fact the majority of informal housing in Trinidad and Tobago would have been designed by professionals or received approval from Town and Country Planning. This is exacerbated by the fact that formal mechanisms for risk transfer such as insurance are either limited or largely unavailable to the poor. Squatter residents are also at times resistant to investing in increasing the structural integrity of their homes due to the financial cost (which they cannot afford) and the fact that they do not have any legal rights to the land on which they reside, at least until they have occupied for so long a time that they fulfill the conditions to be covered under the squatter regularization act.

4.6 Marginalization of Special Need Populations

Within the past two decades, Disaster Risk Reduction has become a more prominent issue on the global agenda, prompting regional, state, local and private agencies to invest significant resources in risk reduction initiatives. Often disregarded in these initiatives however, is the segment of the population with special needs, such as the approximate “one billion people across the globe, representing one fifth of the world’s population who live with some form of disability” (UNISDR 2013). Special need populations represent those members of society who may encounter additional challenges and require special assistance in order to adequately, absorb, respond to and recover from the impacts of hazards. Considered to be one of the most socially vulnerable groups, it is no surprise that the post disaster death tolls are often dominated by persons with disabilities, for example, “the death rate of persons with disabilities in the 2011 Great East Japan Earthquake and Tsunami was more than double that of the death rate for the entire population” (UNISDR, 2011). The same can be said for the Haitian earthquake of 2010, which disproportionately affected many persons with disabilities.

In the context of emergencies, special need populations can include the visual, hearing and speech impaired; individuals with physical disabilities; children, elderly, sick and even pregnant women. Looking holistically, this can also be extended to include socially vulnerable populations such as ethnic minorities, people with language barriers and the impoverished. Special need populations which have historically been a blind spot within the realm of Disaster Management, are now moving to the forefront, and are presently a major focus area for intervention. In fact, the theme for the 2013 International Day for Disaster Reduction, celebrated on October 13th was deemed “Living with Disability and Disasters”, celebrated in many countries across the globe, this was a catalyst for activities such as simulation exercises, panel discussions and awareness drives.
It is unfortunate, but accurate, to say that at present Trinidad and Tobago is constrained in its ability to properly protect its special need populations in the event of a major disaster. The main reasons for this are listed below:

- **Lack of Planning, Policy and Legislation**
  At present there are no existing disaster management plans, policies or legislation which speaks specifically to the care and protection on special need groups in emergencies.

- **Inadequate Resources**
  In a society comprised of various social groups, needs tend to differ. Young children, pregnant women, the elderly and disabled all have unique features which can add to their needs particularly in situations such as evacuation, sheltering, relief distribution and the rehabilitation process. The majority of designated public shelters are not equipped to handle persons with disabilities. This information is off course based on assumption, as there is limited overall information the condition of shelter facilities. Additionally items typically made available in shelters such as food and medicines are not prepared with persons with special need persons in mind.

- **Lack of Data**
  There is no central repository of data on the location or particular needs of vulnerable persons in Trinidad. The Tobago Emergency Management Agency (TEMA) however, must be commended on the launch of their special needs registry. This information can greatly assist disaster planners and emergency response personnel when preparing for and responding to disasters. It will also ensure that the individual needs of persons who are differently able or the elderly are met in the event of or during an emergency. This database may also aid in the logistical planning for disasters where special resources such as equipment, medical supplies and the like can be made available and also be consistently replenished for special populations.

- **Poor Management of Special Needs Population Centers**
  There are numerous private and state owned centers dedicated to providing care for persons with special needs, such as homes for the aged, schools for persons with disabilities of impairments, and orphanages. Unfortunately, as was uncovered in a recent Emergency Planning for Special Needs Workshop hosted by the ODPM in 2013, the majority of these homes do not undergo regular safety inspections, have updated emergency plans, safety committees or mechanism for early warning. It should be noted that under the OSH Act, facilities such as these are required to maintain certain levels of safety, but unfortunately this act has not properly enforced and inspections are rarely conducted.

- **Gaps in the National Emergency Response System**
Another major discovery at the Workshop was that there are currently no mechanisms in place for persons with hearing impairments to place emergency calls, as the majority of emergency contact lines rely on voice communication.

Needless to say, before any intervention can be made towards reducing the vulnerability of these groups, an assessment should be conducted to identify gaps and challenges, in order to better guide actions.

4.7 Additional Factors

There are a variety of additional factors aside from those listed above, which also contribute to socio-cultural vulnerability, but due to the scope of this study, were not considered to be major factors, and could not be discussed in detail. Some of these factors include:

- **Gender**: The Global Gender Gap Report 2013 ranked Trinidad and Tobago at number 36 of the 133 countries considered in the report, which is an improvement of 7 places since 2012. That being said it is still important to ensure gender sensitivity when designing vulnerability and risk reduction projects. Ignoring the wisdom and experience of women who still play a large role in the management of the home and family in Trinidad and Tobago would be considered a significant loss.

- **Acceptable Risk and Strong Ties to Community**: In some situations community members may be fully aware of the threats they are exposed to and still choose to stay in a particular area for various reasons, one of them being strong ties to the community. Such scenarios pose quite a problem for first responders when evacuations have been ordered or the area becomes too unsafe for continued settlement.

- **Equity**: Unequal distribution of resources and rights can lead to conflicts and discontent, and trigger the deterioration of social systems. For example, individuals who are frequently impacted by flooding, who feel marginalized by that fact they believe that their problems are not being handled with the same attention or resources as others, may be unwilling to discuss issues related to flood preparedness and mitigation planning, receive essential aid services or taking preventive measures to protect themselves from flood hazards.
Chapter Summary

- Socio-Cultural Vulnerability refers to the inability of people, organizations and societies to withstand the adverse impacts of hazards due to the characteristics inherent in social interactions, institutions and systems of cultural values. It is linked to the level of well being of individuals, communities and society.

- Socio-Cultural vulnerability also includes aspects related to levels of literacy and education, the existence of peace and security, access to basic human rights, systems of good governance, social equity, positive traditional values, customs and ideological beliefs and overall collective organization systems (UNISDR 2004). Politics also plays a key role in the generation of this type of vulnerability.

- Some key factors contributing to Socio-Cultural Vulnerability include:
  
  1. A Dependent Population - Dependency in this context is used to describe situations where there is heavy reliance on external parties such as the state for assistance. While it is commendable that state and non-government agencies alike, use available resources for the betterment of its citizens, if these programmes are not properly managed they can create conditions for vulnerability.
  
  2. Band-Aid Approach and Political Will - management institutions in the past have opted for a ‘quick-fix’ or ‘band-aid’ approach, which essentially involves the implementation of short term solutions to appease victims or the public, which do not actively work to fix the problem and prevent recurrence.
  
  3. Risk Perception, Hazard Awareness and Experience - Many citizens may not be aware of, or fully comprehend the risks to which they are exposed. In fact a large segment of the population has not experienced a disaster. While other citizens have adopted the “God is a Trini” mentality, believing themselves immune to the impacts of hazards.
  
  4. Cultural Barriers - Culture and tradition are diverse in the sense that they can both heighten and reduce a community’s vulnerability to hazards.
  
  5. Poverty - Poverty is the factor most often associated with vulnerability. People who face severe economic constraints are highly vulnerable and less able or inclined to invest in strategies for mitigation and preparedness.
  
  6. Marginalization of Special Need Populations - Special need populations represent those members of society who may encounter additional challenges and require special assistance in order to adequately, absorb, respond to and recover from the impacts of hazards. In the context of emergencies, special need populations can include the visual, hearing and speech impaired; individuals with physical disabilities;
children, elderly, sick and even pregnant women. Looking holistically, this can also be extended to include socially vulnerable populations such as ethnic minorities, people with language barriers and the impoverished. Special need populations which have historically been a blind spot within the realm of Disaster Management, are now moving to the forefront, and are presently a major focus area for intervention.
Localized Assessment of Vulnerability
A Preliminary Study from the Disaster Management Perspective
5.0 Localized Assessment

For a more granular look at vulnerability and risk, a localized assessment was planned for the 14 municipalities of Trinidad and Tobago. In order to facilitate this, the ODPM VRAT - Vulnerability and Risk Assessment Tool was developed and can be found in the appendix of this document. The findings of which will be shared in this section.

5.1 Hazard Identification Analysis and Prioritization

This step was designed to determine the hazards which pose a significant threat to the area being assessed. Various parameters were used to determine hazard priority, which were included but not limited to:

1. Hazard Frequency - Historically, how often has the event occurred?
2. Area Impact - Were the impacts widespread or limited to one specific area?
3. Damage Impact - How extensive were the damages caused?
4. Speed of Onset – The rate at which the hazard takes to produce its impact

Analysis of these parameters can be used to determine the magnitude/severity of the threat.

Table 3 ranks hazards affecting the different areas in order of priority based on the above mentioned parameters, and discussions with relevant disaster management coordinators and first responder agencies. Flooding, fires and landslides received high rankings, while potentially devastating hazards such as earthquakes and tsunamis barely made mention, this is partially due to their low frequency of occurrence, and the limited of experience disaster management and response coordinators has with such events.

With regard to hazard frequency and damage impact a more simplistic analysis on the event data alluded to the fires being the most damaging hazard (injury, death, public and private property damage etc) and flooding being the most frequent. Figure 25 illustrates the most the nation’s four most frequent hazards affecting the country and their municipal distribution.

The findings of the hazard priority analysis by ranking using the Vulnerability and Risk Assessment Tool are represented in Table 4 below.

<table>
<thead>
<tr>
<th>#</th>
<th>Area</th>
<th>Hazard Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>#1</td>
</tr>
<tr>
<td>1</td>
<td>Penal /Debe</td>
<td>Flooding</td>
</tr>
<tr>
<td>2</td>
<td>Siparia</td>
<td>Fire</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Point Fortin</td>
<td>Fire</td>
</tr>
<tr>
<td>No.</td>
<td>Location</td>
<td>Disasters</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------</td>
<td>----------------------------------</td>
</tr>
<tr>
<td>4</td>
<td>Princes Town</td>
<td>Flooding, High Winds, Landslides</td>
</tr>
<tr>
<td>5</td>
<td>Mayaro/Rio Claro</td>
<td>Flooding, High Winds, Fire</td>
</tr>
<tr>
<td>6</td>
<td>San Fernando</td>
<td>Flood, Fire, High Wind, Landslide</td>
</tr>
<tr>
<td>7</td>
<td>Couva/Tabaquite/Talparo</td>
<td>Flooding, Fire, Earthquakes, Tsunamis, Tropical Cyclones</td>
</tr>
<tr>
<td>8</td>
<td>Chaguanas</td>
<td>Flooding, Harmful Animals, Spills</td>
</tr>
<tr>
<td>9</td>
<td>Tunapuna Piarco</td>
<td>Flooding, Fire</td>
</tr>
<tr>
<td>10</td>
<td>Arima</td>
<td>Flooding, Fire, High Winds, Landslides</td>
</tr>
<tr>
<td>11</td>
<td>Sangre Grande</td>
<td>Flooding, Fires, High Winds, Landslides</td>
</tr>
<tr>
<td>12</td>
<td>Diego Martin</td>
<td>Flooding, Landslides, Fires</td>
</tr>
<tr>
<td>13</td>
<td>San Juan /Laventille</td>
<td>Landslides, Flooding, Fire</td>
</tr>
<tr>
<td>14</td>
<td>Port-of- Spain</td>
<td>Flooding, Air Pollution, Landslides</td>
</tr>
<tr>
<td>15</td>
<td>Tobago</td>
<td>Landslides, Tropical Cyclones, Earthquakes, Flooding</td>
</tr>
</tbody>
</table>
Figure 25: Hazard Impact map by administrative areas (municipalities). Source: ODPM 2011
5.2 Critical Facilities
Critical Facilities (CF) are the structures, institutions, industries, networks and systems that are essential to the security, economy, health and safety of the society and environment of Trinidad and Tobago. It is important to note that what is considered to be “critical” can vary from place to place. Disaster Management Coordinators were asked to list the critical facilities within their region. The results obtained were varied, ranging from statements that there were no critical facilities in area, to cell towers, shelters, and shopping malls. No formal critical facilities inventories were readily available, and coordinators displayed different understandings of the concept. The unavailability of information, does not allow for any conclusions to be made regarding the vulnerability of critical facilities and infrastructure, in fact very few facilities were even identified. This highlights a gap in the disaster management process, which contributes to national vulnerability. It is important to note that steps are being taken to bridge these gaps such as the existing cabinet minute for the Critical Facilities Protection Policy (CFPP) Framework and initial mapping of critical infrastructure.

5.3 Societal Analysis
This step as the name implies was designed to deal exclusively with societal issues, in particular special need populations. The NOAA defines areas of special concern as “those locations where individual resources are minimal and personal resources for dealing with hazards are extremely limited”. This means that such areas will rely heavily on public resources in post disaster recovery situations, and also indicated that they will experience greater levels of vulnerability.

The special need population centers identified were primarily homes for the children, elderly, sick, visual and hearing impaired. Data for these special need population centers were collected and compiled into a special needs inventory. Additionally, a survey was conducted among eighty managers and caretakers of special need population centers. Preliminary analysis indicates that the majorities of homes are highly vulnerable illustrated by the fact that many do not have an emergency plan, conduct regular risk assessments or have predetermined evacuation routes or practice regular drills.

5.4 Preparedness and Resilience
Ensuring efficient systems for risk communication, early warning and evacuation/egress are critical to the disaster management process particularly for the response phase. 100% of the regions assessed were equipped with multiple mechanisms and plans in place for emergency risk communication which included but were not limited to social media, landline and mobile telephones, VHF, HF and trunk radios and mobile loudspeakers.

Unfortunately mechanisms for community based early warning, evacuation and egress, were not as robust. Implementing community based early warning systems are considered to be
international best practice and have been proven to save lives. Unfortunately, community based early warning initiatives were only present in 3 areas (Mayaro /Rio Claro, San Juan Laventille and Tobago), while only 4 areas (San-Fernando, Port of Spain, Chaguanas and Tobago) have initiated the development of emergency evacuation and egress routes. Evacuation and egress is critical for any community, particularly in densely populated areas, to ensure the timely evacuation of at risk populations to safety. Having these routes defined beforehand not only assists disaster managers but also allow for the dissemination of information to the public, reducing panic and chaos in emergency situations.

In a localized context, many disaster managers believe that an integration between the top down and bottom up approach, is necessary for project success. This places a significant amount of power and responsibility in the hands of community members, which aligns with the notion that those living in high risk zones are indeed the subject matter experts with regard to hazard exposure and risk. This also allows for initiatives to be tailored specifically to the community, and giving members project ownership often increases the chance of community interest and follow through. For this reason, areas where there are active community groups with dedicated members are excellent starting point to introduce risk reduction programs, typically as part of the group’s activities. One such activity is disaster management training, such as shelter management and emergency response. Assessment of the communities showed that this was already being done with 100% of the areas assessed having received varying types of disaster management training typically routed through existing community organizations. The findings of the assessment are shown in Table 5 below.

<table>
<thead>
<tr>
<th>#</th>
<th>Area</th>
<th>Are there multiple mechanisms for Risk Communication?</th>
<th>Are there Community Based Early Warning Systems?</th>
<th>Have Evacuation/Egress Routes been developed?</th>
<th>Are there active community groups in the area?</th>
<th>Have community members received DRM Training?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Penal /Debe</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Siparia</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Point Fortin</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>Princes Town</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>5</td>
<td>Mayaro/Rio Claro</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>6</td>
<td>San- Fernando</td>
<td>Yes</td>
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<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Couva/Tabaquite/Talparo</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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</tr>
<tr>
<td>8</td>
<td>Chaguanas</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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</tr>
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<td>9</td>
<td>Tunapuna Piarco</td>
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<td>No</td>
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<td>Yes</td>
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<td>No</td>
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<td>San Juan/Laventille</td>
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<td>No</td>
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<tr>
<td>15</td>
<td>Tobago</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

| Percentages | 100% | 27%  | 33.3% | 100% | 100% |

Table 5: Findings of Preparedness and Resilience Survey
Strategies for Resilience
A Preliminary Study from the Disaster Management Perspective
5.0 Strategies for Resilience

Resilience is referred to as “the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions” (UNISDR 2007). There are variety of strategies for resilience, ranging from high level policy and legislative modifications to individual choices and behavioral changes, making resilience building a very realistic and attainable goal. This chapter, which is by no means comprehensive, will offer some suggestions for enhancing resilience in Trinidad and Tobago.

5.1 The Diversion of Resources

In the past a lot of focus has been place on recovery and relief, partially as a band-aid approach and to minimize negative media coverage. Unfortunately, this does very little in the long term to reduce the problem. Diverting some resources into mechanisms and incentives for mitigation and preparedness, will not only being to combat dependency (as discussed in Chapter 4) but also make significant strides to overall vulnerability reduction, especially if strategies include capacity building initiatives such as the development of Community Emergency Response Teams (CERTs) etc.

5.2 Maintain Education and Awareness Campaigns

Mechanisms for the knowledge transfer, information dissemination and awareness are a critical component for risk reduction. By allowing these campaigns to constantly evolve with current trends and advances in technology, it can be ensured that a maximum number of citizens can be reached. It is also advised that the children and young adults be a focus area for intervention, as they are usually a more impressionable group and can be an excellent way to pass on the message of vulnerability risk reduction to their parents and elders.

5.3 Publicize cost effective strategies for Mitigation

Although a variety of cost effective strategies for mitigation exist they are not well known, especially by the groups who need them the most. Simple practices such as having a family emergency plan or an emergency supply kit can make quite a difference in the event of an actual disaster. Structural mitigation changes like installing hurricane straps, cleaning drains, or building ‘hurricane rooms’ can be integrated into the new form of delivering assistance as mentioned previously. Additionally, mechanisms such as risk transfer should not be ruled out.

Risk Transfer is the process of formally or informally shifting the financial consequences of particular risk from one party to another whereby an enterprise or state authority will obtain resources from the other party after a disaster occurs, in exchange for ongoing or compensatory social or financial benefits provided to that other party.
Insurance is a well-known form of risk transfer, where coverage of a risk is obtained from an insurer in exchange for ongoing premiums paid to the insurer. While conventional risk transfers mechanism like property insurance may not be attainable for populations such as squatters, there are many other effective alternatives.

Risk transfer can occur formally where governments, insurers, multi-lateral banks and other large risk-bearing entities establish mechanisms to help cope with losses in major events, as well as informally within community networks where there are reciprocal expectations of mutual aid by means of gifts, credit or the establishment of community pots.

5.4 Protection of Special Need Populations

This can be done through the development of a policy, plan or legislative document, and should include the generation of a special needs database and registry to allow members of this group to share their information with disaster and emergency managers to better guide efforts for response and protection. Caregivers can also be targeted for disaster risk management training.

5.5 Protection of Critical Facilities

The protection of critical facilities should be high on the list national priorities because of the vital role they play in every sector and off course in every phase of the disaster management cycle.

5.6 Enhance Business Continuity Planning

Business continuity is the activity performed by an organization to ensure that critical business functions will be available to customers, suppliers, regulators, and other such entities that must have access to those functions. Business continuity is not something implemented at the time of a disaster; but in fact refers to those activities performed daily to maintain service, consistency, and recoverability. Ensuring business continuity ensures that critical services can be maintained in managing hazard events and can drastically reduce the time it takes for services to return to normalcy in a post disaster event.

5.7 Increase Private Sector Engagement

In Trinidad and Tobago, the primary champions for disaster management are government agencies, and non government or faith based environmental or humanitarian assistance groups, with the private sector being rarely if ever involved. If comprehensive disaster management is to truly be holistically adopted, then the private sector should begin to play a greater role as a key stakeholder. It is therefore up to disaster managers to package disaster management concepts in such a way as to increase private sector interest, for example through partnerships and incentives.
Vulnerability and Risk Assessment Tool

Administered By: ________________________________

Organization: ______________________________________

Email: ____________________________________________

Tele: _____________________________________________

Area Assessed: _____________________________________

Date: ________________ GPS Unit #: ________________

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Certain hazards can be grouped into multiple categories such as fire which could result from Environmental, Industrial or Social Organizational hazards.

Additionally several categories include hazards which can result from either natural or anthropogenic origin. For example gas leaks can occur as a result of human error or due to the impact of an earthquake.
Step 1: Hazard Identification, Analysis and Prioritization

The Damage Impact Score

<table>
<thead>
<tr>
<th>Score</th>
<th>Severity</th>
<th>Characteristics</th>
</tr>
</thead>
</table>
| 1     | Insignificant | - No damage to property or infrastructure  
          - No injuries  
          - Critical facilities maintained |
| 2     | Negligible  | - Injuries or Illness treatable with first aid  
          - Minor quality of life lost  
          - Critical facilities and services shutdown for 24 hours or less.  
          - Less than 10% Damage to property and infrastructure |
| 3     | Limited     | - Injuries and/or illness do not result in permanent disability  
          - Critical facilities shut down for more than one week  
          - More than 10% property is severely damaged |
| 4     | Critical    | - Injuries and/or illness result in permanent disability  
          - Complete shutdown of critical facilities for at least 2 weeks  
          - More than 25% percent of property is severely damaged |
| 5     | Catastrophic| - Multiple deaths  
          - Complete shutdown of critical facilities for 30 days or more  
          - More than 50% of property severely damaged |

**N- Natural Hazards**
Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

**Trigger:**
The element responsible for the initiation of the hazard. For example Explosions or fires can be triggered by Gas Leaks, Flooding and Landslides can be triggered by intense Rainfall etc.
### Table 1: Hazard Identification Analysis and Prioritization

Which hazards affect the area? (use hazards list)

<table>
<thead>
<tr>
<th>Hazard</th>
<th>N</th>
<th>A</th>
<th>Typical Trigger</th>
<th>DI Score</th>
<th>Details</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Step 2: Hazard Priority
For each hazard identified in Table 1 the following parameters should be assessed:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Magnitude</strong></td>
<td>Low e.g. low magnitude earthquakes which produce very little shaking etc</td>
<td>Moderate DI 3</td>
<td>High e.g. Large earthquakes, Hurricanes etc DI 4&amp;5</td>
</tr>
<tr>
<td><strong>Frequency of Occurrence</strong></td>
<td>Year Round Hazards: Occurring at 6month Intervals</td>
<td>Year Round Hazards: Occurring every Quarter For Seasonal Hazards: Normal</td>
<td>Year Round Hazards: Occurring Monthly For Seasonal Hazards: Occurring outside the normal season.</td>
</tr>
<tr>
<td><strong>Speed of Onset</strong></td>
<td>Slow: Impacts felt after at least a week.</td>
<td>Moderate: Impacts felt in under a week.</td>
<td>Fast: impacts felt within a day of hazard occurrence.</td>
</tr>
<tr>
<td>Special Characteristics</td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-----</td>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>To be determined by the one conducting the assessment. E.g ability to respond to said hazard.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Characteristics</td>
<td>Severity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>----------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnitude</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of Occurrence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed of Onset</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Special Characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When ranking, please consider the hazard over a five year period.
### Critical Facilities

Critical Facilities (CF) are the structures, institutions, industries, networks and systems that are essential to the security, economy, health and safety of the society and environment of Trinidad and Tobago. Examples of Critical Facilities:

<table>
<thead>
<tr>
<th>Emergency Shelter</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Schools</td>
<td></td>
</tr>
<tr>
<td>Community Centres</td>
<td></td>
</tr>
<tr>
<td>Churches</td>
<td></td>
</tr>
<tr>
<td>Stadia</td>
<td></td>
</tr>
<tr>
<td>Halls</td>
<td></td>
</tr>
<tr>
<td>Hotels</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Emergency First Response</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Police Stations</td>
<td></td>
</tr>
<tr>
<td>Fire Stations</td>
<td></td>
</tr>
<tr>
<td>Military sites</td>
<td></td>
</tr>
<tr>
<td>Hospitals</td>
<td></td>
</tr>
<tr>
<td>Health Centres</td>
<td></td>
</tr>
<tr>
<td>Emergency Operations Centres</td>
<td></td>
</tr>
<tr>
<td>Response equipment storage sites</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relief</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Food storage sites</td>
<td></td>
</tr>
<tr>
<td>Medical supplies storage</td>
<td></td>
</tr>
<tr>
<td>Distribution vehicles</td>
<td></td>
</tr>
<tr>
<td>Dams</td>
<td></td>
</tr>
<tr>
<td>Water treatment facilities</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recovery</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Buildings</td>
<td></td>
</tr>
<tr>
<td>Power generating facilities</td>
<td></td>
</tr>
<tr>
<td>Power transmission facilities</td>
<td></td>
</tr>
<tr>
<td>Fuel storage facilities</td>
<td></td>
</tr>
<tr>
<td>Fuel transmission facilities</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Television transmission sites</td>
<td></td>
</tr>
<tr>
<td>Radio transmission sites</td>
<td></td>
</tr>
<tr>
<td>Telecommunication sites</td>
<td></td>
</tr>
<tr>
<td>Key distribution lines</td>
<td></td>
</tr>
<tr>
<td>Repeater sites and base stations</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transport</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Major roadways</td>
<td></td>
</tr>
<tr>
<td>Airports</td>
<td></td>
</tr>
<tr>
<td>Seaports</td>
<td></td>
</tr>
<tr>
<td>Heliports</td>
<td></td>
</tr>
<tr>
<td>Aviation control towers</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Assessment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Testing Laboratories</td>
<td></td>
</tr>
<tr>
<td>Key water distribution lines</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Wastewater treatment facilities</td>
<td></td>
</tr>
<tr>
<td>Sewer treatment facilities</td>
<td></td>
</tr>
<tr>
<td>Standby/ Back-up Facilities</td>
<td></td>
</tr>
<tr>
<td>Stockpile/ storage sites</td>
<td></td>
</tr>
<tr>
<td>Banks</td>
<td></td>
</tr>
<tr>
<td>Custodial facilities (jails, prisons, etc.)</td>
<td></td>
</tr>
</tbody>
</table>
Key Infrastructure

Key infrastructure should include facilities and infrastructure which are important, but not critical. This should also capture facilities and infrastructure which if not protected can become potentially hazardous such as major industrial sites such as an oil refinery or a landfill. Examples of Key Infrastructure: Pipelines, Major Industrial Sites and Processing Plants, Dumps/Landfills etc.

High Risk

For the purposes of this study, high risk areas will be considered as sites which have frequented by hazard occurrences in the past and those located in close proximity to potentially hazardous areas, such as industrial complexes, major faultiness or river beds.

<table>
<thead>
<tr>
<th>Facility &amp; Coordinates</th>
<th>Affected by any Hazards / located in a high risk Area?</th>
<th>If yes which Hazard/s?</th>
<th>Details / impact etc</th>
</tr>
</thead>
<tbody>
<tr>
<td>E:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Step 4: Societal Analysis

Social Vulnerability

Social Vulnerability refers to inability or limited capacity of people, organizations, groups or societies to adequately absorb, respond to and recover from the impacts of hazards and disasters. They include but are not limited to:

- Elderly – Homes for the Aged
- Young Children – Orphanages etc
- Sick /Mentally Challenged /Differently Able
- Hospitals /Nursing Homes etc
- Foreigners / people with Language Barriers
- Poor – Squatter Settlements
- Mobility
- Literacy

Social vulnerability can be influenced by cultural trends and traditions, which means the elements can vary by community, it is therefore important to engage residents of those familiar with the area being examined in order to ensure the accuracy of the data collected.

Key

MCC- Maximum carrying Capacity

PCC- Present Carrying Capacity
### Societal Analysis

<table>
<thead>
<tr>
<th>Area/ Community /Facility</th>
<th>Location</th>
<th>MCC</th>
<th>PC</th>
<th>Yes</th>
<th>No</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>E:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N:</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Is it located in a high risk area?**

**Step 5: Communication, Early Warning and Resilience**

<table>
<thead>
<tr>
<th>Risk Communication and Early Warning</th>
<th>Yes</th>
<th>No</th>
<th>Please describe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are there multiple mechanisms for Risk Communication?</td>
<td></td>
<td></td>
<td>How are risk messages communicated?</td>
</tr>
<tr>
<td>Are there Community based Early Warning Initiatives?</td>
<td></td>
<td></td>
<td>If Yes, what are the initiatives?</td>
</tr>
<tr>
<td>Community Action</td>
<td>Yes</td>
<td>No</td>
<td>If Yes, please list /describe</td>
</tr>
<tr>
<td>------------------</td>
<td>-----</td>
<td>----</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Are there any CBO’s NGO’s and FBO’s active in the area?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have any evacuation or egress routes been developed?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there any members of the community who have received training/education to deal with the impact of hazards on their own, or until emergency services arrive.</td>
<td></td>
<td></td>
<td>If Yes please describe the type of training and approximately how many were trained.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructure and location</th>
<th>Yes</th>
<th>No</th>
<th>If Yes, please list /describe</th>
<th>If no please list limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the Community have sufficient drainage? i.e. do drains and rivers overflow or fill up quickly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Step 6: Environmental Sensitivity

The purpose of an analysis of environmental sensitivity is to identify locations where there is the potential for secondary environmental impacts from natural hazards and target vulnerable locations for hazard mitigation activities. Areas of environmental sensitivity include but are not limited to: Environmental resource areas, particularly those which exhibit sensitivity to secondary hazard impacts such as chemical spills, gas leaks etc. For example: wetlands, coral reefs, rivers, nature reserves, water sheds etc.

<table>
<thead>
<tr>
<th>Environmental Sensitivity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area &amp; Location</strong></td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
</tbody>
</table>
Step 7: Mitigation

Mitigation refers to the techniques used to lessen or limit the impacts of hazards and related disasters. Mitigation can be either structural, which refers to physical action such as dredging rivers and spraying for mosquitoes, while non-structural deals with the non-physical aspects such as policy, planning, education, outreach etc.

Each mitigation initiative outlined will be assigned a score to reflect its effectiveness.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>No mitigation in place</td>
<td>0</td>
</tr>
<tr>
<td>Not effective</td>
<td>1</td>
</tr>
<tr>
<td>Moderately Effective</td>
<td>2</td>
</tr>
<tr>
<td>Very Effective</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mitigation</th>
<th>Yes</th>
<th>No</th>
<th>If yes please Describe, and state for which hazards</th>
<th>Who is responsible</th>
<th>How often is it done?</th>
<th>EScore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is non structural mitigation practiced?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Limitations

Please list any limitations encountered in the application of this tool

| Is structural mitigation practiced? |  |  |  |  |
Recommendations /Comments
Recommendations can be based on the gaps uncovered while using the tool

_____________________________________________________________________________________________________________________

_____________________________________________________________________________________________________________________

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