Creating Our Sustainable Future: Belize, Central America, and the Caribbean

Belize Natural Energy, Charitable Trust (BNECT)
IC² Institute, Austin, Texas and
The Artic University, Norway
January 2016
Note: Cover photo “our connected environment” shows ocean temperature flow of the Gulf Stream from Southern United States and the Caribbean, to the coast of Norway.
Key Objective

To help determine and implement important education, business, and environmental initiatives that create technology-based jobs and careers for Belizeans and features Belize as a model for sustainable development for the Caribbean and Central America.
Acknowledgements & Participants

We thank Norway’s NORAD for providing a grant that made it possible for Norwegian and United States researchers to join with Belizean academic, business and government leaders to explore the best ways to increase science, technology, engineering, and math (STEM) education throughout Belize’s tertiary education system. As noted in this report, the planning processes that was begun with NORAD funding has increased engagement of key participants in regards to a range of environmental, educational, and developmental challenges in Belize at the individual and institutional levels. Below are the names of the international planning and research team representing The Artic University of the North, Norway, the University of Texas at Austin, and Belize.

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<tr>
<th>Norway</th>
<th>United States</th>
<th>Belize</th>
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<td>Akvaplan Niva</td>
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<td>Derek Satchwell</td>
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<td>Ministry of Education, Youth and Sports</td>
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Belize, Central America, and the Caribbean

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Creating Our Sustainable Future:
Belize, Central America, and the Caribbean

Even small dots on the map deserve to be heard and are especially important as they are on the front lines on the impact of Global Warming – Climate Change is a massive generational problem that affects us all.

PRESIDENT BARAK OBAMA
Global Climate Conference
December 1, 2015
Le Bourget, France

Introduction
Given the looming realities of Climate Change many of the world’s smallest countries are faced with the extraordinary burden concerning their responsibility, or lack of responsibility, toward their exceptional and often globally important natural resources. They generally lack the critical mass of human talent and financial capital to make needed initiatives and effective investments. In addition, such small countries are often “forgotten” by international agencies that tend to focus attention on more visible, hostile, and globally threatening locations.

Belize, a developing country of 360,000 inhabitants, is overwhelmed by the challenge of the steward for 70% if the largest coral reef in the Western Hemisphere and also of a major portion of the “biological corridor” of the Mesoamerican peninsula while also working to build an economy that provides employment and career opportunities as well as an accessible quality of life for its citizens. Sixty-five percent of Belize’s natural habitats are ostensibly protected under government environmental programs; however, the country’s small size, combined with the lack of needed financial and human capital and know-how, are serious obstacles to pursuing viable sustainable economic development strategies. This is a challenging task as The World Bank ranks Belize as 8th among 167 nations as being most vulnerable to climate risk. While Belize has the lowest population density in Central America the country’s growth rate of 1.97% per year is the second highest for Central America and one of the highest in the Western Hemisphere.

This report is the result of a cooperative effort involving participants from Belize, Central America; Austin, Texas; and Tromso, Norway. The focus on Belize is grounded in the recognized importance of this nation’s strategic location in terms of globally important and increasingly threatened marine and terrestrial ecosystems including tropical forests and the largest barrier reef in the western hemisphere.
The focus is on education, business, and government strategies to break Belize’s cycle of poverty through sustainable economic growth. Belize’s economy, like many emerging nations in Central America and the Caribbean, is highly dependent on tourism, agriculture, aquaculture, and forestry industries that are dependent on the health of the nation’s natural resource base. Many Belizean leaders in government, academic, and business and Belizean citizens want to develop the country in an economically sustainable manner.

We submit that fostering economic development while protecting Belize’s natural resources are not disparate goals in that there are mutually beneficial solutions. Quality education in science, technology, engineering, and math (STEM) subjects integrated with environmental studies and the arts and entrepreneurship will foster the innovative capacity needed to provide sustainable solutions to economic challenges for Belize and will serve as an important model for other small developing nations faced with similar environmental and economic development challenges in Central America and the Caribbean.

**Belize Sustainability Project**

We are most concerned with how to most effectively pursue sustainable wealth and job creation in a small and vulnerable nation such as Belize? We focus on energy related opportunities and challenges and suggest a way forward through focusing on entrepreneurship and STEAM (Science, Technology, Engineering, the Arts, Math) education in cooperation with local and international education institutions and talent. We seek to find viable strategies that protect the nation’s natural resources while creating regional wealth; strategies that may be generalizable to Central America and the Caribbean. Lead participants in the Belize Sustainability Project include participants from Belize; Austin, Texas, and Tromso, Norway, as follows.

**Belize Natural Energy Charitable Trust (BNECT)**

Since the first commercial oil discovery in 2005, *Belize Natural Energy Limited* (BNE Ltd.) has established itself as a world-class company with a genuine commitment to Belize’s sustainability and social engagement. BNE was founded on the vision that oil and gas could positively transform Belize through public-private partnerships with a focus on education and on supporting sustainable development programs. The BNE Charitable TRUST (BNECT) was established in 2008 as a strategic partnership between the Government of Belize and the Belize Natural Energy Limited with the goal of making a positive difference in the lives of all Belizeans. The Trust seeks to empower people and communities to be engaged in economic development in a socially and environmentally responsible manner through funding education related projects and capacity building programs; initiatives that support the social environment; a student loan program; and micro-enterprise credit managed by the Belize Enterprise for Sustainable Technology (BEST).
Austin, Texas

The “Austin Model” of building a world-class entrepreneurial and innovative economy is well known nationally and internationally being rated the No. 1 US city for startups in the 2015 Kauffman Index Report. An important research and education component to The Austin Model was and continues to be the Innovation, Creativity, & Capital (IC²) Institute at the University of Texas. For 30 years IC² Institute has worked on economic development projects in emerging and developed regions worldwide. Lessons have been learned that will be particularly useful to building an effective Belizean Model of sustainable economic development. Based in Austin, Texas, The Belize Foundation (www.thebelizefoundation.org) was established in 2010 as a non-profit (501c3) to help fund and promote human and environmental development, conservation, and sustainability within the nation of Belize. The Foundation seeks to provide and leverage Belizean and international talent, capital, and know-how for the development of creative and innovative opportunities for the development of Belize’s economic and human assets for an improved and sustainable quality of life.

Tromsø, Norway

The country of Norway has become well known for managing and evenly distributing the high income from their valuable resources, such as petroleum, hydro energy and fish. However, the country has more in common with Belize than first meets the eye: It is also a small country; it is heavily focused on protecting its natural resources. Further, it wasn’t always a rich country; in fact, it has rapidly evolved from being one of the poorest countries in Europe to becoming the global example for how to develop national resources while maintaining a strong environmental focus. Many of the special competencies developed in Norway are useful to be considered and possibly adapted by Belize as well as other Caribbean and Central American nations. Tromsø, Norway is the “capital of the arctic” and has experience in developing an economy in spite of geographical and demographic challenges. Marine resources, oil extraction, environmental care and climate change are central topic here. Thus, Norway and Belize provide important scientific and practical environmental and economic contrasts—The Far North vs. The Caribbean—to better understand the challenges of and responses to Global Warming.

Overall Strategy

The overall strategy for the Belize Sustainability Project is to develop needed programs, processes, and metrics that foster national and international collaboration across public and private sectors to provide the talent and capacity for sustainable social and economic development, Figure 1. Such capacity building includes primary, secondary, and tertiary education development within Belize that includes quality science, technology, engineering, and math education as well as an appreciation for the arts and business, social, and civic entrepreneurship. In addition the challenge is to move from creativity to innovation that fosters job and wealth creation for Belize. International academic, business, and government alliances and support are seen to be an important component to the sustainable success of this vision.
Belize: One country - two geographical regions

Belize is located in the Mesoamerican region, however the country is also politically and culturally tied to the Caribbean. Across both the Mesoamerican and Caribbean regions Climate Change presents increasing challenges to emerging economies. The Mesoamerican Biological Corridor (MBC) is an initiative of Central America and Mexico and was launched in the 1990s to protect animal migration while promoting ecological sustainability. The MBC is not a geographically delimited area but a concept of development and conservation in Core Zones, Buffer Zones, Corridor Zones, and Multiple-Use Zones where each zone has varying availability and constraints for human use. All the protected areas have significant human populations and in many cases are indigenous inhabitants. About 600 protected areas in Central America are part of the MBC and about 45% are located in Belize more than any of the neighbor countries, see Table 1. Mesoamerica contains somewhere between 7 to 10% of the world’s known species. While the MBC initially focused on environmental protection objectives have evolved favouring the integration of conservation with economic development.

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1 Central Mexico to Belize, Guatemala, El Salvador, Honduras, Nicaragua, and northern Costa Rica.
2 British West Indies/Anglophone Caribbean: Anguilla, Antigua and Barbuda, Bahamas, Barbados, Bay Islands, Guyana, Belize, British Virgin Islands, Cayman Islands, Dominican Republic, Grenada, Jamaica, Montserrat, Saint Croix (briefly), Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, and Trinidad and Tobago
Table 1: Mesoamerican Biological Corridor (MBC) protected areas and the percent located in each Central American country.

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<thead>
<tr>
<th>Country</th>
<th>Protected Areas</th>
<th>% of countries areas</th>
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<tbody>
<tr>
<td>Southern Mexico</td>
<td>33</td>
<td>18.8%</td>
</tr>
<tr>
<td><strong>Belize</strong></td>
<td><strong>59</strong></td>
<td><strong>44.8%</strong></td>
</tr>
<tr>
<td>Guatemala</td>
<td>104</td>
<td>26.3%</td>
</tr>
<tr>
<td>El Salvador</td>
<td>3</td>
<td>1.6%</td>
</tr>
<tr>
<td>Honduras</td>
<td>106</td>
<td>19.0%</td>
</tr>
<tr>
<td>Nicaragua</td>
<td>76</td>
<td>21.7%</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>151</td>
<td>24.6%</td>
</tr>
<tr>
<td>Panama</td>
<td>69</td>
<td>29.5%</td>
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The Mesoamerican Coral Reef

The Mesoamerican Reef lies within the Caribbean Sea and touches the coasts of Mexico, Belize, Guatemala and Honduras, Figure 3. It is the largest barrier reef in the Western Hemisphere stretching nearly 700 miles from the northern tip of Yucatan down through the Honduran Bay Islands. The scenic beauty of the region’s coastal area makes it a prime tourist destination which puts ever increasing pressure on fragile reef environments. Large-scale
agriculture run-off also negatively impacts the coral reefs. Increasing sea levels and water temperatures from climate change also threatens the coral and associated marine animals as well as the communities that depend on the reef for their livelihood and food.

Coral reefs buffer adjacent shorelines from wave action and prevent erosion, property damage, and loss of life while providing goods and services worth $375 billion each year (Costanza et al., 1997). An estimated half a billion people live within 100 kilometers of the associated reef and benefit from its production and protection. In addition, mangroves provide habitat for fish and shorebirds as well as protect coastal areas from the damage associated with hurricanes and strong storms. Coral reefs are some of the most diverse and valuable ecosystems on Earth as they support more species – about 4,000 species of fish and 800 species of coral – given their area than any other marine environment. In addition, scientists estimate that there may be 1 to 8 million undiscovered species and organisms living in and around reefs (Reaka-Kudla, 1997). In terms of future economic development, reef biodiversity is considered a key resource to new medications and other compounds for the 21st century.

**Figure 3. The Mesoamerican Reef (shown in crimson)**

![Map of the Mesoamerican Reef](image_url)
Challenge

Belize, for its small size, is remarkably diverse ecologically and culturally. However, its forests and marine resources are under significant threat, mainly from high deforestation rates, improper solid waste management, rapid coastal development, increasing poverty, weak institutional and legal frameworks, and the recent discovery of sweet crude oil. Sustainable solutions to these challenges will require innovative, practical, and cost-effective strategies that involve all stakeholders and that seek to improve the socio-economic conditions of these stakeholders. Belize's network of protected areas must be managed transparently, utilizing best management practices and informed by applied scientific research if the biodiversity they contain is to be maintained.

PROFESSOR COLIN A. YOUNG

Belize, with 360,000 inhabitants and a poverty rate of 43%, is responsible for managing 70% of the largest coral reef on the western hemisphere and 45% of the Mesoamerican biological corridor. While up to 65% of the Belize’s natural habitat is “protected” by national environmental programs, needed personnel and financial resources are lacking to effectively manage these natural assets. Contributing to the challenge, Belize’s national economy is dependent on tourism which directly impacts the country’s natural resource base. In addition, agriculture, aquaculture, and forestry are especially vulnerable to exploitation, natural disasters, and climate change. Belize is ranked 8th among 167 countries being most vulnerable to climate risk (World Bank). While climate change is predicted to increase the population’s exposure to natural hazards, the presence of unsustainable management practices such as unchecked land conversion, the expansion of agriculture to inadequate terrain or marginalized soil and the concentration of people in highly exposed cities also increases the risk and impact of climatic variation (United Nations, 2012).

Belize’s major environmental vulnerabilities include the sustainable use of land, minerals, water, and energy. Resulting challenges include maintaining biodiversity while mitigating ecosystem loss from deforestation and unsustainable practices. These considerable challenges are exacerbated by climate change resulting in the increased impact of natural disasters such as floods and hurricanes. While tropical cyclones and accompanying storm surges have historically resulted in significant damage, a major current threat to Belize is recurrent flooding due to heavy and persistent rainfall and the altering of natural drainage, wetlands and water catchment areas.

Belize’s population is concentrated in coastal cities, towns and villages. The vulnerability of concentrated populations in exposed areas such as in Belize City (Belize City is home to

approximately 17% of the country’s population is compounded by inadequate housing and infrastructure. Climate change research confirms that sea surface temperatures have increased as sea levels have risen in the Mesoamerican region. The 2007 Vulnerability Assessment by the Belize Coastal Zone detailed a range of possible effects of climate change, based on modelled scenarios developed by the National Meteorological Service (NMS). According to the study, the major impacts predicted on Belize’s biophysical resources will be from rising sea levels, increased sea surface temperatures, changes in weather patterns, and increased storm activity.

Corals are most susceptible to increased sea surface temperature and storms. Coral is also being lost to bleaching, disease and physical damage resulting from the pressures of tourism. Mangroves and sea grass beds are threatened by changes in weather patterns and storm events resulting in physical damage and detrimental changes in biological processes such as reproduction. Coastal areas, beaches and atolls suffer from inundation, erosion and storm surges. The socioeconomic impacts deriving from loss and fragmentation of natural habitats and the reduction of coastal areas heavily challenge country development, since they directly affect the tourism and fisheries industries (Neal et al., pg.9).

**Institutional Challenges**

The economy of a country is not categorized by its access to natural resources, but how it manages those resources through productive institutions (Mehlum, Moene, and Torvik, 2005; Wright and Czelusta, 2004).

While the government of Belize emphasizes the importance of sustainability and renewable energy, there important challenges in the existing institutional framework. For example, Belize has experienced significant bottlenecks in their human rights reporting over the last decade. In 2011, UNDP carried out a “Rapid Capacity Assessment on Belize Human Rights Reporting Capabilities” that revealed a number of challenges in the organization of the human rights reporting system, and uncovered issues related to less-than-optimal institutional arrangements, leadership, and knowledge and accountability patterns. The report concluded: (a) there is a lack of clarity of mandates of relevant ministries in regard to human rights reporting; (b) respective conventions are insufficiently mainstreamed in the ministries; (c) progress in the reporting system is hampered by insufficient staff, and (d) the generalization of duties of ministry staff means that responsibilities for ensuring human rights reporting inevitably does not get assigned. In short, leadership challenges combined with limited staff with knowledge deficits results in a systematic lack of accountability.

In response to such challenges, Horizon 2030 was developed after a range of interviews with multiple stakeholders throughout Belize with the goal of establishing a framework to achieve

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a national vision for development. To meet the nation’s challenges, the report suggests three strategies should be implemented across Belize’s levels of government.

**Public planning:** Development policies should be inclusive, planning should be integrative and programs should include clear monitoring and evaluation processes. The end goal is to create community value so that all citizens have a stake to contribute to sustainable development. Open dialogue with diverse communities is seen as crucial to paving the way towards long term and mutually beneficial goals.

**Economic resilience:** The objective is to increase sustainable agricultural production, creating environmental and economically sustainable tourism and diversification of the small business sector. Also called for is an educated and skilled work force including entrepreneurs and a strategic outline of investments in infrastructure that maximize overall economic capabilities.

**Implementation:** The collaboration of district committees is seen as important for an inclusive implementation strategy. Such broad representation will allow better program monitoring including reports to the National Assembly and the Ministry of Economic Development.

### Belize’s Economy

Belize’ economy is based primarily on agriculture and commodity exports and tourism and most recently Belize’s on-shore oil industry. In addition to petroleum, Belize’s primary exports are citrus, sugar, and bananas. Belize’s trade deficit has been steadily increasing as a result of low export prices for oil, sugar and bananas as well as a decline in tourism.

### Petroleum Resources in Belize

In 2003, Belize Natural Energy (BNE) signed a production sharing agreement with the Government of Belize and in 2005 oil was discovered in the Mennonite Community of Spanish Lookout in Western Belize. At the time of discovery BNE had to develop needed infrastructure to produce and market Belize Light Crude. In 2009, BNE discovered the Never Delay Field (ND) Northeast of Belmopan. After BNE’s initial success, about 18 other companies have worked to attain oil exploration licenses from Belize’s government. There is an expectation that there are large oil reserves offshore and an important looming question is whether and how to best explore these resources. It would be devastating for the tourism if off-shore petroleum exploration results in an oil spill.

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6 Currently BNE produces ~2,000 barrels of crude oil per day, ~1,800 gallons of Liquefied Petroleum Gas (LPG) and ~160 million cubic feet per day (MCF/D) of fuel gas for electricity generation (internal use).
Public concern regarding oil exploration, especially offshore drilling, has led to intense criticism of oil companies risking Belize’s world heritage assets. In a case brought by Oceana (COLA) and the Belize coalition to Save Our Natural Heritage, it was determined that Belize’s government had failed to properly assess the environmental impact of offshore oil exploration and that the oil companies did not have the ability as well as the needed funds, assets, machinery, equipment, tools and technical expertise to drill safely. As a result, in April 2013, Belize’s Supreme Court declared null and void offshore drilling contracts issued by the government. However, despite this obstacle, after some relatively minor operational restructuring, several oil companies started offshore operations in May 2013.

Dr. Colin Young observed in 2008 the majority of potential oil reserves are located within Belize’s protected areas. The issue of changing the law on environmentally sensitive areas to accommodate oil exploration is an understandably complex and important issue. Tension between the public and “development” interests and policies and actions toward oil exploration highlight serious problems encountered in managing both growth and conservation. As noted by Daniel Gutierrez, BNE, Marketing Logistics and Communications Manager (NORAD Workshop, 2014),

> People talk about how we can get our doctors and engineers to come back home. Our economy has gone one direction. We have kind of misinterpreted the term sustainable as anti-industrial. If we don’t have industry, we don’t have jobs. The environmentalists are not being helpful. There is a culture in Belize that has developed, which is anti-industrial. Here we have students wanting to be engineers, but young people get bombarded at school with messages like “hydro plants are bad for Belize because they destroy the environment,” or “the oil and gas industry is not good for the environment.” We need to have parents and friends say, “It’s okay to like science and go into engineering.” Otherwise you have a lot of pressure that pushes them toward business and non-STEM areas. That’s something we have to deal with as a country.

The emerging oil industry is clearly an important asset for Belize. However, while this industry is providing important wealth and jobs a lack of advanced drilling and pollution containment technologies and management practices in environmentally sensitive areas is a significant threat to Belize’s economic and social well-being. In short, oil exploration in Belize is at a crossroads. All choices toward development of these resources are highly political and some are of questionable legality. One potential path facilitating safe oil exploration would be for Belize businesses leaders to collaborate with the National Government, The University of Belize, and international experts to provide the needed workforce with the necessary skills and technology to make oil drilling as safe as possible. In addition civic and business leaders need to revisit relevant policies and inform the public on key issues. On a less desirable path, industry’s quest for quick profit could undervalue important and costly safety issues resulting in a lack of transparency, understanding, and
accountability and ultimately environmental disaster. Protecting the natural environment and enhancing socio-economic development for communities affected by the petroleum industry is paramount. As Belize’s pristine and irreplaceable natural and historical environments decline so will the tourist industry along with the nation’s untapped opportunities as a center for research and education on these important environmental and sustainable energy assets.

**Renewable Energy**

Fortunately, Belize has a range of energy options as the country is rich in renewable resources such as solar, hydro and biomass. As of 2015, about 50% of Belize’s electricity needs are met by domestic hydro-power and the remaining 50% is imported from Mexico. This ratio is not likely to shift as the country’s hydro-power resources are fully developed.

Biomass presents additional and important opportunities for clean energy in Belize. For example, Belcogen, a large biomass plant, was installed in Orange walk in 2012. This plant works cooperatively with the local sugar cane industry to burn sugar cane waste products at high temperatures with low oxygen to produce a clean burn with minimal greenhouse gasses. High standards, set by the World Bank were incorporated into the construction of the plant to reduce emissions. These standards include electrostatic precipitators to pull particulate matter from the exhaust; instead of smoke being produced, the plant’s chimney emits a “clear haze,” and the chief by-product is a charcoal that is appropriate for household use. This biomass plant represents sustainable development at its best as it processes agricultural waste into energy with minimal negative impact on the environment. Follow-through at the Belcogen plant to troubleshoot failures or inefficiencies as they appear will be pivotal in its long term success against well-sighted goals. When the plant was installed, the goal was to meet about 20% of the nation’s energy needs.

Belizean solar energy potential remains largely untapped because of the high initial investments needed and because existing systems have provided mixed success due to a general lack of expertise for proper installation and maintenance. However, Tobias Bostrom, a Norwegian solar energy expert who visited Belize, observed improper installation and/or improper angles of use. As he stated,

> While it’s true that Belize has a rainy season, the statistics show that solar could be a positive alternative since solar is effective in Norway where we receive much less sunlight. I think that some troubleshooting and problem solving in Belize will help make solar more effective overall.

Belize has made a commitment to the “Small Island Developing States Sustainable Energy Initiative” (SIDS DOCK) to collectively reduce energy by 25%, generate a minimum of 50% of electric power and decrease conventional transportation fuel use by 20-30% by 2033.

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7 Belizean wind energy resources are minimal as average wind speeds are relatively low since there are no prevailing sea winds and the barrier reef reduces the impact of tide and wave action.
These objectives are part of The Ministry or Science Technology and Energy’s (MESTPU) Strategic Plan 2012. In order to execute these mandates, several programs and activities are proposed to support the development of the country’s non-renewable and renewable energy resources and to improve energy efficiency and conservation to transform to a low carbon economy. Core strategies include:

- Improving energy efficiency and conservation across all sectors
- Reducing the country’s dependence on imported fuel by 2020
- Tripling the amount of modern energy carriers derived from waste material
- Institutionalizing a countrywide infrastructure to collect data and assess the potential for converting solar, wind and hydro to electricity.

Like other Central American and Caribbean countries, Belize’s reliance on imported energy threatens to hinder the country’s development. Belize needs to improve its energy conservation across all sectors of the country to build resilience of the national economy to climate change and other impending challenges.

**Education**

Education is a central pillar for sustainable social and economic progress (Barnett et al., 2010). Horizon 2030 Belize calls for the expansion of curricula and new methods of education delivery by stressing the importance of improving quality and accessibility along with the integration of science and technology and the expressive arts at all levels of society (Education Sector Strategy 2011: 2016⁸). The implementation of the Horizon 2030 framework will require broad input and involvement as well as extensive coordination and effort to evaluate and adjust priorities along multiple points of interest. This is an understandably challenging task. For example, in Belize, elementary and secondary education is not free.

“There are plenty of families who have to decide whether to feed a child or give him or her an exercise book, and guess what? They, of course, prefer to feed their children. They don’t send them to school simply because they can’t afford it.”

Belizean Respondent

While the Belizean population broadly embraces positive concepts for human rights and sustainability of the environment, education continues to present a primary limitation against these goals. We promote that, to meet these goals for sustainability in society, environment, and the economy, requisite education needs to include a strong base in innovation, and entrepreneurship and STEM targeted to facilitate sustainability. We see this combination as

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foundational for economic development in any region, and that this development will provide the populace with new opportunities to pursue social improvements and fill the nation’s gaps in addressing human rights.

A key question is whether Belize’s education institutions will receive the investments necessary to promote programs that encourage students to become educated citizens and skilled employees to provide the needed talent for established and emerging industries and the public sector. One direction sees increased investments in Belize’s education institutions leading to continued improvement in primary and secondary school enrollment as well as extended efforts to increase the variety of post-secondary studies. Another direction leads to underfunding and results in a stagnation of educational efforts as demand overruns capacity and where resulting education and training are not adequate to support Belize’s economic and social transformation as well as meeting increasing environmental challenges.

Education in entrepreneurship and the development of a strong entrepreneurial ecosystem is needed to help the nation increase the GDP. This report stresses the importance of three platforms important to Belize’s sustainable economic development:

- Business, Civic, and Social/Environmental entrepreneurship
- An emphasis on sustainability of Belize’s human capital, heritage, environment, and economy
- An emphasis on science, technology, engineering, the arts, and math education (STEAM) as key to Belize’s educational, economic, and environmental transformation

**Entrepreneurial education**

Job creation is of critical national concern and is widely recognized as essential to moving Belize forward. Currently those who are fortunate to be able to pursue higher education face a dilemma on graduation to either become underemployed or leave their home country to find suitable employment abroad. Belize is facing serious economic challenges and is lacking the required entrepreneurial capacity to leverage and build on the country’s human and environmental assets to develop sustainably, economically, and socially.

*Business Entrepreneurship* centers on linking talent, technology, capital, and business know-how at the regional-level for the creation of opportunities though new business processes and products. Talent refers to individuals or champions who make things happen and who facilitate the development of new business opportunities. Capital, whether venture, angle, or government grants, provides the fuel for development of the business idea. Business know-how includes management, legal, marketing, and sales and distribution and is crucial to the initial success and growth of new ventures.
Figure 4. Three platforms for Belize’s sustainable economic development

Civic Entrepreneurship utilizes innovative approaches and partnerships in the pursuit of leveraging regional, national, and international resources to solve challenges and to create new infrastructures for accelerated and sustainable development. Civic Entrepreneurship is built upon the networking key regional academic, government, and business leaders. Civic entrepreneurship helps build regionally based "smart infrastructure" for commercialization of science and technology and new businesses development for new industries as well as for enhanced competitiveness of established industries.

Social & Environmental Entrepreneurship focuses on finding creative and innovative ways to improve society through social and economic inclusion. Social entrepreneur’s network and link public and private sectors including non-profit and non-government organizations (NGOs) and foundations to solve challenges and to provide new opportunities for an accessible and improved quality of life for all. Social entrepreneurship adds a different dimension to policies through the design and implementation of solutions that form the foundation for social innovations that are sustainable. Environmental-based

9 Wildlife Conservation Society, World Wildlife Fund, Protected Areas Conservation Trust
10 http://studentsforliberty.org/blog/2012/12/28/social-entrepreneurship-a-key-to-poverty-reduction-and-agorism
entrepreneurship is important to develop practical, cost-effective solutions linking Belize’s energy needs and development opportunities.\textsuperscript{11}

The University of Belize has taken initial steps to pave the way for the establishment of a Belize Centre for Excellence in Science Technology and Innovation (STI). In cooperation with the Belize Trade and Investment Development Service (BELTRAIDE), the Small Business Development Centre (SBDC) has been in operation since October of 2012.\textsuperscript{12} The lessons learned and accomplishments achieved by the SBDC provide crucial information to identify opportunities and unmet needs of innovation and business, social, environmental, and civic entrepreneurs. This collaboration is a good example of sharing resources and goals among government, university research, and private businesses to maximize success.

**STEAM Education: Needs and Challenges**\textsuperscript{13}

STEAM-based education (science, technology, engineering, arts, math) is key to providing training for technical, business, and environmental talent needed to develop as well as to protect Belize’s natural resources while building successful businesses. The call is to promote education in the natural sciences, information technology, engineering, and mathematics along with creativity and innovation in modes of delivery in the classroom and through distance education. As opposed to teaching of subject-related content in isolation from other content areas, STEAM education requires an interdisciplinary approach to content delivery. The objective is to have students realize the connectivity across content and the relevance of such content for their field of study and to solving real-world problems. Such an approach to learning will play a vital role in the development of a qualified workforce in terms of skills and attitudes that employees bring to the workplace. Two current and important Belizean initiatives in this regard are:

2. In cooperation with the Belize Trade and Investment Development Service (BELTRAIDE), the Small Business Development Centre (SBDC) has been in

\textsuperscript{11} Organizations such as Blue Ventures focus on marine conservation efforts and offer volunteer opportunities to help conduct research on the Barrier Reef. As a self-described “science-led social enterprise,” the primary goal is aiding communities who depend on the coast for their livelihood. Blue Ventures conservation makes economic sense by designing a model that takes advantage of Belize’s strongest assets and forming a niche around them. For example, volunteers gather data for external parties such as the Belize Fisheries Department and the National Coral Reef Monitoring Network. With growth and success, Blue Ventures has expanded into different initiatives that promote conservation with land animals as well.
\textsuperscript{12} Belizeinvest.net
\textsuperscript{13} The authors of this report are indebted to Professor Gertrudes Velasquez, University of Belize, for compiling these statistics and analysis.
The lessons learned and accomplishments achieved by the SBDC provide crucial information to identify opportunities and unmet needs of innovation and business, social, environmental, and civic entrepreneurs.

Belize faces the challenges in STEAM education that are common to other Central American and Caribbean nations: A shortage of primary and secondary teachers with STEM backgrounds. Non-STEM teachers continue to teach in the traditional methods in which they were taught and when required to teach STEM courses, they often teach from textbooks with limited practical experience. Teacher discomfort and sometimes frank avoidance of STEM subjects is surreptitiously passed to another generation. Approximately 75% of the University of Belize FST fulltime faculty are male and approximately 78% have a Bachelor's or Master's degree, Table 2.

Table 2. Academic qualifications of male and female faculty at the University of Belize

<table>
<thead>
<tr>
<th>Gender</th>
<th>BBA (%)</th>
<th>MSC/ MBA (%)</th>
<th>PhD (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>2 (3.9)</td>
<td>7 (13.7)</td>
<td>4 (7.8)</td>
<td>13 (25.5)</td>
</tr>
<tr>
<td>Male</td>
<td>4 (7.8)</td>
<td>27 (52.9)</td>
<td>7 (13.7)</td>
<td>38 (74.5)</td>
</tr>
<tr>
<td>Total</td>
<td>6 (11.7)</td>
<td>34 (66.6)</td>
<td>11 (21.6)</td>
<td>51</td>
</tr>
</tbody>
</table>

Although the University of Belize expects faculty members to engage in academic research along with teaching; actual faculty engagement in such research is limited and sporadic, Table 3.

Table 3. Research Engagement of University of Belize Faculty

Female students tend to avoid STEM education in general and computer programming education in particular. University of Belize student enrollment from 2000 to 2014 indicates an average difference of 27.2% in female and male enrollment. While the overall student

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15 Belizeinvest.net
enrollment for the University of Belize favors females, the enrollment trend over the same period in the Faculty of Science and Technology is the opposite. Average female enrollment in UB FST over the period 2000 to 2014 is 32% below average male enrollment (Table 4). Enrollment data from 2000 to 2014 indicates large gaps in enrollment by gender for UB FST programs in agriculture, architecture, building and civil engineering, mechanical and electrical engineering, information technology, and mathematics at the associate's degree and bachelor’s.

Table 4. University of Belize and UB FST Enrollment Trends by Gender

Table 5. Enrollment vs. Graduated at University of Belize
At Galen University, the Environmental Science (ESCI) Program led to a consistent enrollment in computer science classes by males and females; however, this trend changed significantly in 2006 when female enrollment increased as male enrollment remained stagnant, Table 6. Galen’s computer science program, on the other hand, clearly exhibits a male-dominated program, Table 7.

**Table 6. Environmental Science (ESCI) Enrollment by gender at Galen University**

<table>
<thead>
<tr>
<th>Semester</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAL 2003</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>FAL 2004</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>FAL 2005</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>FAL 2006</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>FAL 2007</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>FAL 2008</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>FAL 2009</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>FAL 2010</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>FAL 2011</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>FAL 2012</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>FAL 2013</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>FAL 2014</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

**Table 7. CSCI: Enrollment by Gender at Galen**

<table>
<thead>
<tr>
<th>Semester</th>
<th>MALE</th>
<th>FEMALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAL 2003</td>
<td>0</td>
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<td>FAL 2010</td>
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<td>FAL 2011</td>
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<tr>
<td>FAL 2012</td>
<td>5</td>
<td>0</td>
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<tr>
<td>FAL 2013</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>FAL 2014</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

In summary, Belize faces the challenges in STEM education that are common to Central America and the Caribbean: a shortage of primary and secondary teachers with STEM backgrounds.
Female students tend to avoid STEM education in general and computer programming in particular. Approximately 75% of the UB fulltime faculty is male, and approximately 78% have a bachelor’s or master’s degree. Interestingly, Galen University currently has parity in enrollment for its Environmental Science program and from 2004 to 2011 saw an overall increase in female enrollment while male enrollment remained constant.

Lack of equipment and infrastructure limits the capacity for computing and IT usage in UB and Galen University classrooms while students are regularly exposed to smart phones and computers at home and often are more IT literate than the teachers.

In spite of professorial encouragement to do so, tertiary students most often do not enroll in non-required STEM courses.

The lack of adequate IT equipment and infrastructure limits the capacity for computer use in classrooms. Interestingly, students using smart phones and computers at home often know more about IT than their teachers.

Faculty members at the University of Belize and Galen University are expected to conduct research and publish in addition to teaching and community service; however, since teaching loads are extremely high research activity is extremely low.

Conclusion

Job creation in a sustainable economy is a critical national concern for Belize as well as for other nations in Central America and The Caribbean. Launching and growing profitable businesses is crucial to creating meaningful jobs and career prospects as well as to providing the tax revenue needed to foster successful education and training programs and a sustainable quality of life. Entrepreneurship education and the development of a strong entrepreneurial ecosystem is an important component of this vision.

A major challenge to implementing innovative job creating programs is applying new and pioneering types of public/private cooperative activities and sharing resources and goals among government, university, and private businesses to maximize success, Figure 5. The creativity of entrepreneurs, the support of the government and business, and the dedication of universities quality education will be a cornerstone of twenty-first century Belizean economic, environmental, and social development. The vision is to leverage Belizean assets and know-how with national and international networks and strategic alliances to:

- Promote high quality education and research with application to Belize’s social and environmental assets and challenges
- Facilitate entrepreneurial activity and business development well suited to benefit Belizeans and sustainable economic opportunities for job and wealth creation

16 In the United States, this number has also fallen since the 1990’s, rather than increasing.
• Leverage Belize’s ecological and human diversity to provide useful lessons and knowledge for environmental and cultural conservation and improved quality of life
• Make Belize an exceptional regional and international model for sustainable development.

**Figure 5. National and International Alliances in Capacity Building for Belize’s Sustainable Development**

**Reference Documents**


Lupini, Sara – your Professional report


Munoz, Ilse “Belize: Decoding the Census,” Bridging Disciplines Program, The University of Texas at Austin, August 2015.

Weigand, Madison, “Educating Belize: Challenges and Opportunities for the Future” Bridging Disciplines Program, The University of Texas at Austin. August 2015.