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CASE STUDY:
Being SMART: Piloting, Replicating and Scaling Up Disaster Risk Reduction and Sustainability in Health Facilities

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Case Study: Being SMART: Piloting, Replicating and Scaling Up Disaster Risk Reduction and Sustainability in Health Facilities

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Website: www.uwi.edu/EKACDM

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LIST OF ACRONYMS AND ABBREVIATIONS

ACP	African, Caribbean and Pacific Group of States
BCPR-UNDP	Bureau for Crisis Prevention and Recovery-UNDP
BRAGSA	Buildings, Roads and General Services Authority, St Vincent
BVI	British Virgin Islands
CARILEC	Caribbean Electric Utility Services Corporation
CARICOM	Caribbean Community
CBO	Community Based Organisation
CC	Climate Change
CCA	Climate Change Adaptation
CCCCC	Caribbean Community Climate Change Centre
CCRIF	Caribbean Catastrophe Risk Insurance Facility
CDB	Caribbean Development Bank
CDEMA	Caribbean Disaster Emergency Management Agency
CDEMA CU	Caribbean Disaster and Emergency Management Agency Coordinating Unit
CDEMA	Caribbean Disaster Emergency Management Agency
CDM	Comprehensive Disaster Management
CERT	Community Emergency Response Teams
CIMH	Caribbean Institute of Meteorology and Hydrology
DANA	Disaster Assessment Needs Analysis
DALA	Damage and Loss Assessment
DDC	District Disaster Committee
DIPECHO-EC	Disaster Preparedness ECHO Programme, European Commission
DFATD	Department of Foreign Affairs, Trade and Development, Canada
DFID	Department for International Development, the United Kingdom
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
ECDG DM	Eastern Caribbean Development Partners Group on Disaster Management
ECLAC	Economic Commission for Latin America and the Caribbean
EOC	Emergency Operations Centre
EPA	Environmental Protection Agency
EU	European Union
EWS	Early Warning Systems
FAO	Food and Agriculture Organization
GFDRR	Global Fund for Disaster Risk Reduction
GDI	Gender Development Index
GII	Gender Inequality Index
GIS	Geographic Information Systems
GDP	Gross Domestic Product
GOSVG	Government of St. Vincent and the Grenadines
HDI	Human Development Index
HFA	Hyogo Framework for Action

HTERP	Hurricane Tomas Emergency Recovery Project
ICT	Information, Communications and Technology
IDA	Initial Damage Assessment
IDB	Inter-American Development Bank
IFRC	International Federation of Red Cross and Red Crescent Societies
INFORM	Index for Risk Management
MCMH	Milton Cato Memorial Hospital
MIRA	Multi-Cluster/Sector Initial Rapid Assessment
MoF	Ministry of Finance
MOTW	Ministry of Transport and Works
NAEB	National Environmental Advisory Board
NDO	National Disaster Organisation
NEMO	National Emergency Management Organisation
NEOC	National Emergency Operations Centre
NHMC	National Hazard Mitigation Committee
OCHA	Office for the Coordination of Humanitarian Affairs
OECS	Organisation of Eastern Caribbean States
OFDA	Office of Foreign Disaster Assistance
PAHO	Pan American Health Organization
PDNA	Post Disaster Needs Assessment
RRT	Regional Response Team
RSS	Regional Security System
SIDS	Small Island Developing States
SITREP	Situation Report
SOP	Standard Operating Procedure
SPCR	Strategic Programme for Climate Resilience
SVG	St. Vincent and the Grenadines
UN	United Nations
UNDG	United Nations Development Group
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
UNISDR	United Nations International Strategy for Disaster Reduction
US	United States
USAID	United States Agency for International Development
USD	United States Dollars
UWI	University of the West Indies
VINLEC	St. Vincent Electricity Services
WB	World Bank

PREAMBLE

This case study documents the mainstreaming of environmental sustainability to build disaster resilience in critical infrastructure, specifically a hospital located in St. Kitts and Nevis. It is a local level case study that focuses on a remarkable pilot project. The case study also documents the implementation successes of the pilot and its extensions in the British Virgin Islands. Lastly, several strategies and policies are recommended to scale up the lessons learned from the pilot project.

This case study sheds light on the following questions:

1. How can environmental sustainability for critical infrastructure be mainstreamed into disaster risk reduction?
2. What are the prospects for scaling up successful environmental sustainability mainstreaming projects especially in the public and critical infrastructure sectors?

This case study was developed through the collection and analysis of primary and secondary data and information. Primary information was collected from open-ended interviews with project officers of the Pan American Health Organization (PAHO) and national disaster office officials in St. Kitts and Nevis. Secondary information was collected from PAHO documents and project reports, project website reports, media documents and public information. Data analysis consisted of examining, categorising and recombining the evidence to answer the questions above. Reliability was assured through progressively more detailed data collection and more focused second and third interviews (with relevant informants). Internal validity was maximized by triangulation of data sources and the use of multiple respondents.

The main limitation of the data collection was gaining access to relevant personnel for interviews. Initial introductory interviews with PAHO personnel were often afforded but follow-ups to obtain more details for more pointed questions were difficult to secure, even by email. In such follow-ups, sometimes officials responded that they were not able to provide information or need to seek permission to share internal information.

Nonetheless, the case study presented here achieves the task of analysing a successful environmental sustainability implementation story pertaining to man-made structures. All too often in the Caribbean context, this has not been the case. The focus, interestingly enough, has been almost solely on consideration of integrated natural systems (ecosystems) sustainability and disaster risk reduction. This case study is, therefore, pioneering in this regard. Secondly, there are few Caribbean examples of environmental sustainability mainstreaming into disaster risk reduction, even fewer of successful initiatives or scaling up such activities and we would venture to say this is the only example to date of a successful initiative being scaled across or adapted to another sector – from public health (hospitals) to that of education (schools and community learning centres) in the British Virgin Islands (BVI). Even as an emerging success story, this already suggests good lessons for the future.

EXECUTIVE SUMMARY

Natural disasters have significant impact on the health sector in the Caribbean and the functioning of communities that depend on the national healthcare systems including hospitals, health centres and emergency transport services. The Pan American Health Organization (PAHO) and the World Health Organization (WHO) have estimated that nearly seven in 10 hospitals in Latin America and the Caribbean are located in disaster prone areas, putting them at risk of becoming casualties themselves during hurricanes, earthquakes or flooding. In an effort to reduce risks posed by natural disasters on health care infrastructure, these organisations have embarked on an initiative called the “Smart Hospitals” programme, a multi-year initiative targeting a dozen hospitals in Dominica, Grenada, St Lucia and St Vincent and the Grenadines. It seeks to ensure that health facilities are disaster resilient and also environmentally friendly. It is unique that the initiative recognises the opportunities to incorporate environmental sustainability strategies in hospital upgrades that will reduce operating costs and produce less pollution. A hospital is considered “SMART” when it links structural and operational safety with green interventions, at a reasonable cost-benefit ratio.

There are two main objectives of this case study. The first is to describe the progressive steps involved in designing and implementing the “SMART Hospitals” Initiative in the Organisation of Eastern Caribbean States (OECS), particularly the tools used to support the decision-making processes and how they were employed in the pilot project; the success of the programme to date, from initial design and development of critical evaluation and assessment tools through to piloting the initiative in selected hospitals in the OECS, ensuring that advocates and stakeholders alike, are confident in the proof-of-concept before considering an expansion. The second objective of the case study is therefore to review how the “SMART Hospitals” concept was expanded in the British Virgin Islands and the novel, innovative adaptation of tools and methods to schools and communities. Based on the lessons learned through the case study, several strategies and policy prescriptions are set forth to encourage scaling up and adaptation of successful green infrastructure-disaster risk reduction initiatives in the region.

The results in pilot hospitals are improved air quality, reduced water and energy costs and improved working conditions. These improvements also influence users’ decision to visit health facilities; in facilities that have adopted the “SMART Hospitals” Initiative, the number of users seeking care has increased by 40%. Participating hospitals have instituted measures including reinforcing their roofs and windows to resist hurricane-force winds and installing new rainwater-collection tanks and solar panels to supplement their traditional sources of water and energy. Other measures include improvements in accessibility for people with disabilities, use of energy-efficient LED light bulbs and replacement of air conditioners with newer, more energy-efficient models.

The Caribbean health sector specific tools developed for use by health administrators includes three items, namely a Hospital Safety Index which is a rapid-assessment tool for determining the probability that a health facility will be able to continue functioning in an emergency; a Baseline Assessment Tool to collect information on a building’s performance and operations and how it measures up against current building code, regulatory requirements and zoning regulations and Green Hospitals Checklist which outlines feasible areas where “SMART” measures can be introduced. These tools have the potential to scale up application to other healthcare facilities throughout the Caribbean and to scale across, meaning adaptation to other types of service oriented facilities such as schools as is being tested in the BVI.

INTRODUCTION

1 INTRODUCTION

More than 67% of the nearly 18,000 hospitals in Latin America and the Caribbean are located in areas at high risk for disasters and climate change. Hundreds have been destroyed as a result of disaster events causing enormous economic losses (including rebuilding costs, service loss, lost income and work days) for the health sector as well as limiting emergency care to victims and directly threatening the lives of patients and healthcare workers. There is a social impact too since community life often gravitates around schools, churches and health centres and loss of one severely affects community resilience.

In 2010 for example, Hurricane Tomas, a Category 1 hurricane, cost the health sector in Saint Lucia EC$8.3 million, as a result of damage to a number of hospitals. About half of this cost was attributed to relocating and rebuilding the badly damaged Dennery Hospital.
Many of these losses could have been avoided or reduced by taking pre-emptive action. For example, there is a clear correlation between reduced numbers of destroyed houses by hurricanes in the Caribbean and the use of safe building techniques such as hurricane straps.

Of the 131 public hospitals identified in 15 Caribbean countries, 38 were surveyed. Of this number, 86% had a Category B Hospital Safety Index score, indicating that current safety levels and ability to function are potentially at risk. Functional factors such as the absence of a disaster committee, poorly labeled or obstructed emergency routes; and non-structural issues such as risk of roof, communication and fire suppression system damage, water and gas supplies etc., tend to be the predominant causes of increased vulnerability. In terms of structural safety, 80% received a satisfactory score to various hazards. The recognised strengths included good electrical systems, fuel storage and the availability of medical and laboratory equipment and supplies (PAHO, 2014).

It is well established that the Caribbean is a highly natural hazard[1] -prone region. Hurricanes Gilbert, Ivan and Tomas are stark reminders of how the direct and indirect impact of natural disasters can significantly disrupt lives, livelihoods and the focus of this case study - access to health services and the sector's ability to provide care. Hospitals require a significant investment and represent between 40-60% of the budget of Ministries of Health in Latin America and the Caribbean. However, today it is also becoming increasingly clear that the health sector itself is one of many contributors to the impact of climate change, making it imperative to step up efforts to reduce the environmental footprint and increase the resiliency of health facilities.

The Hyogo Framework for Action 2005-2015 makes specific reference to "promote the goal of 'hospitals safe from disaster' by ensuring that all new hospitals are built with a level of resilience that strengthens their capacity to remain functional in disaster situations and implement mitigation measures to reinforce existing health facilities, particularly those providing primary health care". The World Health Assembly and WHO Regional Committees have passed resolutions with member states pledging to make their hospitals safer.

[1] Natural hazards are geographical events which occur naturally Under (earthquakes and volcanoes), On (floods) or Above (climatic conditions such as droughts and tropical cyclones) the surface of the earth. Things such as droughts, floods, tropical cyclones, volcanic eruptions and volcanoes regularly happen on a small scale throughout the world. However, if one of these natural hazards leads to – a significant loss of human life and/or – damage to property, and/or – environmental damage, it is called a Natural Disaster.

A continued focus on safe hospitals was recognised in the Communique of the High Level Dialogue of the Global Platform for Disaster Risk Reduction in May 2013 which proposed to all stakeholders to rally behind: "... a global safe schools and safe health structures campaign in disaster- prone areas with voluntary funding and commitments to be announced at the World Conference for Disaster Risk Reduction for 2015." The comprehensive Safe Hospitals framework is intended to guide global and national actions for implementing safe hospitals as a major priority in the Post-2015 Framework on Disaster Risk Reduction and in country and community strategies for disaster risk reduction (DRR).

The innovative SMART Hospital Health Care Facilities Project is the first of its kind to be implemented in the region. It seeks to develop resilient and climate-adapted health care facilities through the application of interventions aimed at reducing the vulnerability of these facilities and their impact on the environment. The project combines a Caribbean adapted version of an established assessment tool called the Safe Hospital Index which was developed by PAHO and the WHO to measure and improve hospital sustainability.

So far, the project has resulted in a valuable toolkit for health care personnel, architects, engineers and others to apply. It has also demonstrated the application of measures to improve safety, reduce risk and also to 'green' healthcare facilities. Furthermore, as the facilities selected in the pilot phase for retrofit were of different ages, one being more than 30 years old and the other less than five years old, the project further illustrated how impacts can be made and benefits gained from older and newer facilities. However, given the nature of the project and the new approach being taken in the untested waters of the Caribbean region, there would be several lessons learned along the way.

The following sections describe the Caribbean context and scenario in which disaster risk reduction in the healthcare sector is practiced; the urgency for change and improvement in how emerging priorities including climate change and environmental sustainability can be mainstreamed into traditional sector operations and strategy and the considerations taken in the deployment of the pilot phases of the SMART Hospitals Initiative. After this, we describe the novel extensions and positive impact of the programme as adapted in another jurisdiction outside of the pilot phase purview and what this could mean for the broader appeal, applicability and scalability of the initiative and those like it. Lastly, recommendations are made on how the programme should be expanded and continued including a call for a broader policy intervention approach that would assist in shifting the implementation from initiative to more expansive, holistic integration into Caribbean healthcare regimes.

TABLE 1: IMPACTS OF NATURAL DISASTERS ON HOSPITALS AND HEALTH FACILITIES IN THE CARIBBEAN & LATIN AMERICA

Location	Event	Year	Nature of Hazard	Overall Effects
Mexico	Earthquake	1985	8.0 magnitude	49 health facilities damaged, including 3 major hospitals (loss of use of 5,829 beds)
Jamaica	Hurricane Gilbert	1988	Cat. 3	24 hospitals and health centres damaged or destroyed – 5,085 beds lost
Dominican Republic	Hurricane George	1998	Cat. 3	87 hospitals and health centres damaged or destroyed
Haiti	Earthquake	2010	7.0 magnitude	50 hospitals and health centres damaged or destroyed; economic losses est. US $7.8 billion

Source: PAHO, 2014

FIGURE 1: IMPACT OF EARTHQUAKE ON INFRASTRUCTURE IN HAITI

1.1 ENVIRONMENTAL SUSTAINABILITY IN HOSPITALS AND HEALTHCARE SYSTEMS

Hospitals are significant contributors to natural resource depletion and environmental change. The objective was to establish the extent to which hospital environmental sustainability has been studied and the key issues that emerge for policy, practice and research. Common environmental sustainability concerns in hospitals include structural design, direct energy consumption, water usage, procurement, waste, travel and aesthetics. Some countries, particularly the United Kingdom, have begun to invest systematically in environmental sustainability of the public healthcare infrastructure but this is a long way off in most of the developing world.

There are however, weaknesses in the evidence base. Knowledge regarding the sustainable architecture of hospital buildings is at a relatively mature stage. Similarly, there is developed knowledge regarding devices and technologies used within hospitals to reduce the environmental effects of direct hospital energy and water use. Less is known about the social factors that influence how healthcare professionals use resources and interact with the buildings and technologies available. A significant part of the environmental footprint of hospitals relates to decisions regarding the use of pharmaceuticals and medical devices. Medical 'cradle to grave' life cycle assessment studies have been undertaken to understand the full financial and environmental costs of hospital activities (Forbes and Naylor, 2014). Assessments of environmental impacts and natural resource use are beginning to be produced, both at the level of individual hospitals and at the health system level. These are an important start, but in many areas do not yet provide sufficiently detailed information to guide decision-making. Rising resource costs and climate change mitigation measures are creating increasing stimuli for research on hospital sustainability.

1.2 CRITICAL INFRASTRUCTURE[2] PERSPECTIVES ON ENVIRONMENTAL SUSTAINABILITY AND DISASTER RISK REDUCTION

Critical infrastructure is composed of the assets, systems and networks, whether physical or virtual, so vital to national interests that their incapacitation or destruction would have a debilitating effect on security, national economic security, national public health or safety or any combination thereof. Public health is one of the key identified critical infrastructure sectors (U.S. Department of Homeland Security, 2016). When hospital and health centres in the Caribbean are impacted by natural hazards, their ability to remain functions in times of natural disasters is compromised. In many national contexts, with limited healthcare infrastructure present in communities in the first place, the debilitation of any such facilities can have a significant impact on emergency response in times of natural disasters.

[2] See U.S. Department of Homeland Security, https://www.dhs.gov/what-critical-infrastructure).

> “There is a clear need to reinforce the importance of environmental concerns in the entire disaster management cycle of prevention, preparedness, assessment, mitigation and response and to integrate environmental concerns into planning for relief, rehabilitation, reconstruction and development. This will also require the enhancement of capacities to undertake short and medium-term activities in disaster management based on long-term environmental considerations” (Toepfer, UNEP 2005).

The guiding principles of the Hyogo Framework for Action say “the sustainability of development depends on its ability to prevent new risk creation and the reduction of existing risk”. Sustainability is integral to managing natural hazard risks and recovery from natural hazard events.

There are two main arms of discourse on the topic of critical infrastructure greening and preparedness for natural hazards and disaster response. The first is strengthening the preparedness of facilities to withstand natural hazards and the second relates to how damaged facilities are rebuilt to bolster resilience. At the same time, with scarce resources and the need for many public health institutions to ‘do more’ with limited budgets and resources, it is increasingly evident that ‘green building infrastructure’ for environmental sustainability, is not only a responsible approach but can also be a cost saving approach which simultaneously contributes to the infrastructure resilience strengthening process in the event of natural hazards.

Environmental management tools are not systematically integrated within the disaster risk reduction framework and vice versa, but it is important to realise that these tools were primarily developed from a risk management approach. For example, elements of the environmental management tools include risk assessment, hazard identification, spill response, and emergency/contingency planning. Those activities are central to the practice of disaster risk management (Labadie 2006). Two specific issues are becoming increasingly prominent from an environmental perspective: impact on the natural environment and impact on the man-made environment. For example, the natural environment includes the ecology of the affected areas while waste issues affect the man-made environment. There is growing consensus around linking disaster risk reduction with environmental sustainability. The Hyogo Framework for Action (HFA) calls for efforts to promote the implementation of “integrated environmental management approaches that incorporate disaster risk reduction, including structural and non-structural measures…”

Process	Current Approach	Sustainable Approach
Build back	“Build back better”	“Building back differently”
Resilience	Immediate (rebuilds, copes)	Immediate (adapts and builds capacity) and long-term (maintains, sustains, mitigates)
Integration of climate change and resource use	Climate adaption and mitigation not integrated into recovery, which limits long-term sustainability and resilience.	Climate adaption and climate mitigation planning and prioritisation initiated through sustainable recovery.
Integration of governance aspects	Opportunity to improve governance not take, which limits cooperation and wider benefits.	Improved cooperation between government and affected communities, which in turn better enables a sustainable approach to led and supported by different actors.

An integrated approach to mainstreaming environmental sustainability into critical infrastructure development will improve disaster preparedness as would consideration of long-term planning for both climate change adaptation and mitigation. It will better-ensure resilience and the ability of critical infrastructure to bounce back quicker from future disasters. Disasters provide an opportunity to rethink what approaches can be taken to increase resilience to shocks and disaster for the longer term. Some use the term ‘climate resilient’ infrastructure that puts mitigation and adaptation to climate change and wider sustainability challenges at the core. The concept of ‘building back differently’ can free up resources from reconstruction that further expands infrastructure and the wider built environment post-disaster to improving the quality or resilience of existing environments.

CASE BACKGROUND

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2 CASE BACKGROUND

PAHO is spearheading the “SMART” Hospitals Initiative to ensure that health facilities in the Caribbean are both safe and green. While there is broad support for the principles of smart health facilities, there are very few actual policies at the national level that call for a shift away from the traditional disaster response model to one that proactively seeks to minimise the health impact of a disaster through climate adaptation, mitigation and preparedness. At this point therefore, all such initiatives are voluntary.

In the last decade, nearly 24 million people in the Americas lost health care for months, and sometimes years, due to the damage directly related to disasters (The Heritage Foundation, 2013). On average, a hospital out of service in the region leaves approximately 200,000 people without health care and the loss of emergency services during disasters sharply reduces the chance to save lives. Many countries in the Caribbean have only one referral hospital. The vulnerability of health facilities in disaster situations cannot be underestimated. There is a widely held expectation that health facilities are prepared to deal with emergency situations. However, the impact of past earthquakes and hurricanes in the Americas has proven that hospitals and other health facilities are indeed vulnerable. Many have been left unable to function and provide not only emergency services but also routine medical care and public health services. The loss of a healthcare facility is not only a significant public health issue but also a political and economic one (Gerwig, 2014).

In addition to the need to build new and retrofit existing health facilities so that they are structurally sound, there is growing recognition of the need to reduce the non-structural vulnerability of existing facilities. This is particularly true in hospitals where between 85-90% of the facility’s value resides in architectural finishes, mechanical and electrical systems and the equipment and supplies contained in the building. A building’s non-structural elements include architectural elements (such as ceilings, windows and doors), medical and laboratory equipment and lifelines (mechanical, electrical and plumbing). Considerations related to the equipment and lifelines focus on their location and whether they are anchored properly. The reinforcement of non-structural elements can significantly reduce hurricane-related risks for the health facility and its occupants.

Health facilities in the Caribbean are vulnerable to climate change and variability. Climate-related hazards create risks that disrupt the delivery of health services. Extreme weather events (such as storms, floods, drought etc.) create emergency situations that damage infrastructure, compromising access to critical resources (food and water) and the safety of patients, visitors and staff. The effects of climate change can increase the risk of some infectious diseases including vector, water and food-borne, new and emerging; as well as worsen air quality. Rising sea levels, together with coastal erosion and saltwater intrusion, increase the intensity of tropical storms and hurricanes and disrupt rainfall patterns and the freshwater supply, thereby presenting a significant threat to Caribbean islands. The anticipated negative health impacts of climate change include worsening sanitary conditions due to limited water supply during droughts or contaminated water supplies as a result of floods-conditions that favour the spread of water and vector- borne diseases like malaria, dengue and diarrheal ailments, as well as heat stress in vulnerable groups.

When health facilities are destroyed or damaged by climate-related disasters, their ability to provide emergency care to victims and ongoing health care for communities tend to be very limited. It is, however, noteworthy that national and regional climate change policies in the Caribbean have not articulated a suite of responses to the impact of climate change and climate variability on health facilities. Most, if not all of these policies focus on the impact of climate change on diseases. The Caribbean Regional Framework for Achieving Development Resilient to Climate Change for instance, only seeks to disseminate information and promote the adoption of practices to prevent and/or reduce exposure to vector-borne diseases resulting from increased temperatures, extreme rainfall and flooding.

As climate variability and climate change are becoming increasingly observable and as science points to an increase in the number of hazard-related events in the Caribbean, it makes good sense to protect these critical facilities at the levels of life protection; investment protection and operational protection.

The United Nations Economic Commission for Latin America and the Caribbean (UNECLAC) estimates that the region lost more than US$3.12 billion in a 15-year period due to damage to health infrastructure. Indirect losses are estimated to be significantly higher when measuring the increases in health care costs for the millions who have been left without health services for a prolonged period of time. In the Caribbean, hurricanes have severely damaged hospitals in Dominica, Jamaica, Montserrat and St. Kitts and Nevis. Hurricane Gilbert prompted the evacuation of some hospitals in Jamaica in 1988. There are also many examples of Caribbean hospitals and other health facilities that were flooded because they were located in vulnerable areas and/or were poorly maintained.

During the past several decades, there has been a major increase in the cost of natural disasters globally. Between 2000 and 2008 alone, global losses were estimated at US$620.6 billion. This upward trend in losses has occurred in the Caribbean as well. For Caribbean nations, the impact of natural hazards is particularly pronounced, given the size of the islands and their Gross Domestic Product (GDP). For the purpose of comparison, Hurricane Katrina, which is often used as a benchmark for a significant catastrophic event, accounted for less than a 1% of the United States GDP while on the other hand, Hurricane Ivan (2004) resulted in more than a 200% loss to the GDP of the Cayman Islands and Grenada. It has become clear that beyond the immediate and tragic loss of life, catastrophic events can also unleash a set of circumstances that hinder a government's ability to effectively finance its immediate recovery and longer-term redevelopment processes. This impact has a further reverberating effect on the wider economy whilst also exacerbating the level of poverty among survivors.

Governments are often challenged with the task of financing post-disaster recovery efforts. While dealing with the fiscal demands of relief operations, such as ensuring the availability of emergency assistance and sourcing funding for shelter, food and medical attention for displaced persons, governments also must contend, simultaneously, with the challenge of mobilising sufficient resources to undertake the medium to long-term recovery and reconstruction process. This can include tasks that range from clearing debris to restoring critical services. These expectations are often precariously juxtaposed with the need for governments to subsidise the reconstruction of private assets such as the homes of displaced low-income families, all of which must be accomplished in an environment of dramatically declining revenue.

Health facilities use a great deal of energy because of how they are run and the large number of people who use them. In fact, hospitals expend about double the amount of energy per square foot as office buildings. Therefore, health facilities have a significant carbon footprint. Not only are utility costs high, the resources used to pay for energy consumption could be put to better use to improve health services. In the U.S., it is estimated that health care organisations spend nearly $8.8 billion on energy each year to meet patient needs (Reynolds, 2012). Every dollar a non-profit health organisation saves on energy has an impact on operating margins; it is equivalent to increasing revenues by $20 in hospitals or $10 in medical offices. The cost of energy in the Caribbean is among the most expensive in the world; in 2006, it cost between US$0.24 and US$0.37 per kilowatt hour as compared to US$0.08 per kilowatt hour in the U.S.

In light of this reality, Health facilities will achieve multiple gains by integrating disaster risk reduction with low carbon energy use, climate change adaptation and environmental protection. In addition to the impact on the cost of health care, investing in these efforts leads to financial and social benefits including behavioural change. In light of these issues, PAHO/WHO is working towards the goal of health facilities that are not only safe but also 'green.'

2.1 MAINSTREAMING ENVIRONMENTAL SUSTAINABILITY INTO HOSPITALS

Three main tools were developed to assess the need for environmental sustainability mainstreaming into hospitals, taking into account where such mainstreaming could be operationalised and implemented and where and how such interventions could make the most positive impact on hospital resilience, disaster risk reduction and the operational quality of care. These tools are the Hospital Safety Index, the SMART Hospital Baseline Assessment Tool and the Green Hospital Checklist described below.

Specifically, environmental sustainability and the vulnerability of health facilities to potential hazards intersect across six major areas (PAHO/WHO, 2013).

1. Buildings: The location and building specifications, particularly regarding design, resiliency of the material and physical vulnerability, determine the ability of hospitals to withstand adverse natural events. The slightest structural or architectural element that collapses or fails, results in both financial and human costs.
2. Patients: It is customary for health facilities to operate 24 hours a day at about 50% of their service capacity. Any disaster will potentially increase the number of patients and amplify their level of risk. Waiting lists get longer since it becomes impossible to meet both routine demand and that generated by the emergency. Patients also suffer from the decline in the provision of services as a result of damaged, partially evacuated or non-operational facilities.
3. Hospital beds: In the aftermath of a disaster, the availability of hospital beds frequently decreases even as demand goes up for emergency cases of those injured.
4. Medical and support staff: It is hardly necessary to describe the significant disruption to the care of injured caused by the loss of medical or support personnel. In order not to suffer a concomitant loss in response capacity, outside personnel must be hired temporarily, adding to the overall economic burden. Sometimes, the death of a specialist can entail major technical costs for the country affected by the disaster.

5. Equipment and facilities: Damage to non-structural elements (such as equipment, furniture, architectural features and medical supplies) can sometimes be so severe that it surpasses the cost of structural damage. Even when the damage is less costly, it can still be critical enough to force the hospital to stop operating.
6. Basic lifeline and services: The ability of hospitals to function relies on lifelines and other basic services such as electrical power, water and sanitation, communications, and waste management and disposal.

The effort to "go green" could be very beneficial for hospital facilities. Hospitals as a whole have a fairly significant impact on their surrounding environment, according to data from the U.S. Environmental Protection Agency. Every day, US hospitals generate close to 7,000 tons of infectious, hazardous and toxic waste. Hospitals also affect the environment because of several other factors, including mercury use in medical devices and equipment, use of other materials with potentially toxic effects (such as cleaning materials, batteries and pesticides), energy consumption, greenhouse gas emissions and water usage. While it may seem daunting to revamp a hospital to become more sustainable, there are several ways hospitals can reduce their environmental footprints. The United States Environmental Protection Agency (EPA) recommends the following:

- Explore ways to conserve water: Replace toilets, faucets and showers with water-efficient alternatives and purchase high-efficiency dishwashers.
- Save energy: Reducing energy use and carbon output is particularly tricky for hospitals, but not impossible. Hospitals can reprogramme heating and cooling plants, re-engineer air handling systems and upgrade light bulbs among other changes.
- Change waste disposal protocols: Hospitals produce so much waste that it can be challenging to dispose of it in an environmentally friendly way. For example, regulated medical waste has to be disinfected before going to the landfill. Disinfection methods like incineration are both energy intensive and known to release noxious fumes. On the contrary, processes like autoclaving, chemical treatment and microwaving can be eco-friendly.
- Practice chemical safety: Dozens of chemicals used in hospitals can be dangerous. LCD displays, fluorescent lamps, CRT monitors, flame-retardant mattresses, wheelchair cushions and even baby bottles can contain hazardous chemicals if bought from the wrong manufacturer. Hospitals can improve chemical safety by making conscious purchasing decisions and recycling toxic goods, like batteries.
- Revamp entire supply chain to be more sustainable: Work with vendors to ensure that all products the hospital purchases are as environmentally friendly as possible, from medical supplies to printer paper.
- Make renovations and upgrades greener: When making renovations or building new facilities, consider adhering to internationally recognised ratings systems such as Leadership in Energy & Environmental Design (LEED) standards.

Going green may be considered a costly endeavour for hospitals, which may cause them to put sustainability on the back burner. However, going green could actually save hospitals money in the long run.

Investing in making health care facilities SMART, that is both environmentally green and disaster resilient has financial and social benefits in addition to those related to health. Key co-benefits include reduced operation and maintenance costs thereby facilitating greater allocation towards patient care and health in the community; reduced impact of volatile and high energy costs and greenhouse gas emissions; improved environmental performance and a healthier healing and work environment. Measures implemented could include safety improvements, use of energy efficiency appliances and ventilation, renewable energy applications, improved heating and cooling systems, water conservation and rainwater harvesting etc.

Despite numerous co-benefits, sometimes potential conflicts or trade-offs exist between environmental performance features and safety measures. For example, those measures that improve environmental performance but compromise safety/hazard resistance (or vice-versa) and improved resistance/safety to one type of hazard but increased vulnerability to another.

Specific examples of such risk management trade-offs include the following. Heavy structures resist winds better but light structures resist earthquakes better; flexible structures attract greater wind forces but stiff structures (generally) attract greater earthquake forces; base isolators used to protect building foundations and enable some movement during earthquakes need to be flood-proofed to reduce their vulnerability to flood damage; wooden framed structures often used for small buildings or ancillary services, perform better in seismic zones, but their lightness and lack of moisture resistance can be a disadvantage in floods (FEMA, 2009).

2.1.1 THE HOSPITAL SAFETY INDEX (HSI)

The HSI is a tool developed by PAHO and regional experts which is used by health authorities to gauge the overall level of safety of a hospital or health facility in emergency situations. The HSI helps health facilities assess their safety and avoid becoming a casualty of disasters by providing a snapshot of the probability that the facility will continue to function in emergency situations, based on structural, non-structural and functional factors, including the environment and the health services network to which it belongs. By determining a hospital's score, decision makers will have an overall idea of its ability to respond to major emergencies and disasters. The HSI does not replace costly and detailed vulnerability studies. However, because it is relatively inexpensive and easy to apply, it is an important first step towards prioritising investment in hospital safety.

There are a number of steps to calculating a health facility's safety index score. A trained team of evaluators will use the Safe Hospitals Checklist to assess the level of safety of 145 areas of the health facility which are grouped by location, structural, non-structural and functional components. Once the checklist has been completed, the evaluation team collectively validates the scores and enters them into a scoring calculator, which weighs each variable according to its relative importance to a hospital's ability to withstand a disaster and continue func¬tioning. The safety score is calculated automatically. The final Hospital Safety Index score places a health facility into one of three categories of safety, helping authorities determine which facilities most urgently need interventions.

- Category A is for facilities deemed able to protect the lives of occupants and are likely to con¬tinue functioning in disaster situations.
- Category B is assigned to facilities that can resist a disaster but in which equipment and critical services are at risk.
- Category C designates a health facility where the lives and safety of occupants are deemed at risk during disasters.

Calculating the safety score allows health facilities to establish maintenance and monitoring rou¬tines and look at actions to improve safety in the medium term. This quick overview will give countries and decision makers a starting point for establishing priorities and reducing risk and vulnerability in healthcare facilities. This tool has also been adapted to improve the safety and response capacity of smaller health facilities in emergency situations. Smaller facilities are defined as those of low complexity, which together with major hospitals, make up the health network. These include primary care facilities that offer certain specialised services such as obstetrics and gyne¬cology, pediatrics, internal medicine and general surgery and often have 20 beds or less.

Below are some examples of structural risk reduction practices conceptualised for inclusion in the SMART Hospitals project:

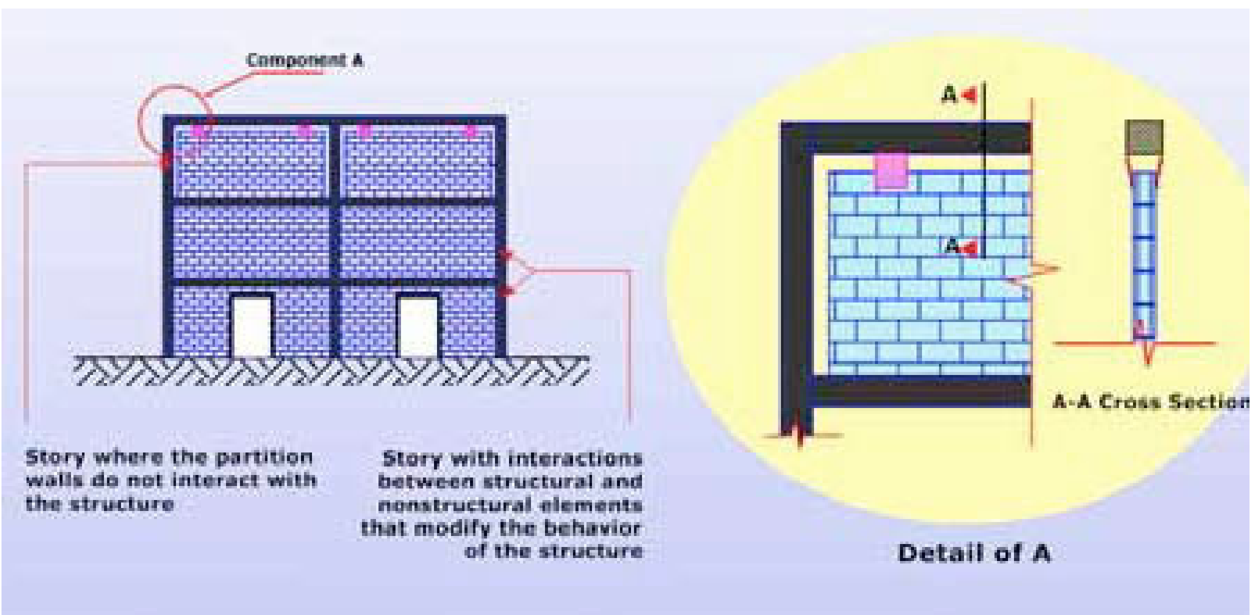

FIGURE 2: STRUCTURAL SEISMIC INTERACTIONS BETWEEN STRUCTURAL AND NON-STRUCTURAL COMPONENTS

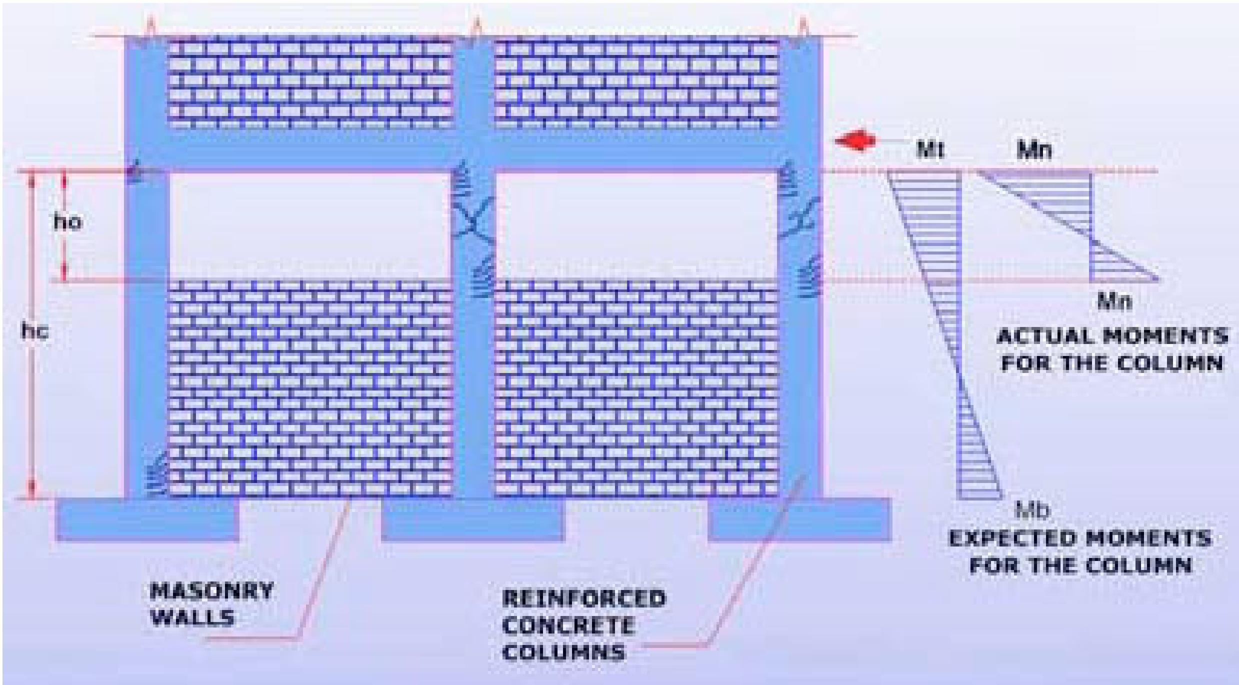

FIGURE 3: SEISMIC CONSIDERATIONS: MASONRY WALLS INTERACTING WITH REINFORCED CONCRETE (RC) FRAME, CAUSING FAILURE DUE TO SHORT COLUMNS.

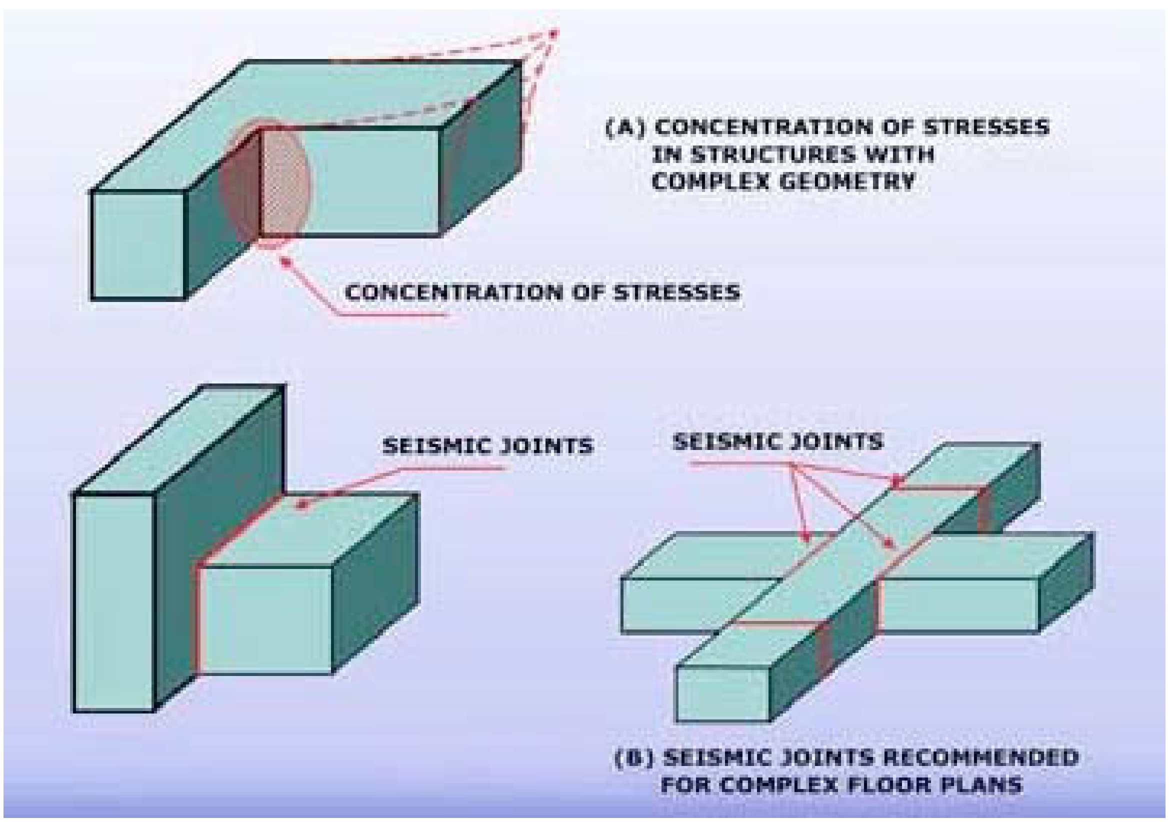

FIGURE 4: SEISMIC CONSIDERATIONS: USE OF SEISMIC JOINTS

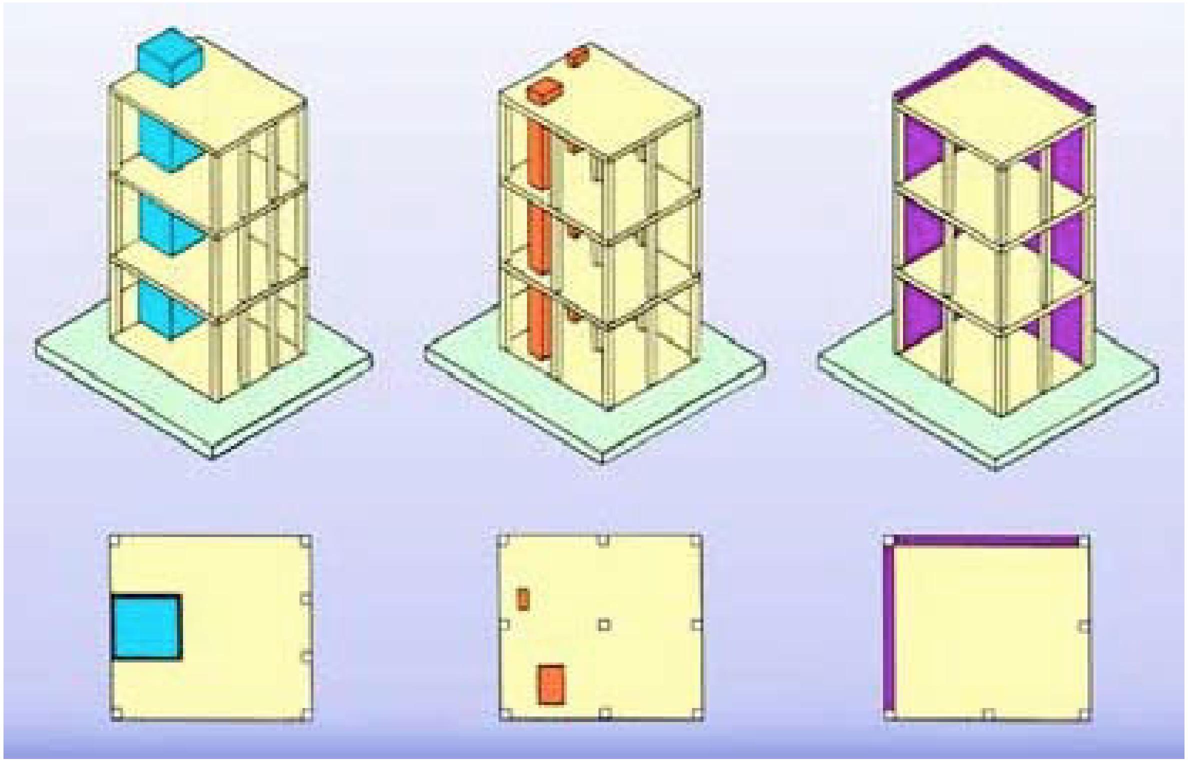

FIGURE 5: SEISMIC CONSIDERATIONS: ASYMMETRY DUE TO LOCATION OF STRUCTURAL ELEMENTS.

2.2 IMPLEMENTATION OF THE PILOT PROJECT AT THE POGSON MEDICAL CENTRE, ST. KITTS AND NEVIS

2.2.1 HEALTH FACILITIES IN ST. KITTS & NEVIS

Each Ministry of Health has directorates of community health services and health institutions. The latter directorates manage primary, secondary and tertiary medical services in hospitals and rural urgent care centres, as well as long-term care in senior citizen homes. The main referral hospital is the new150-bed Joseph N. France General Hospital on St. Kitts. Two district hospitals on St. Kitts provide basic inpatient services. The 50-bed Alexandra Hospital is the main health facility on Nevis.

The Directorate of Community Health provides population-based services. The island is served by a network of health facilities. The 17 community health centres (11 on St. Kitts and 6 on Nevis) are staffed by nurses and nursing auxiliaries, medical officers and environmental health officers. Each centre is responsible for the health of the population in a defined area and provides a range of services, including maternal and child health care, general medical services and chronic disease management. The services are free at the point of delivery.

All medical products, vaccines and new technologies were imported during the pilot period. About 90% of the medications used in the public sector are obtained through the Organisation of Eastern Caribbean States Pharmaceutical Procurement Service. Vaccines were purchased through the PAHO Revolving Fund for Vaccine Procurement.

2.3 HOSPITAL ASSESSMENT

A health facility's age, physical condition, quality of construction, structural, non-structural and mechanical integrity and compliance with current building, fire and electrical codes are important factors to consider in any audit. The SMART Hospital Baseline Assessment Tool (BAT) helped to assess these factors for the Pogson Hospital, by collecting reliable and detailed information on the building's performance and operations and how it measured up against current code and regulatory and zoning requirements.

The information drawn from the assessment covers the building's operating systems; capital improvement requirements and history; energy and water usage; waste generation; Indoor Environmental Quality (IEQ); occupant satisfaction; facility management; security, overall design and architectural features and any signs of physical deterioration. The assessment also examines building codes, fire safety, accessibility and health and safety. This information is needed to 'smarten' the facility, making it environmentally friendly, safe and disaster resilient, prioritise measures to reduce energy and water consumption, waste generation and undertake a cost-benefit analysis of the proposed interventions.

The Baseline Assessment Tool is composed of the following sections:

1. Criteria for selecting a health care facility for green retrofitting.
2. Patient/Administrator Occupant Satisfaction Survey. This examines such factors as lighting, temperature, glare, ventilation and perception of the building's safety during natural disasters. It highlights areas of concern that should be addressed during the project design and decision making process.
3. Required baseline information to properly evaluate the health facility. Information useful for calculating the carbon footprint of the structure is also included.
4. Evaluation of property condition. This helps to determine the suitability of a structure for retrofitting and includes evaluation of the structure, doors, windows, flooring, structural defects, air conditioning systems or equipment, items of deferred maintenance and building code violations. The information/ schematics/site plans, energy and water usage data and all other information required to complete this assessment will help evaluators decide which structure is suitable for 'smartening' green retrofitting. For the evaluation to be thoroughly comprehensive, every effort should be made to gather as much of this information as possible, prior to making decisions.

2.3.1 THE GREEN HOSPITALS CHECKLIST

Hospitals use the greatest proportion of energy during daily operations, when energy needs for heating water, lighting and telecommunications are most acute. Studies suggest that between 70 % and 80% of greenhouse gas emissions (GHG) are released during this period. Because of the high level of carbon impact associated with the operational phase, it is essential to identify low-cost (often non-structural) measures that can be easily implemented. The SMART Hospitals Toolkit helps existing hospitals identify and implement low-cost adaptation measures. Several green building rating systems exist. LEED, developed by the United States Green Building Council and BREEAM, the United Kingdom BRE Environmental Assessment Method are two of the more well-known certification systems. Recognising that health facilities require special atten¬tion due to the nature of their operations and services (often with strict regulatory requirements, 24/7 operations and specific programmatic demands), LEED created the rating system, LEED for Health Care.

The Green Hospitals Checklist developed for this toolkit has adapted existing green building rating systems to the Caribbean context, ensuring that it covers both the building itself and the facility's operations. Achieving certification under existing green building rating systems will be difficult in the Caribbean, due to the systems' strict requirements, the absence of Caribbean environmental policies, as well as the cost and availability of technical capacity in the region. The Green Hospitals Checklist outlines feasible areas and applies to planned renovation projects, which are an ideal opportunity to introduce 'SMART' measures. The full checklist is provided in Appendix III.

COST-BENEFIT ANALYSIS FOR MAINSTREAMING ENVIRONMENTAL SUSTAINABILITY AT THE POGSON MEDICAL CENTRE

3 COST-BENEFIT ANALYSIS FOR MAINSTREAMING ENVIRONMENTAL SUSTAINABILITY AT THE POGSON MEDICAL CENTRE

To answer this question in the pilot phase of the SMART Hospitals Initiative, one of the major outputs was to create a model climate smart healthcare facility at the Pogson Medical Centre, St. Kitts and Nevis, which could serve as an example for other facilities in the wider Caribbean. The intent was to hopefully show through a quantitative approach, that the investment in change in alignment with the SMART programme could produce cost savings to operations in the short to long term and that the safe and green hospital concept did not mean costly interventions.

At this particular pilot site the retrofitting sought to address the priority issues of: (i) strengthening the infrastructure such as roofing and ceiling, walls, windows, doors, plumbing, electrical and disposal and sanitation systems;(ii) installing an emergency power and renewable energy systems; and (iii) ensuring compliance with safety standards aimed at risk reduction and enhanced staff awareness and development. The aim of the particular interventions was to retrofit the Pogson Medical Centre such that it improved the conditions under which health care is provided and reduce the cost of operation and maintenance of the facility while simultaneously mitigating the severe negative impacts associated with extreme weather events, especially tropical storms and hurricanes.

Specific objectives included:

- Improve the ventilation, security, safety, hygiene, accessibility, disposal, lighting, heating and cooling, health, sanitation, aesthetics and morale at the medical facility.
- Improve efficiency in water and energy consumption, which will save the hospital money that could be used to provide better healthcare services to the community.
- Achieve a retrofitted roofing infrastructure, which complies with the strictest security criteria and standards against storm and hurricane impact.
- Install a complete emergency energy supply system (generator and photovoltaic or solar).
- Demonstrate how safe (Disaster Risk Reduction) and green (environmentally responsible) components can be combined to create a SMART healthcare facility.
- Serve as an example for public buildings such as schools, health centres, government offices and private buildings such as residences and hotels.

Box 1: Pogson Medical Centre Baseline Information

- New modern facility constructed in 2009; both a hospital and a clinic
- Serves 3,125 persons (2001 census)
- A 12-bed facility with 24 full-time staff
- Energy usage averages 47,500 kilowatt hours (kWh) per month
- Equipped with central air conditioning, security system with cameras, emergency backup power, etc.
- No reserve water supply

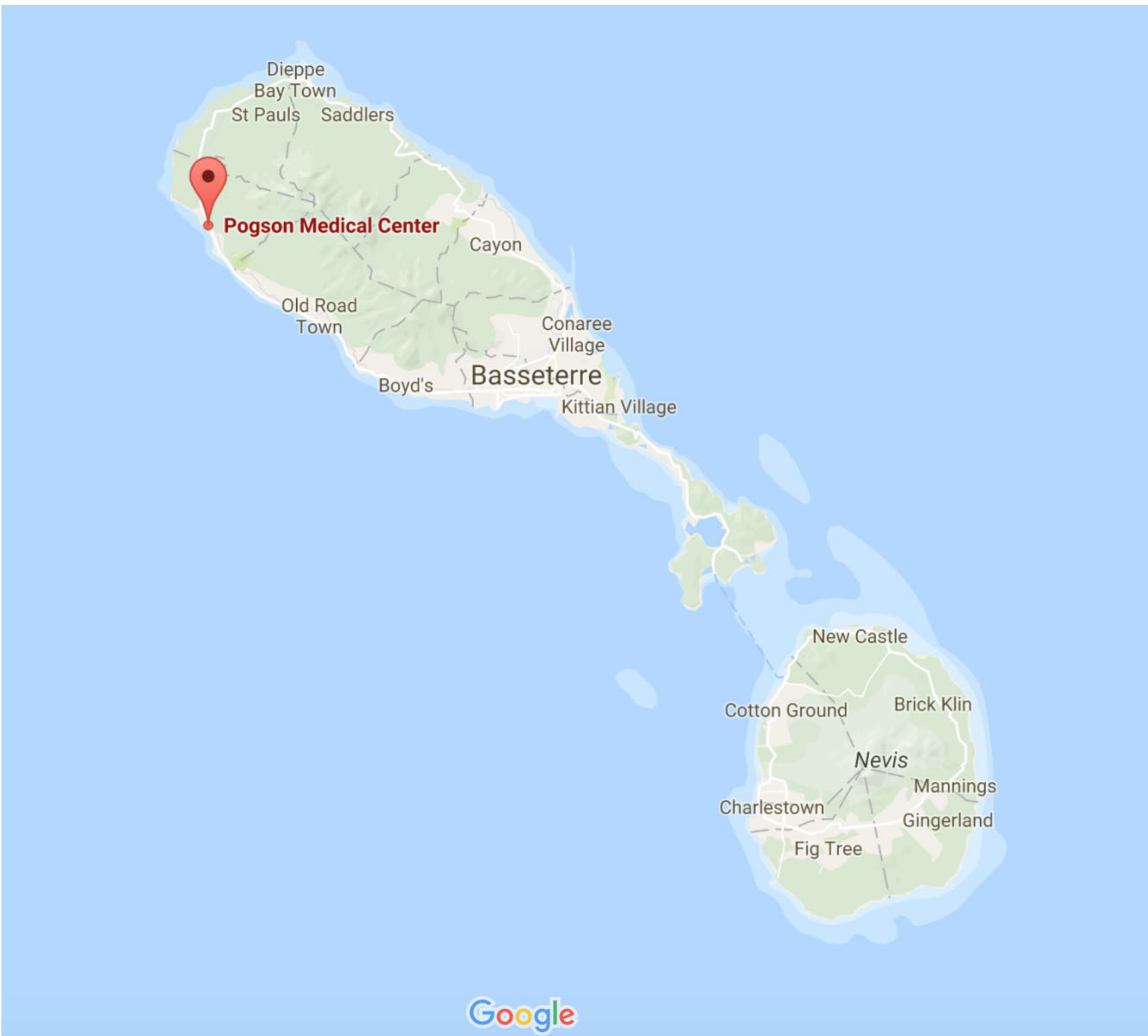

FIGURE 6: MAP OF ST. KITTS AND NEVIS HIGHLIGHTING THE POGSON MEDICAL CENTRE LOCATION

A cost-benefit analysis (CBA) methodology was utilized to ascertain the impacts of alternative options. CBA provides an indication of how much a prospective project or investment contributes to social welfare by calculating the extent to which the benefits of the project exceed the costs– essentially society's 'profit' from a projected investment (Vorhies and Wilkinson, 2016). It involved summing up the value of the costs and benefits of each option and comparing these to determine net benefits (i.e. the extent to which benefits exceed costs). In effect, the methodology provided a basis for assessing and comparing economic and financial trade-offs, for the SMART Hospital intervention in St. Kitts and Nevis.

The main steps in performing a CBA are presented in Figure 7 (see Appendix 1 for more details).

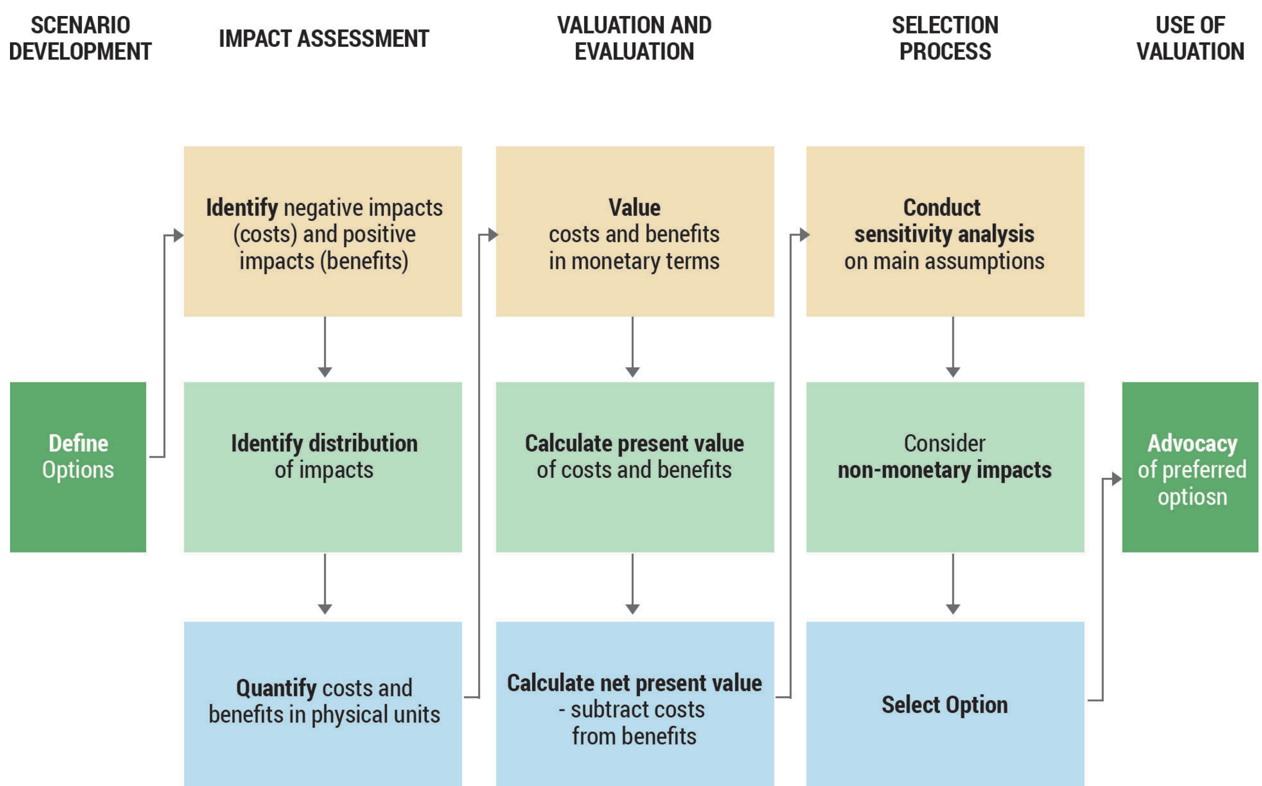

FIGURE 7: METHODOLOGICAL STEPS IN THE COST BENEFIT ANALYSIS FOR THE SMART HEALTHCARE FACILITY

The CBA revealed that the 'cost' of taking no action included the following, which is not an exhaustive list:

- Continued disrepair of the medical facility, which hinders its efficient operation.
- The roof is prone to leaks under high wind conditions, the roof over the main entry is vulnerable to wind uplift and hurricanes and there is a risk of the roof cracking.
- Some windows require wider mechanism replacement or repair.
- The X-ray room window and door require proper lining to prevent radiation exposure.
- The emergency exits require improved security features and emergency panic bar mechanisms.
- Some bathroom fixtures require replacement while others have minor damage and are in need of repair.
- Light fixtures including receptacles, switches and lights need replacement.
- Ballast units need to be replaced with 60Hz units.
- Electrical breakers trip when multiple appliances and equipment are in simultaneous use.
- Battery supply is faulty.
- Diesel storage tank is not properly anchored to foundation; electrical meters should be relocated, properly sheltered and mounted outside the generator housing; and there is no existing alternative power supply.
- Lack of ventilation because cooling units are not working or are susceptible to flood damage.
- Inadequate water storage capacity and non-existent water treatment systems.
- Shelving units for storing medical supplies and files are not properly secured.
- Fading, peeling and moss/mould growth on the exterior walls and ceiling tiles.
- Inadequate emergency exit signage, faulty or damaged emergency fire equipment, non-existent emergency lights and illegible fire extinguisher instructions.
- Staircases and handicap ramps are exposed to the elements, making surfaces slippery when wet.
- Drains require demarcation to differentiate between storm and sewer manholes, pipes need to be flushed and landscaping completed to prevent water runoff.
- Incomplete wastewater treatment system.
- Use of a sub-standard building code.
- Capital cost of designing and retrofitting the medical facility.
- Incremental maintenance costs.

Credit: PAHO Caribbean Office

FIGURE 8: FRONT OF THE RENOVATED POGSON MEDICAL CENTRE

Credit: PAHO Caribbean Office

FIGURE 9: BACK OF THE RENOVATED POGSON MEDICAL CENTRE

The CBA revealed that the ‘benefits’ of taking no action included the following which is not an exhaustive list.

- Revised hospital design to withstand more intense hurricanes. Minimized vulnerability to wind uplift of the roof and improved structural integrity of the building.
- Improved health facilities and services leading to reduced mortality and other social spill-off benefits.
- Resolved roof-leaking issues.
- Improved hospital ventilation, security, safety, hygiene, accessibility, lighting, healthier, sanitary, aesthetics and staff morale.
- Reduced energy demand and improved efficiency/conservation and reliable production of electricity.
- Enhanced hospital conformity to safety and risk reduction and staff awareness and development.
- Improved drainage of the landscape around the facility and reduced potential for flooding.
- Properly treated sewage water that can be circulated through a drip irrigation system into gardens of the centre.
- Minimised the overflow and pumping of sewage to eliminate the potential of sewage water flowing through open drains.
- Creation of a baseline from which policy recommendations can be drawn for incorporation into building codes for St. Kitts and Nevis and the wider Caribbean.

It was also ascertained that the hospital would require numerous refurbishments and updates to meet the SMART objectives. These costs represent the initial expenses for retrofitting the hospital. However, to maintain the SMART Hospital certification into the future, incremental maintenance and operational costs would be incurred. These include building inspections, roof checks and maintenance, sanitation and safety checks, painting of the facility, administrative monitoring, insurance, labour costs associated with operating the facility and contingency for unforeseen or unplanned expenses. (Cost estimates for these items are listed in Appendix 2.)

If no actions were taken to retrofit the facility, it was estimated that it would deteriorate at a rate of 5% annually, thereby hindering its efficient operation over the next 20 years. It is assumed that the cost of deterioration to the medical facility is 5% per year of all tangible and non-tangible assets. Additionally, the facility is vulnerable to climate variability and climate change and would not be equipped to deal with the potential impact of climate change and extreme weather events such as hurricanes. Two potential revenue sources, in the form of savings were identified; from the efficient utilization of water and efficiency in energy usage (assuming that the proposed renovations led to 20% and 10% more efficiency in water and energy consumption respectively). Given the identified revenue streams, from a financial point of view, the project on average could see net losses of up to US$1,776 (at current prices) per year for 20 years.

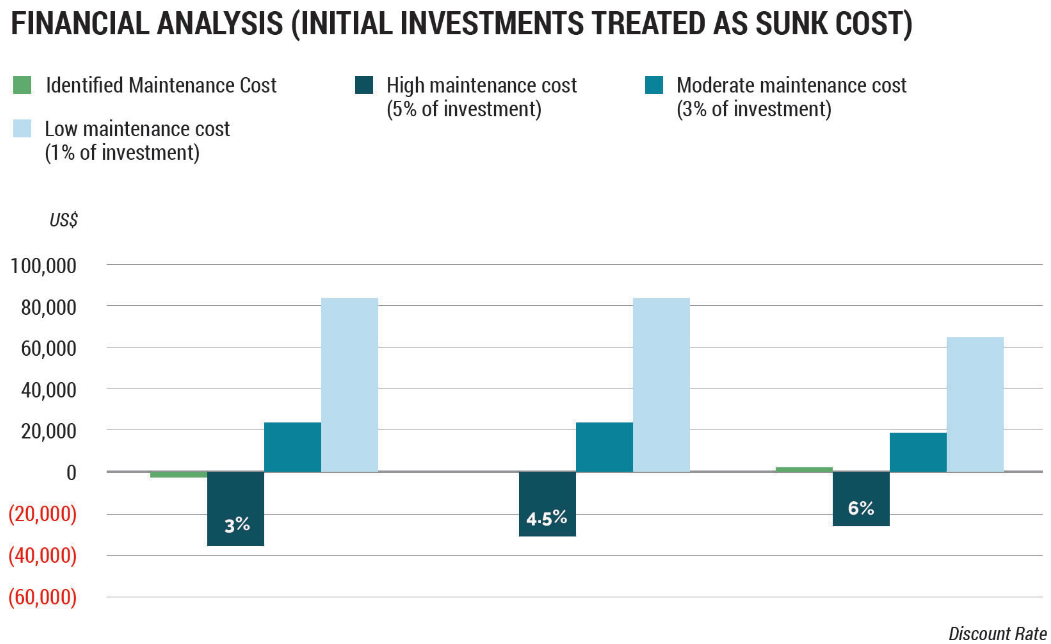

FIGURE 10: FINANCIAL ANALYSIS

The broader analysis of social and environmental costs and benefits included:

- The utility derived from the improved ventilation, security, safety, hygiene, accessibility, conservation, lighting, health, sanitation, aesthetics and morale.
- Treatment and reuse of sewage water for landscaping purposes.
- Lessons learnt from implementing such an initiative and the possibility of replicating this project for public buildings, hotels and schools.
- Other benefits, not yet valued such as net emissions, increased storage capacity, flood and earthquake mitigation.

Additionally, a survey of health facility users found that 40% of them were satisfied with the current health service, 56.7% were indifferent and 3.3% dissatisfied. Some 58.3% of the respondents want to see the facility retrofitted. The major concerns cited included:

- Deteriorating structure, hospital facilities needs upgrading.
- Inadequate medical supplies at the facility.
- Lack of specialist care and the need for more trained and qualified health professionals and other staff.
- Lack of privacy with medical records.
- Absence of provisions for long-term admissions/treatments resulting in persons requiring long periods of monitoring having to be transported from the Sandy Point area to the hospital in the capital.
- Better distribution of medical staff is needed to ensure availability of doctors at rural hospitals.
- High cost of health-care and medication.
- Lengthy wait-time for service.

The analysis also identified certain risks and uncertainties associated with retrofitting the Pogson Medical Centre. These factors requiring consideration included:

- Extreme Events/Hurricanes: The retrofitting exercise was to be implemented during periods of possible extreme weather events, causing appreciable construction delay risks.
- Human Resource Barriers: One of the biggest challenges is in identifying the right skilled contractors to carry out the works as some techniques are new and others require contractors with good experience and knowledge in disaster risk reduction and climate change adaptation.
- Financial Barriers: The funding allocated for the demonstration component is specific and as such the scope of works had to be adjusted based on proposals received. The challenge here is ensuring maximum benefits and greatest impact from the limited allocations.
- Communication Barriers: Keeping all stakeholders involved and informed can be challenging as well as there are many players in the DRR and climate change arena who used to be part of the implementation and review process. Extensive administrative processes within implementing agency contributed to delays.

3.1 STAKEHOLDER ENGAGEMENT

The Project Steering Committee was established to help guide the implementation of project activities. The committee members included representatives of the project funders (DFID), PAHO management and technical specialists, hospital management and technical specialists, workers' union representatives and community representatives.

A series of regular meetings was scheduled to update the Project Steering Committee of progress. Informational meetings were also held with hospital staff and interested government and Ministry of Health representatives throughout the project.

Patient	(1) a person who has lived with and/or experienced an illness of injury, (2) a caregiver or family member of such a person, or (3) a member of a relevant advocacy organization.
Stakeholder	All other members of the healthcare community, such as clinicians,hospitals and health systems, purchasers, payers, industry, training institutions, and policy makers.
Engagement	A bidirectional relatinoship between the stakeholder and researcher that results in informed decisions aking about the selection, conduct, and use of research.

FIGURE 11: PATIENT-STAKEHOLDER-ENGAGEMENT RELATIONSHIP

At important technical meetings, joint decisions were made to include a formal Cost- Benefit Analysis (CBA) for both demonstration com¬ponents of the project. The committee also agreed that the safe/ green components should be properly documented. Compliance with building codes in the demonstration countries was considered important criteria.

The Project Consultant/Principal Consultant developed a Baseline Assessment Tool with criteria for selection of facilities. The meth¬odology for facility assessments, tendering and works was also clearly defined and these were included in the Inception Report along with the findings from the assessment of all facilities. All technical components to support the tender process were also developed as a detailed scope of works with specifications of works to be carried out by the chosen consultant.

The tools developed for inclusion in the toolkit were shared and discussed. In addi¬tion, a presentation was made by the Project Consultant detailing the process involved in the selection of interventions and the works proposed for each building and part of the facility and premises. The group also reviewed the draft Sustainable Building Annex and offered comments. It was agreed that a Peer Review Group would be established from the Disaster Mitigation Advisory Group (DiMAG) member¬ship to review the Toolkit Version 6 and the engineering components of the annex. It was also recommended that architectural components be included in the annex and reviewed by members once completed.

LESSONS LEARNED FROM THE PILOT PROJECT

4

4 LESSONS LEARNED FROM THE PILOT PROJECT

From the pilot phase several operational level lessons were learned with respect to the retrofitting of the healthcare facility to meet SMART objectives. At the Pogson Centre, these included:

- Projects of this nature should be well coordinated and reporting lines known by all.
- Maintenance programmes must be established to ensure that "SMART" status is maintained.
- Identification of a maintenance officer to ensure that training is provided in the operation of the new systems and proper hand over of manuals is performed
- Works undertaken should ensure that there are provisions for future expansion
- Open lines of communication between the contractor and consultant for the duration of the project to facilitate constant dialogue.
- Clarity of tender process.
- Selection of a multi-skilled principal consultant to guide the variety of works and to engage in some of the actual works required to prepare the facility.
- Project teams should comprise individuals trained in architecture, engineering (various specialties) and green/sustainable building.
- Public Relations is important throughout implementation of the project.
- Community empowerment activities are important/useful.
- Good risk analysis and mitigation measures for addressing delays and hazard impacts should be included.
- Develop a detailed scope of works and hand over manuals and built drawings to Ministry of Health and maintenance personnel.
- Ensure the involvement of National Disaster Organisations (NDOs) and other national level partners such as planning and building authorities, maintenance units/agencies, energy units and climate change focal points to facilitate effective national level coordination and ensure cross training for personnel.

Box 2: Progress of Pogson Medical Centre Retrofitting works:

- Project officially commenced on September 24, 2013 by Williams Electronics.
- Project cost is US$170,102.36 or EC$459,276.37
- Retrofitting works were completed
- Turnover of the facility on January 20, 2014

SMART Hospitals Project to Improve Caribbean Facilities

The overarching vision is for the Caribbean countries to have safer, ecofriendly and disaster resilient hospitals. This will be achieved with the implementation of the Pan American Health Organization's (PAHO/WHO) SMART Hospitals Initiative, which will support Caribbean countries in improving their health care facilities.

The project is spearheaded by a team of Caribbean experts and will be piloted at the Georgetown Hospital in St. Vincent and the Grenadines and Pogson Medical Centre in St. Kitts and Nevis. It is designed to establish an integrated approach to building and retrofitting health care facilities to ensure that they are environmentally friendly and disaster resilient.

According to PAHO's Regional Advisor in the Area on Emergency Preparedness and Disaster Relief, Dr. Dana Van Alphen, "the project will allow for the development of a 'Smart Health Care Facilities Annex' to accompany national building standards and codes and the development of the Smart Hospital Toolkit to guide the implementation of climate change mitigation measures in existing and proposed facilities. It also seeks to enhance national capacity to deliver climate smart health care facilities by providing training workshops, advice through the Disaster Mitigation Advisory Group (DiMAG) and supporting policy strengthening."

4.1 SUCCESS IN DISASTER RISK REDUCTION

The Georgetown SMART Hospital, retrofitted just months earlier, withstood the heavy rains that impacted St. Vincent and the Grenadines (SVG) on December 24, 2013.

- No impact to Georgetown Hospital.
- Hospital beds were full and facility was able to provide continuous health services for the community.
- Water storage systems were connected and served a large portion of the population who had no water.
- Back up power supply functioned well.
- All systems were fully tested and worked well.

[3] http://www.paho.org/disasters/index.php?option=com_content&view=article&id=1700%3Asmarthospitals&catid=860%3Aother-news&lang=en

FIGURE 12: NEWLY INSTALLED 1,000 GALLON WATER STORAGE TANK

FIGURE 13: NEW PUMP ROOM WITH PUMP AND WATER FILTER SYSTEM

4.2 SUCCESSES IN ADAPTING THE SMART HOSPITAL APPROACH TO SCHOOLS AND COMMUNITY CENTRES

The Department of Disaster Management (DDM) in the British Virgin Islands (BVI) has taken great leadership in adapting the concept of “SMART” and its various assessment tools. They have applied the “SMART” concept in schools and other educational and civic facilities. The DDM has an existing Safe School Programme which focuses on school health and safety standards and it has now added a green, climate resilient component to pilot a “SMART” Schools Programme modeled after the SMART Hospitals Initiative.

More than ten schools in the BVI have received Safe School certification which is awarded following an assessment of the schools conducted by the DDM in accordance with the School Health and Safety Policy developed in conjunction with the Ministry and Department of Education and Culture. This policy establishes minimum standards that are identified through an assessment checklist and includes things such as location, design, construction, health and safety operations, retrofitting, environment, play grounds, evacuation and disaster planning procedures.
Safe School certification requires schools to score a minimum of 80% on the assessment checklist. The actual Safe School Certificate is valid for three years.

“In conducting the assessments of this first group of 10 schools, we found that each had emergency contingency plans which are exercised annually, as well as trained safety officers and first aiders in place. There was sound evidence that health and safety as well as disaster preparedness activities were being incorporated into the operations of each school and that these activities were being closely monitored and evaluated. We are proud of their achievement and from the various reactions to the presentation, they were delighted as well. ”

(Department of Disaster Management)

The DDM is now on a quest to encourage the principals to move on to the next phase of certification which will see the schools receiving SMART School designation for combining their health and safety requirements with climate change adaptation initiatives or ‘green’ practices.

“The DDM is keen to see the schools achieve the next level of certification and some of them, have already embarked on or are considering green measures. We have provided each with a guidance tool which outlines the requirements for incorporating green measures aimed at obtaining the SMART School designation and the department is certainly eager to see them move purposefully in that direction”

Ms. Sharleen DaBreo
DDM Director

FIGURE 14: CERTIFIED SCHOOLS PARTICIPATING IN RISK REDUCTION PROGRAMME RECEIVING THEIR SAFE SCHOOL CERTIFICATE

There are 63 registered schools in the BVI and the DDM is already working with another group of 10 schools to institute the necessary measures that would enable them to qualify as Safe Schools and to pay greater attention to the greening of these institutions.

"Climate change is a very real concept and we all have a responsibility to adopt practices that will help to slow this inevitable process. As public buildings, schools tend to have a sizeable carbon footprint, given the amount of energy used. One of the easiest ways to green your school would be to reduce energy consumption and one of the easiest ways to change behavioral practices within communities is to begin to instill that change within our young children."

(Department of Disaster Management)

FIGURE 15: INSTALLATION OF ENERGY EFFICIENT LIGHTING

The SMART School Programme is designed to create safer, healthier and greener learning environments and offer better educational experiences for school administrators, teachers and students while also fostering a culture that promotes environmental sensitivity, energy and water efficiency and conservation and healthy students and schools.

By early 2015, under the SMART Schools initiative in the BVI, close to 200 energy saving light bulbs were installed in the Seventh-day Adventist (SDA) School, one of three schools involved in the pilot in Sea Cow's Bay. The installation of the Light Emitting Diode (LED) bulbs serves to provide higher quality lighting in classrooms while reducing energy consumption costs.

The SDA School was chosen for this component of the project because the energy data acquired through the audits completed at all three schools revealed that this school had the most potential for significant savings to be obtained through the installation of LED lighting. In addition, the light fixtures at the SDA School were in good condition and the project funds were maximised by purchasing the bulbs.

"This type of lighting provides an improved colour rendering when compared to the fluorescent type bulbs that are common in most schools in the BVI. Studies have shown that this enhanced color created by the LED bulbs results in better student performance and improved information retention."

Dr. Evangeline Inniss
DDM Deputy Director

The LED lights are noticeably whiter and softer on the eyes, provide a more aesthetically pleasing light quality that teachers and administrators alike very much appreciate. The reduced costs of energy consumption will help to create an improved learning environment because money saved can be invested into programmes and tools that will further enhance students' education. The DDM encouraged schools involved in the "SMART" School Pilot to sign on to the Green Pledge, a programme developed to encourage the adoption of energy conservation procedures and ensure their use as well as monitor the energy saving data with the intention of providing an illustration of cost savings over time.

Overall, the "SMART" model has gained significant political traction in the BVI and was approved by Cabinet for implementation since 2014. The Comprehensive Disaster Management (CDM) Strategy and Programme Framework which was also approved by Cabinet, seeks to further institutionalise an integrated approach to disaster management in the BVI. Outlining the importance of this strategy, then Deputy Governor, Mrs. V. Inez Archibald said, "It is important that any strategy on disaster management have the full involvement of all sectors of society and all levels of Government if we are to avoid loss of lives and reduce the impact to property and the fragile environment in which we live and work. This strategy reflects this approach and includes a well-structured implementation mechanism which has received full endorsement by Cabinet."

Inspired and informed by PAHO's SMART Hospitals Initiative, the strategy is based on the development of SMART communities that use sustained mitigation, adaptation and resilient techniques to resist, absorb, accommodate and recover from the effects of hazard impacts in a timely and efficient manner.

RECOMMENDATIONS AND CONCLUSIONS

5

5 RECOMMENDATIONS AND CONCLUSIONS

For more than a decade, PAHO/WHO's disaster programme has been working to address the safety of health facilities and to promote comprehensive mitigation policies so that losses, such as those experienced in a host of Caribbean countries, would not occur again. One of the hindrances to more widespread uptake at the regional level is the absence of a policy platform. The clear lack of comprehensive national, regional and sector specific policy frameworks that support the institutionalisation of initiatives such as SMART, hamper the widespread diffusion and uptake regardless of the potential for success.

The SMART Hospitals Initiative in the Caribbean builds on proven tools such as the Hospital Safety Index, and aims to bridge the gap between environmental performance or climate-proofing and hazard resilience or disaster risk reduction in health facilities. However, the best design criteria for safe hospitals are not always the most beneficial for climate adaptation and mitigation. Therefore, it is necessary to develop higher design and construction standards for new hospitals, incorporating lower energy and water use to help withstand expected climate variability and change (Paterson et al., 2014). Energy efficiency must be combined with disaster resiliency. Countries need to be smart about what is useful, needed and cost effective. In this context, the construction of safe, disaster -resilient health facilities must take into account the risk of climate change and climate variability and the need for a reduced environmental footprint, with the ultimate goal of not only protecting the lives of patients, staff and other occupants, but also ensuring that such facilities continue to operate after a disaster (Tudor et al., 2015). Fortunately, the knowledge of how to build safe hospitals not only exists, it is also readily available.

5.1 POLICY RECOMMENDATIONS TO BUILD DISASTER RISK RESILIENCE

Any policy on SMART health facilities should build on established principles and priorities that governments in the Caribbean are using to improve the resilience of these facilities. These include the cost-benefit framework used by PAHO to demonstrate the feasibility of making a health facility ”SMART”(e.g. the Pogson Medical Centre in St. Kitts and Nevis). In the long run, the SMART Health Facilities Initiative is expected to yield several benefits, including cost savings on health, utility bills and travel expenditure; reduced greenhouse gas (GHG) emissions; improved air quality; reduced transmission of airborne infections and aggravation of respiratory conditions; increased productivity; improved staff and patient satisfaction; improved physical access to hospitals and improved access to safe water. The results of the pilot project will support design of a policy position and provide government decision-makers and sector stakeholders with evidence that will increase confidence in the tools and approaches necessary to achieve sustainable changes.

With the potential of the “SMART” Hospital concept tested and proven through the pilot projects and the further application being explored in schools in the BVI, there is now need to set the stage for larger scale, more intense deployment across the region. One way to do this can be through a strategic policy approach. With an acceptable policy framework upon which to base and expand the initiative, wide scale adoption of the initiative across the region could become a reality. The recommended policy framework would promote that:

- A safe health facility is structurally, non-structurally and functionally able to withstand the impact of all types of natural hazards and mitigate the impacts associated with climate change and variability.
- A green health facility has a small carbon footprint and an equally small environmental footprint (through sustainable and sound environmental management practices such as proper waste management; reduced medical waste; increased recycling; water conservation; reduced use of materials that may have toxic effects; green landscaping to reduce water use and manage storm water more sustainably.
- A SMART health facility will protect the lives and health of patients and health workers; has taken measures to reduce the damage to hospital infrastructure and equipment as well as the surrounding environment; will continue to function as part of the health network, providing services under emergency conditions; will use scarce resources more efficiently, thereby generating cost savings; and has improved strategies to adjust to and better cope with future hazards and climate change.

This framework represents a composite set of activities and interventions from preparedness to mitigation, planning to prediction and response to recovery - all directed towards achieving disaster resilience, climate change adaptation, reduced carbon footprint and improved environmental sustainability (Kenny, 2012). Through this ongoing process, Caribbean health facilities in collaboration with governments and civil society, can plan for and reduce the impact of disasters, their environmental footprint and their carbon footprint. The SMART Health Facilities Initiative represents a paradigm shift away from the traditional disaster response model to one that proactively seeks to minimise the health impact of a disaster through climate adaptation, mitigation measures (including climate-proofing and reduction of the environmental footprint) and preparedness. Consequently, it is essential that this health policy is incorporated into the political agenda of Caribbean member states and that the required resources are allocated.

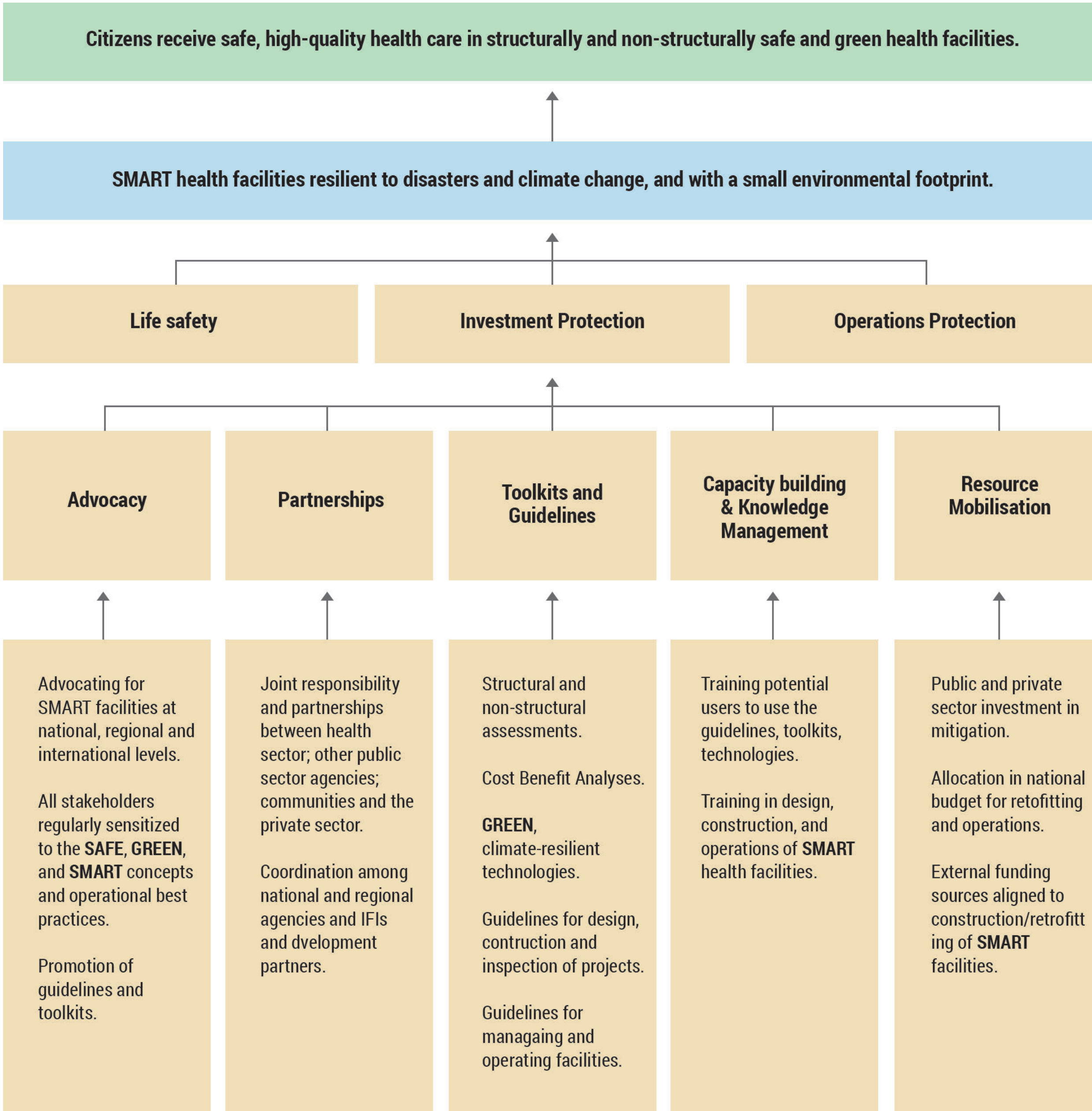

FIGURE 16: PLAN FOR SMART POLICY DESIGN AND IMPLEMENTATION

In-country policy can be implemented within the framework of existing Ministry of Health work programmes with the support of technical expertise from PAHO. Such an approach is not likely to require renegotiations or amendments to existing strategic partnerships that national Ministries of Health already have with PAHO and other regional, international and civil society organisations. National governments can be encouraged to adopt such a policy on the basis that it will contribute to the priorities and directives in disaster risk reduction, adaptation to climate change and sustainable environmental management; be cost-neutral and will help safeguard health facilities, which are important critical infrastructure assets and ultimately contribute to national security (Leaning & Guha-Sapir, 2013).

A SMART health facilities policy should cover several key points including:

- A clear policy statement that the outcome will be the sustainable development of the Caribbean health sector.
- Coverage of operations and maintenance, disaster management organisations, planning, finance, public services and architecture and engineering involved in determining the vulnerability of health facilities.
- Adherence to design and construction to building codes, fire safety guidelines and other risk reduction measures.
- Reduction of the non-structural and functional vulnerability of existing facilities through greening and energy efficient strategies.
- Enactment of legislation and allocation of financial resources to renovate and retrofit the most critical facilities to increase protection levels and safeguard the workforce, patients and their families.

5.2 POTENTIAL LIMITATIONS

The main challenge is likely to be in mobilising resources. One reason is the belief that it will require a substantial initial investment thereby affecting eventual profits or health budgets. This reticence on the part of governments and the private sector alike is exacerbated when financial resources are scarce, forcing mitigation projects down the list of priorities (Bosher, 2014). This is why cost-benefit analysis case studies such as the one undertaken for the Pogson Medical Centre are vital illustrations to elicit confidence by governments and show that the opposite is true - protecting the costly investment demands high safety and performance standards that increase total construction costs by no more than 1% to 2%. If the cost of the non-structural elements (which account for about 80% of the total cost of the facility) is added, the incorporation of mitigation measures into the construction of a new health facility accounts for less than 4% of the initial investment. The cost of preventive maintenance is not high if it is considered part of the normal operating budget of a facility. Proper maintenance not only reduces the degradation of the health facility but can also ensure that services such as water, gas and electricity and non-structural components such as detailing, roofs and doorways, continue to function properly during an emergency.

Above all, political and financial commitment and leadership by the Ministries of Health will be required. Policy support measures that can be implemented include:

- Assigning a specific entity in the Ministry of Health to develop a disaster risk reduction programme.
- Actively supporting a campaign on SMART Health Facilities by involving a variety of partners including (a) stakeholders within and beyond the health sector; (b) national and international financial institutions and (c) other key contributors.
- Sharing and implementing best practices on practical and significant progress under the SMART Health Facilities Initiative at the country level.
- Encouraging external agencies that finance the construction of new health facilities to incorporate the principles set out in this policy.
- Collaborating with other public and private sector agencies to introduce green and climate-resilient technologies and methods to achieve immediate health and economic benefits in the heath sector.
- Inserting this policy into other relevant national policies and strategies and, where appropriate, ensuring that it is incorporated into the government's legislative agenda.

Lastly, the objectives and elements of the Policy on SMART Health Facilities are applicable beyond the health sector. These objectives and elements can be used to make other critical infrastructure, such as schools 'SMART'. Indeed, the Government of the BVI has already applied the tools and guidelines to the education sector and discussions are now underway to use these same building blocks in the tourism sector and communities.

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APPENDIX I

Cost-Benefit Analysis (CBA) Methodology to be applied to Infrastructure/Facilities

Define Options: The first step in the CBA was to identify the alternative options to be considered. These options were specific to the particular problem and context but under other circumstances may have included investments, projects, policies and development plans. It was important to have a clear and detailed description of each option as outlined in the following section.

Identify costs and benefits: We identified all negative impacts (costs) and positive impacts (benefits) related to each option under consideration. These include costs and benefits accruing to affected groups and individuals (not just those involved in the project development) and projected costs and benefits that will be incurred in the future. If known, it is useful to describe the geographical and temporal boundaries of the analysis, i.e. the area and number of years over which the costs and benefits are expected to accrue. In our analysis, the entire island was seen as being the beneficiary and the project was projected to have a lifespan of 20 years.

Identify the distribution of impacts: Costs and benefits of alternative options will not be distributed evenly over the various individuals and groups impacted by the project. Although the overall impact of the project may be positive, some groups may lose while others gain. The distribution of costs and benefits (and the potential need for compensation), therefore, becomes an important determinant of whether the project was acceptable and desirable. The gainers and losers from each option were identified using categories that are relevant to the context in question. Groups were defined by income class and asset base mainly, though in other studies they may be defined by ethnic group, profession, location etc.

Quantify costs and benefits in physical units: Each cost and benefit was quantified in relevant physical units for each year in which those benefits and costs occur. It is often useful to use spreadsheets such as Microsoft Excel to create a table with each cost and benefit item represented by a column and each year included as a row. Microsoft Excel was used for the analysis.

Value costs and benefits in monetary units: Each cost and benefit was quantified in monetary units for each year in which it occurs. In cases where costs and benefits were not directly observable in monetary terms in well-functioning markets (as is the case for many environmental impacts), estimates were made using non-market valuation methods such as contingent valuation through the application of a questionnaire survey.

Calculate present values: Calculating present values (PV) involved discounting values that occur in future years. Present value costs and benefits were tallied across years to obtain the total present value costs and benefits.

Calculate the net present value (NPV): The net present value (NPV) of each option was calculated by simply subtracting the present value costs from present value benefits. A positive NPV indicates that implementing the project will improve social welfare. The NPVs of alternative investments should be compared in order to identify the most beneficial project.

Calculate the benefit cost ratio (BCR) and internal rate of return (IRR): The results of a CBA can also be represented by two other indicators of a project's worth (in addition to NPV). These are the benefit cost ratio (BCR) and the internal rate of return (IRR). BCR is the ratio between discounted total benefits and costs, and it shows the extent to which project benefits exceed costs. A BCR greater than 1 indicates that the benefits of a project exceed the costs. The IRR is the discount rate at which a project's NPV becomes zero. If the IRR exceeds the discount rate, the project generates returns in excess of other investments in the economy and can be considered worthwhile.

Conduct sensitivity analysis: Information on the monetary values of costs and benefits of alternative options will often not be known with absolute certainty. Uncertainty over the values or assumptions included in the analysis leads to the results also being uncertain. Different values may have resulted in a different ordering of options in terms of NPV. It is therefore necessary to recognise areas of uncertainty and test how sensitive the results are to changes in values or assumptions. One such area is the discount factor applied. This and other things were varied to test the sensitivity of the analysis.

Select option: Based on the information generated on the NPV of each option, the sensitivity of the results, the distribution of impacts and additional non-monetary information, a decision-maker can select the most preferred option.

Use the results: The results of the CBA can be used in various ways to influence a decision on a policy or project.

APPENDIX II

Estimated costs of selected retrofits to meet SMART objectives

Items	Description	Cost (US$)
1	Preliminaries	26,473.06
2	Roof Renovations	18,531.14
3	Windows	3,088.52
4	Doors	33,799.28
5	Plumbing and Sanitary Fixtures	14,339.58
6	Electrical Works (Light and Power)	40,283.18
7	Electrical Works (Emergency Power Supply)	7,280.09
8	Mechanical Works	36,091.61
9	Interior Furnishings	1,103.04
10	Wall Finishes	3,750.35
11	Ceiling Finishes	4,480.37
12	Code Compliance	9,526.29
13	External Works	409.13
Total		**188,155.65**

APPENDIX III

Green Hospital Checklist

SMART HOSPITALS INITIATIVE GREEN HOSPITALS CHECKLIST					
CATEGORY	TITLE	INTENT	ACHIEVABILITY		
			Yes	Planned	No
Renovations					
Water	Water Use Reduction	• Are you able to monitor water usage throughout your facility? • Have you added a rainwater capture system? • Are faucets and plumbing water efficient (e.g. low-flow faucets; dual flush toilets, etc.)? • Does your facility have an educational program that highlights the need to conserve and use water efficiently?			
	Water-efficient Land-scaping (no potable water used)	• Have you captured rainwater and installed a drip irrigation system for landscaped areas? • Do you have space to install an aerobic sewage treatment system so that the effluent can be used for irrigation? • Have you utilized local, drought-resistant species and mulch plantings?			
Energy and Atmosphere	Renewable Energy: On-site Generation	• Do you have an energy conservation plan? • Has the facility's roof been assessed to ensure that it can accommodate a PV system and/or a solar hot water heater? • Does your roof face south/southwest to allow for maximum solar exposure? • Is your rooftop energy system secure against natural hazards?			
	Efficient Equipment/ Fixtures/Appliances	• Have you conducted an energy audit? • Do you have an energy conservation plan? • Are equipment and appliances energy-efficient rated (US/EU standards)? • Have you replaced your light bulbs and electrical devices with more efficient models/types?			
	Refrigerant Management	• Do you know what type of refrigerant your devices/ appliances use? • Have you phased out any devices that contain chloro-fluorocarbons (CFC) and replaced them with devices that contain/use refrigerants that have a reduced global warming potential (GWP) or less potent ozone depleting substances? • Is your equipment serviced by a professional to reduce leakage /release into the atmosphere?			
Materials and Resources	Management of Con-struction Waste	• Does your construction company or public works department have a construction waste management plan?			

SMART HOSPITALS INITIATIVE GREEN HOSPITALS CHECKLIST					
CATEGORY	TITLE	INTENT	ACHIEVABILITY		
			Yes	Planned	No
	Sustainable Materials	• Have you ensured that the building materials/products utilized are rapidly renewable or have recycled content?			
	Mercury Elimination	• Have you replaced bulbs containing mercury? • Have you phased out mercury-containing medical devices?			
	Eliminate Use of Persistent Bioaccumulative and Toxic Chemicals (PBTs)	• Can you avoid using building materials/products that contain Persistent Bioaccumulative and Toxic Chemicals (PBTs)?			
	Furniture and Medical Furnishings	• Have you procured furniture/furnishings that use wood from managed forests or that contain no PBTs, PVC, heavy metals or other harmful chemicals?			
Indoor Environmental Quality	Environmental Tobacco Smoke Control	• Is there a national no-smoking policy or can you establish a facility policy?			
	Natural Ventilation	• Have you checked that all windows are operable so that you can take full advantage of prevailing North-East Trade Winds?			
	Low-Emitting Materials	• Have you procured materials, furnishings, paints, sealants, adhesives, etc. with no or reduced amounts of Persistent Bioaccumulative and Toxic chemicals Volatile Organic Compounds (VOCs), Semi-volatile Organic Compounds (SVOCs), Halogenated Fire Retardants (HFR), heavy metals, phthalates, perfluorochemicals (PFCs) and other chemicals? • Have you checked labels, ingredient lists, and material safety data sheets for hazardous components or requested these from suppliers? • Have you issued specifications for composite wood products that contain no urea-formaldehyde resins? • Have you procured paints without antimicrobial ingredients and metal products that are pre-painted? • Do you avoid cleaning/sterilizing substances that contain volatile components such as Volatile Organic Compounds (VOCs), Semi-volatile Organic Compounds (SVOCs) and other harmful chemicals?			

SMART HOSPITALS INITIATIVE GREEN HOSPITALS CHECKLIST					
CATEGORY	TITLE	INTENT	ACHIEVABILITY		
			Yes	Planned	No
	Chemical and Pollutant Source Control	• Have you provided an entryway system, grills or mats that can capture dirt and particulates brought in from outside the facility? • Can you procure equipment that is efficient and uses less hazardous chemicals? • Have you labeled and properly stored all chemicals as per manufacturer's recommendations? • Do you use natural cleaning products wherever and whenever possible? • Have you ensured that pesticides and other chemicals used on the exterior of the facility are applied safely by a trained professional? • Do you use local landscape plants/shrubs? • Is there an incinerator onsite? If not, is there an alternative for waste disposal?			
	Controllability of Systems: Lighting	• Do you utilize daylight while eliminating direct sunlight? • Have you used shade trees or shading devices on the exterior to eliminate direct sunlight from the building? • Have you installed lighting controls such as light sensors and occupancy sensors in staff and patient areas? • Have you provided individual lighting controls to enable adjustments to suit individual patient while limiting disturbance in multiple-patient areas?			
	Daylight and Views	• Have you added light shelves to reflect light further into the interior?			
Operations					
Chemical Management	Chemical Management Policy	• Has a national chemical management policy that aims to reduce the purchase and use of hazardous chemicals been developed?			
	Community Contaminant Reduction: Leaks and Spills	• Have you documented the purchase, delivery, storage and use of all hazardous chemicals and substances stored onsite? • Have you provided secondary containment and security for substances stored outdoors, above ground or underground? • Have you educated staff on proper handling and storage of chemicals and the proper procedures for spills/leaks?			

SMART HOSPITALS INITIATIVE GREEN HOSPITALS CHECKLIST					
CATEGORY	TITLE	INTENT	ACHIEVABILITY		
			Yes	Planned	No
	Indoor Chemical Contaminant Reduction: Hand Hygiene Products, Sterilization and High Level Disinfection	• Has a national policy been developed that prohibits the disposal of chemicals down drains? • Have you phased out the use of Ethylene Oxide and high level disinfectants (glutaraldehyde and other hazardous substances) and replaced them with safer alternatives? • Have you ensured that all sterilizing and disinfecting appliances are top-of-the-line and efficient? • Have you replaced manual disinfection with automatic machine washers/disinfectors?			
	Pharmaceutical Minimization, Management and Disposal	• Have you created a policy that establishes procedures for procuring, storing, dispensing and proper disposal of all pharmaceuticals? • Have you ensured that pharmaceuticals are ordered on an as-needed basis to minimize expiration and that expired/unused pharmaceuticals are properly disposed of? • Have you ensured that safer alternatives, such as products that contain no Mercury or PBTs, are ordered?			
Solid Waste Management	Solid Waste Land Disposal	• Have you established a policy and guidelines to achieve zero waste and aligned your operations and procurement with this goal in mind? • Have you minimized the sources of waste? • Have you properly segregated waste at all times and stored it in a secured location until disposal? • Have you ensured that the solid waste facility that accepts waste from your facility is well managed?			
	Solid Waste and Material Management: Waste Prevention and Reduction	• Have you made waste reduction a goal and ensured that all of your purchases—from high-end machinery and equipment to food and office supplies—are aligned with this goal? • Have you streamlined and computerized procedures, printing on both sides of paper and purchased paper that contains recycled content? • Have you procured or leased photocopiers and printers that are capable of printing on both sides? • Have you made arrangements to ensure that biodegradable waste such as paper, cardboard, plant-based waste and food waste can be composted on-site, in the community or at a municipal or commercial facility?			

SMART HOSPITALS INITIATIVE GREEN HOSPITALS CHECKLIST					
CATEGORY	TITLE	INTENT	ACHIEVABILITY		
			Yes	Planned	No
	Regulated Medical Waste Reduction	• Have you established a waste management policy that seeks to reduce overall waste generation, ensures that all waste generated is properly segregated and stored and ensures that staff is aware of and trained in the requirements of the waste plan? • Do you avoid mixing infectious and other medical waste with regular garbage? • Have you ensured that plastics, anything containing PVC, batteries, mercury-containing products and materials treated with flame retardants are not incinerated along with other medical waste and that an effort is made to reduce the purchase, use and disposal of these materials? • Do you purchase supplies that use fewer raw materials and that generate less waste and are recyclable? • Have you considered using alternative medical waste treatment technologies in an effort to reduce the volume of waste that is incinerated or disposed of in landfills?			
Environmental Services	Environmentally Preferable Cleaning: Products, Materials and Equipment	• Do you procure cleaning products and materials that are environmentally benign or that are less toxic than other products and that still maintain the high level of cleanliness required in the facility? • Have you ensured that disposable paper products, like paper and hand wiping towels, contain recycled content? • Do you prohibit products that are manufactured with carcinogens, mutagens and teratogens; aerosols; asthma-causing agents, respiratory irritants, benzene-based solvents, very acidic or alkaline products; anti-microbial hand soaps; persistent, bioaccumulative and toxic chemicals (PBTs); and products requiring disposal as hazardous waste?			
	Integrated Pest Management	• Have you or the agency responsible for maintaining your facility developed and implemented an Integrated Pest Management program?			
Food Services	Sustainable Food Policy and Plan	• Have you developed a sustainable food policy and plan that seeks to make the procurement of food and food services in general more sustainable? • Do you encourage farmers to shift from fertilizer and chemical-dependent farming to practices that are more closely aligned with natural processes?			
	Local, Sustainably Produced Food Purchasing	• Have you implemented a sustainable food plan and increased the procurement of locally and regionally sustainably produced foods?			

SMART HOSPITALS INITIATIVE GREEN HOSPITALS CHECKLIST					
CATEGORY	TITLE	INTENT	ACHIEVABILITY		
			Yes	Planned	No
	Reusable and non-re-usable Products: Food Service Ware, Non-Food Service Ware and Bottled Water Elimination	• Do you eliminate the use of disposable products (plastic, paper, styrofoam) in food services? • Do you reduce the use of non-food service paper products such as paper towels and napkins? • Have you eliminated or reduced the use of bottled water for patients?			
	Food Waste Reduction, Donation and Composting	• Have you examined ways to reduce food waste? • Have you considered donating food that remains at the end of daily operations to food banks, churches and other community groups?			
Environmentally Preferable Purchasing	Mercury Reduction	• Have you prepared a plan to phase out or replace items that contain mercury such as medical devices and light bulbs?			
	Electronics Purchasing and End of Life Management	• Have you ensured that electronic equipment is not disposed of in landfills or incinerated?			
	Solid Waste Reduction in Purchasing	• Have you ensured that your purchases are in line with the overarching goal to reduce solid waste generation and disposal?			
	Toxic Chemical Reduction in Purchasing	• Have you prepared a comprehensive list of materials, products and supplies that contain harmful chemicals and considered how they will be replaced or phased out? • Have you investigated suitable, safer building materials if renovations or alternations are planned?			

SUPPLEMENTAL INSTRUCTIONAL MATERIAL

Case Usage

This case can be used to supplement lessons primarily related to disaster risk reduction in facilities. It focuses on resilience building in the health facilities sector, in the face of increasing impacts of climatic change and the increasing realisation of the urgency to reduce the impact of operations on the environment by decreasing direct and indirect pollution and achieving more efficient consumption of natural resources. Two broad principles can be highlighted. The first is sector specificity, in this case, of the health sector, where approaches can be developed and implemented successfully and have tangible results. Secondly, the dual objectives of disaster mitigation and environmental sustainability can go hand in hand towards building overall resilience. Added to this is the focus on rational evidence-based decision-making through the use of tools such as the cost-benefit analysis. Another lesson point can be disaster risk reduction innovation in the way the BVI has been able to adapt the health facilities methodologies for use in schools. Lastly, the project outcomes at the operational and policy levels are pointed out and can be used to support the benefits of pilot testing new disaster risk reduction models at the operational level in facilities and the need for mutually reinforcing policy approaches to support the widespread adoption and expansion of projects to full programmes once successes at the pilot stage become evident.

User Audiences

Practitioners

This case is useful to practitioners and operations level disaster risk reduction personnel from three main perspectives. First, it introduces learners to assessment and review tools such as the Hospital Safety Index and the Green Hospital Checklist. These tools are continuously being tested through implementation in several different country contexts. This case presents an opportunity for learners to review the tools and note how they were used in the St. Kitts and Nevis context. Another point for consideration is how these tools are being adapted for facilities in the education sector.

Secondly, this case is an opportunity to immerse learners in the area of environmental sustainability in a tangible and realistic setting. In the past, practitioners would not have equally prioritized environmental issues and disaster risk reduction. However, this is an opportunity to expose learners to that concept and illustrate how closely intertwined their implementation could be.

Lastly, the case presented full details of a cost-benefit analysis conducted for the hospital. This presents an opportunity to introduce learners to this practice and for them to observe the utility of such an approach in justifying projects.

Policy Analysts

For policy analysts and those learners in policy analysis and decision- making roles, the utility of this case revolves around three main points.

First is the application of a commonly cited economic tool used for policy analysis, the cost-benefit analysis. While not novel in method, it is perhaps so in application and context – a hospital in a disaster prone Small Island Developing State. It is therefore useful for the policy analyst to draw from the case such points as – application of the cost benefit method; limitations and assumptions made to develop 'dollar' values for the calculation; limitations to the methodology and data collection and how these are dealt with in tailoring of the method to context.

The second point for the policy analyst is the generation of evidence both through the cost-benefit analysis as well as through the application of the index assessment tools and the broader pilot testing of the hospital itself in terms of retrofit. This is clearly an opportunity for the policy analyst to justify furtherance of the project based on the data and evidence gathered. The adapted application from hospital to schools also gives food for thought on policy arguments that could justify not just expansion of a hospital programme but a cross-sectoral expansion.

Third is the case study's focus on how to use the documented evidence to build the case and craft a broader policy approach with the objective of applying the tools and methods across the hospital sector and other countries. The roles of such a policy have to be advocate for and support the programme, provide guidance and standardize the approach as well as stipulate the level of quality and strategic implementation pathways to make the programme successful.

Academic Content Coverage

1. Development and application of rapid assessment tools at the facilities level.

Rapid assessment processes and tools are used to investigate complicated situations in which issues are not yet well-defined and where there is not sufficient time or other resources for long-term, traditional qualitative or quantitative research. It may be a precursor or first stage to more detailed study. Tools like the Hospital Safety Index and Green Hospital Checklist use intensive team interaction in both the collection and analysis of data instead of prolonged field work and iterative data analysis and additional data collection to quickly develop a preliminary understanding of a situation from the hospital administration and user perspectives.

Activity 1

Follow this link to find the PAHO Hospital Safety Index Guide to Evaluators. Here you would find the checklists for data collection at the hospital.

http://www.paho.org/disasters/index.php?option=com_content&view=category& layout=blog&id=907& Itemid =884

Using the checklists, determine which items will be easier or harder to assess. You may use a scale of 1-5 from easier to harder. What are the reasons that data might be more accessible or not? Data collection may be a regulatory requirement or part of the hospital's own operations processes. Some data may not exist at all and have to be measured or estimated by sight in the field.

Can you do the same exercise with the Green Hospital Checklist located in the case study appendix? Which evaluation in your opinion might be more difficult to complete given what possible data gaps exist?

2. Conducting the cost-benefit analysis of a hospital facility.

A cost-benefit analysis is critical to most projects. It consists of a comparative assessment of all the benefits anticipated from the project and all the costs to introduce the project, execute it and support the changes resulting from it. The cost-benefit analysis helps to:

- Decide whether or not to undertake a project or decide which of several projects to undertake.
- Frame appropriate project objectives.
- Develop appropriate before and after measures of project success.
- Prepare estimates of the resources required to perform the project work.

You can express some anticipated benefits in monetary equivalents such as reduced operating costs or increased revenue. For other benefits, numerical measures can approximate some, but not all, aspects. Whenever possible, benefits and costs are expressed in monetary terms to facilitate the assessment of a project's net value. Consider the costs for all phases of the project. Such costs may be non-recurring (such as labour, capital investment and certain operations and services) or recurring (such as changes in personnel, supplies, materials, maintenance and repair). Also consider the
potential costs of not doing the project (e.g. destruction of a hospital wing in the event of hurricane winds) or potential costs if the project fails; and opportunity costs which are the potential benefits if you had spent your funds successfully performing a different project. The latter may often be a consideration for politicians when deciding on investment of scarce financial resources.

The farther into the future you look when performing your analysis, the more important it is to convert your estimates of benefits over costs into today's dollars. Unfortunately, the farther you look, the less confident you can be of your estimates. For example, you may expect to reap benefits for years from more efficient on-site generators, but changing technology may make your new system obsolete in a few years. Thus, the following two key factors influence the results of a cost-benefit analysis: how far into the future you look to identify benefits and on which assumptions you base your analysis.

The net present value (NPV) is based on the following two premises:

- Inflation: The purchasing power of a dollar will be less one year from now than it is today. If the rate of inflation is 3% for the next 12 months, $1 today will be worth 97 cents just 12 months from today. In other words, 12 months from now, you will pay $1 to buy what you paid 97 cents for today.
- Lost return on investment: If you spend money to execute the project being considered, you'll forego the future income you could earn by investing it conservatively today. For example, if you put $1 in a bank and receive simple interest at the rate of 3% compounded annually, 12 months from today you'll have $1.03 (assuming zero-percent inflation).

To address these considerations when determining the NPV, you specify the following numbers:

- Discount rate: The factor that reflects the future value of $1 in today's dollars, considering the effects of both inflation and lost return on investment.
- Allowable payback period: Estimate the length of time for anticipated benefits to outweigh the estimated costs.
- In addition to determining the NPV for different discount rates and payback periods, calculate the project's internal rate of return for each payback period.

Activity 2:

Using the cost-benefit analysis of the Pogson Medical Centre described in the case study and the additional detail in the appendix, review a similar cost-benefit analysis completed under the same project in St. Vincent and the Grenadines using the Hospital Safety Index and the Green Hospital Checklist. See if you can follow how the analysis was completed, based on the method described above and the guidance in the case appendix here.

http://www.paho.org/disasters/index.php?cx=014283770845240200164%3Ajognakyodi8&q=ST.+VINCENT+COST-BENEFIT+HOSPITAL&searchword=ST.+VINCENT+COST-BENEFIT+HOSPITAL&sa=Search...&cof=FORID%3A0&searchphrase=all&scope=1&option=com_search&Itemid=1&ie=utf8&site=who&client=CLIENT+WHO&proxystylesheet=PROXYSTYLESHEET&output=xml_no_dtd&oe=utf8&getfields=doctype#gsc.tab=0&gsc.q=ST.%20VINCENT%20COST-BENEFIT%20HOSPITAL&gsc.page=1

Are the cost items similar in both hospitals? What about the benefit estimations? How do the results of the analyses compare between hospitals? Based on the cost-benefit analyses which hospital has the stronger argument for investment in greening?

3. Designing appropriate policy and policy instruments to support programme implementation

Policy (n), Policies (pl) - a course or principle of action adopted or proposed by a government, party, business or individual.

Here is a suggested process for practical policy development for a particular programme such as 'SMART'. Research and consultation are key steps in the process. A sound policy is built upon good consultation with those who will be affected by the policy.

Step 1: Identify and define the problem or issue that necessitates the development of a policy. The organisation also needs to know and understand the purpose of policies and recognise that the issue or problem can be effectively dealt with by the creation or modification of a policy.

Step 2: Appoint a person or person(s) to co-ordinate the policy development process. There needs to be someone or perhaps a committee to "drive" the process which may take place over several months.

Step 3: Establish the policy development process. The process entails research, consultation and policy writing tasks. The coordinator should develop a plan of tasks, assign who is responsible for their completion and establish a timeline in which they should be completed.

Step 4: Conduct research. Read policy documents created by other organisations on the same topic. Research legislation; conduct a meeting with staff and other people with experience; survey participants or a particular group of participants; read minutes of management committee meetings; read other documents such as annual reports or event reports; read industry magazines and journals and seek legal advice.

Step 5: Prepare a discussion paper, the purpose of which is to explain the nature of the problem or issue, summarise information yielded by research and suggest a number of policy options. The discussion paper will be an important tool in the process of consultation.

Step 6: Initial Consultation. Circulating the discussion paper to all stakeholders (interested parties) is a first step in the consultation process. It may also be necessary to telephone stakeholders and send notices to remind them to read the discussion paper. It is important to gain as much feedback from stakeholders as possible. This may be done through workshops, open meetings, website postings and meetings with individuals. Several months may be required to ensure that this stage of consultation is thorough.

Step 7: Prepare a draft policy. When there has been sufficient time for the consultation process to be completed, the next step is to prepare a draft policy.

Step 8: In-Depth Consultation. When the draft policy is completed it should be circulated to key stakeholders, published by the organisation and discussed in further meetings and forums. At this stage, it is necessary to seek help from stakeholders to fine-tune the wording, clarify meanings and make adjustments to the policy before it is finalised.

Step 9: Adoption. When the coordinator of the policy development process is reasonably satisfied that all issues and concerns about the policy have been aired and dealt with, it is time to finalise the policy. The final policy document needs to be formally adopted by the management /board of the organisation with an appropriate record entered into the minutes.

Step 10: Communication. Following formal adoption of the policy, it should be communicated far and wide throughout the organisation and stakeholders. Training sessions may be needed to ensure that organisation personnel are fully informed and able to implement the policy. If the policy is not well communicated, it may fail.

Step 11: Review and evaluate. The implementation of the policy should be monitored. The policy may still require further adjustments and furthermore, the reasons for the policy's existence may change. A general practice is to set a date for the policy to be reviewed.

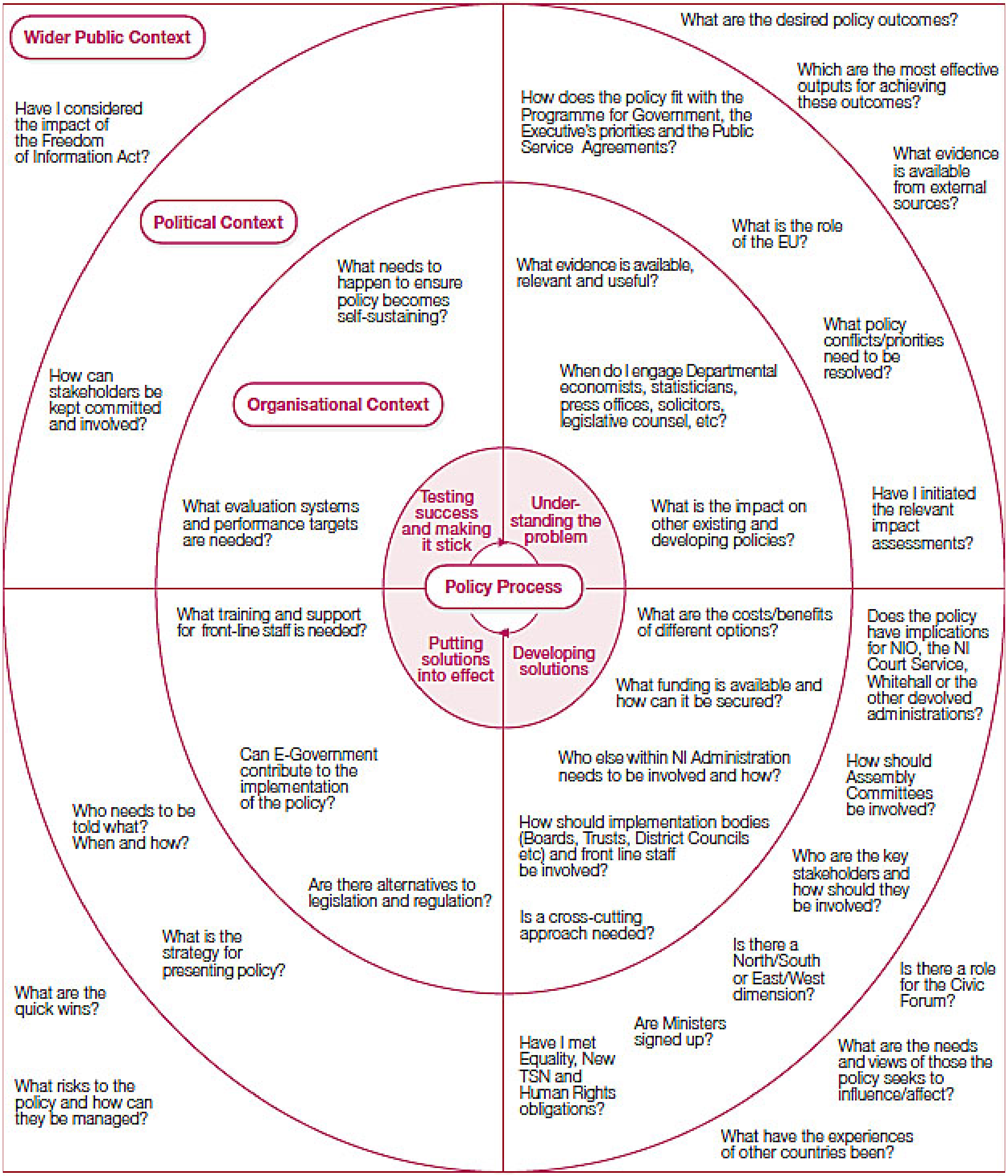
Activity 3

Using the information provided in the case study about the draft policy for the development, implementation and expansion of the 'SMART' programme in the Caribbean, use the diagram below (start from the inner concentric circles working your way outwards) to respond to each of the questions posed in turn.

You may also identify any questions you believe are irrelevant to this draft policy and state why.

At the end of the exercise, justify any gaps in the policy design process and the draft policy which you can tie back to the lack of information available to answer any of the diagrammed questions.

Consider the adapted approach in the BVI of using the 'SMART' principles in school facilities, as described in the case study. Using the 11-step practical policy design process above and again keeping the questions in the diagram below in mind, how might you go about designing a policy specific to 'SMART' in schools and what might the main elements of such a policy look like? Would they be similar to the draft SMART Hospitals Policy presented here?



Model adopted from "A Practical Guide for policy Making" by the Northern Ireland Civil Service (so references in the graphic to Irish institutions can be ignored)

THE EKACDM INITIATIVE

The Enhancing Knowledge and Application of Comprehensive Disaster Management, EKACDM) Initiative is a five year project which was implemented in the Caribbean region from September 2013 to December 2018 by the Disaster Risk Reduction Centre, the Institute for Sustainable Development, the University of the West Indies.This Initiative seeks to establish an effective mechanism and programme to promote an integrated approach to Comprehensive Disaster Management knowledge in the Caribbean region, to fast track the implementation of the CARICOM Enhanced Comprehensive Disaster Management (CDM) Strategy and Frameworks (2007 - 2012 and 2014 - 2024).

The ultimate outcome of the EKACDM Initiative is to reduce the impact of natural and technological hazards and the effects of climate change on men, women and children in the Caribbean region. It seeks to position the region with greater knowledge and practical solutions to strengthen climate adaptation, and other sustainable practices that will make the region more resilient and sustainable.

For further information:

http://www.uwi.edu/EKACDM/index.aspx
http://uwi.edu/drrc/
http://www.uwi.edu/isd/