Rural Livelihoods

CANARI

Caribbean Natural Resources Institute

Technical Report No. 403

Building resilience and adding value to local green enterprises: Developing a 'climate-proofing' methodology

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Caribbean Natural Resources Institute (CANARI)
Technical Report No. 403
December 2017

Acknowledgements:
This case study was developed by Keisha Sandy and Akosua Edwards along with members of the Brasso Seco Paria Tourism Action Committee and Brasso Seco Morne La Croix Farmers Association. These were Elaine Franscois-Phillips, Francis Franscois, Carolyn Toussaint, Melanie Bastaldo, Alicia Maldoo, Kelly Fitzjames, Carl Fitzjames, Winston Maraj, Anthony Mulchan, Mathilda Janette, Robert Metivier, and Judy De Ramos.

CANARI produced this report with support from **Small Island Developing States Community-Based Adaptation (SIDS-CBA) Project**, funded by Australian Aid and implemented by the United Nations Development Programme (UNDP) and delivered by the Global Environment Facility (GEF) Small Grants Programme (SGP).

Citation: : Sandy, K. & A. Dardaine-Edwards. 2017. *Building resilience and adding value to local green enterprises: Developing a 'climate-proofing' methodology*. Technical Report No. 403. Laventille: CANARI.

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ISBN 1-890792-38-1

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Summary

Climate variability and change, and the more intense natural hazards associated with them, negatively impact natural ecosystems which provide the goods and services that are the foundation of many rural enterprises in the Caribbean. Understanding how climate variability and change will affect an enterprise is a key first step to reducing vulnerabilities and building its resilience. The Caribbean Natural Resources Institute (CANARI) has developed a methodology using value chain analysis (VCA) to assess the likely impacts of climate variability and change along each step in the value chain of an enterprise. Value chains show the activities and processes in an enterprise to deliver products and services to the consumer. Because it is a logical structure of the enterprise, value chains offer a frame to analyse the enterprise in the context of climate change. Possible strategies that can be taken to build resilience can then be identified and implemented. CANARI piloted this methodology with two community organisations in a remote small rural community in Trinidad and Tobago which has enterprises around agriculture, agroforestry, agritourism and chocolate and honey production. This pilot was funded by the GEF Small Grant Programme (GEF-SGP), implemented by the United Nations Development Programme (UNDP). Both community organisations found that the VCA helped them to identify where climate change vulnerabilities existed and therefore where they could make improvements to build resilience and add value to the enterprises.

Figure 1: Sign at the entrance of the Manchuria Estate, Brasso Seco Paria. 2012

1. Introduction

1.1 Why local green community enterprises

Rural communities in the Caribbean are often located away from the main centres of business and depend on natural ecosystems for their livelihoods. Homes are built from the wood from trees in nearby forests while shrubs and wildlife provide food and often medicines for the rural families. Goods and services from natural ecosystems also provide much of the resources for community enterprises. Seeds from trees are used in jewellery; guides from the communities take people on tours through the forests or coral reefs; fishermen harvest seafood and either sell or export the products. Enterprises such as these are either the only source of income or supplement the families' incomes. Because of this, natural ecosystems are critical to enterprises in rural communities.

Rural community enterprises or **local green enterprises** (LGEs) is a smaller niche within the wider grouping of micro and small enterprises (MSEs)[1]. MSEs contribute approximately 50% of employment and 40% of the Gross Domestic Product (GDP) in many Caribbean countries (CANARI 2014) and LGEs which are based on the use of ecosystem goods and services are particularly important in rural communities.

LGEs seek to deliver economic, social and environmental benefits to the communities in which they are found. They are community-owned businesses that are socially conscious and strive to be socially inclusive and deliver benefits to the wider community. As an example, Brasso Seco Paria Tourism Action Committee established a fund from the profits of its enterprise to help persons in the community who may need food, money for medical bills, etc. LGEs straddle the line between for profit and non-profit and can also be considered as social enterprises.

1.2 Climate challenges for local green enterprises in the Caribbean

Caribbean small islands are vulnerable to the impacts of climate variability and change and rural communities that depend on natural ecosystems for their livelihoods are particularly at risk. The Caribbean is expected to see an increase in surface temperature and a decrease in rainfall (CANARI 2017). Rising temperature and humidity due to climate variability and change will have severe impacts on the fruiting and flowering of food crops and trees and introduce new pests and diseases to plants and animals. Humans are also susceptible to climate-sensitive diseases including mosquito-borne chikungunya, Zika and dengue that negatively impact the workforce's productivity and in some cases, cause permanent health challenges to the affected individuals. Natural hazards associated with climate change such as landslides, hurricanes and flooding are devastating to small island developing states. Hurricanes in 2017 devastated several Caribbean countries such as Dominica, Puerto Rico and US Virgin Islands and they are struggling to recover. Caribbean rural communities are especially vulnerable, especially where distance from the main towns, cities or ports hinder immediate and long-term assistance to recover from natural disasters.

Climate change will also have an impact on natural ecosystems and compromise their ability to deliver important goods and services. Coral reefs, which act as habitats and nurseries for many of the commercial fish species and protect our shores from storm surges and beach erosion, are bleached with increasing regularity because of increasing sea temperatures and acidity. Trees and plants that stabilise mountain slopes are uprooted in storms and landslides. This is a threat to LGEs, especially where these natural ecosystems provide the goods or services that are the foundation for community agriculture, craft production, ecotourism and agritourism, to name a few. Finding ways to enhance the resilience of community micro and small enterprises in vulnerable rural communities is urgently needed.

1.3 The approach used in the study

The Caribbean Natural Resources Institute (CANARI) worked with the Brasso Seco Paria Tourism Action Committee and the Brasso Seco Morne La Croix Farmers

1 Micro enterprises have 5 or less employees while small enterprises have 6-25 employees.

Association for two years to pilot a methodology using value chain analysis (VCA) to help the community enterprises to build resilience to climate variability, climate change and natural hazards in their enterprises. CANARI had previously worked with both organisations to develop enterprises based on the sustainable use of natural ecosystem goods and services as part of a series of projects to test a methodology for developing enterprises in rural communities through the sustainable use of goods and services from natural ecosystems.

Because of the impacts of climate change on enterprises there needed to be a simple method that entrepreneurs could use to 'climate-proof' their enterprises while focusing on their immediate priority of improving the enterprises. Value chains show all the processes and activities in an enterprise and helps the entrepreneur to determine ways to add value to it (e.g. through being more efficient, reducing costs, etc.). Value chains provide a logical structure by which the community entrepreneurs could identify climate change vulnerabilities at each stage of the enterprises. At the same time, they can assess what is usually of immediate interest to them – adding value to their enterprise – and this provides an incentive for them to undergo the vulnerabilities assessment. Value is added for example, by reducing production costs, increasing efficiency of production, improving quality of goods and services, and/ or improving markets. These increase income to the enterprise. While finding ways to add value to the enterprise, the LGEs can identify actions to address the climate vulnerabilities identified through climate change resilience-building strategies. In this way, climate change becomes one of the priorities to improve the value chain and therefore the enterprise. It helps the entrepreneur to think about the enterprise's development in terms of climatic impacts. For example, an enterprise that installs solar power to a cocoa processing facility to increase its electricity's stability improves the enterprise by (1) being able to regularly produce cocoa goods to supply to consumers and (2) reducing the cost to the enterprise by negating the need to pay electricity bills. It climate-proofs its enterprise by having stable electricity for processing during and after extreme climatic events like storms.

The project was funded by the GEF Small Grant Programme (GEF-SGP), implemented by the United Nations Development Programme (UNDP).

1.4 About Brasso Seco

The community of Brasso Seco, located in north Trinidad, is a community that is highly vulnerable to the impacts of climate variability and change and natural hazards. Brasso Seco is a small, forested community located in the Northern Range in Trinidad, 27.4km away from Arima, a large town. It is rich in biodiversity including butterflies, birds, reptiles and mammals and natural features such as waterfalls, rivers and forests. Paria Bay, located a few kilometres away on the north coast of the island, is also accessible to hikers leaving from the Brasso Seco community.

The 300 permanent residents are heavily dependent on natural ecosystems goods and services for their livelihoods. Agroforestry and agritourism through the cocoa and coffee estates are important sources of income for many. Some villagers lead hikers through the many trails in the nearby forests.

The rural community receives a fair amount of rainfall every year. Rain and wind are frequently heavy enough to down power lines and cut electricity from the national grid. Because the community is far from nearby city centres and located on mountainous terrain, it takes a while for electricity to return (sometimes weeks). Heavy rainfall also causes frequent landslides in the community and blocks access.

Two LGEs from Brasso Seco were part of the pilot. They were Brasso Seco Paria Tourism Action Committee and Brasso Seco Morne La Croix Farmers Association.

2. The community enterprises

2.1 Brasso Seco Paria Tourism Action Committee

The Brasso Seco Paria Tourism Action Committee was formed approximately 20 years ago through a programme developed by the Tourism and Industrial Development Company of Trinidad and Tobago (TIDCO). The organisation strived to improve the lives of its members and the community at large through entrepreneurship. It formed strategic partnerships with organisation like CANARI, the Inter-American Institute for Cooperation on Agriculture (IICA), the United Nations Food and Agriculture Organisation (FAO) and TIDCO to assist in the construction of the visitor facility that serves as an entrance point for the community's visitors, and the construction and furnishing of the cocoa house at the Manchuria Estate. Brasso Seco Paria Tourism Action Committee was also given assistance to develop a business plan that guides its enterprise's development.

The organisation now has several income streams through cocoa and coffee processing, ecotourism in the nearby forest, and a contract with the National Reforestation and Watershed Rehabilitation Programme (a government social protection programme that funds community reforestation). It also caters food for the community's guests; the stone oven bread, smoked chicken, coffee ice cream and cocoa nibs are favourites. Community members who are not part of the group are also invited to sell their products at the visitor facility. Some members recently developed the Brasso Seco Chocolate Company that makes organic dark chocolate bars that are sold in high-end markets in Trinidad and Tobago.

Brasso Seco Paria Tourism Action Committee chose to use its chocolate-making business as the enterprise in the pilot. Brasso Seco Paria Tourism Action Committee grows cocoa on the Manchuria Estate. The pods are harvested and dried at the cocoa house on the Manchuria Estate. The cocoa house had no electricity at the start of the exercise. The dried beans are then taken to the visitor facility to be roasted, ground and further processed and packaged using the electricity there. The visitor facility is more than a kilometre away along a rocky road. The finished products include cocoa nibs, cocoa bars, chocolate ice cream, cocoa butter and dark chocolate bars. They are sold within the community, to visitors to the community and at events throughout the country. The chocolate bars are also sold at a duty-free store at the Piarco International Airport.

The group has more than 45 members but only about 15 very active members.

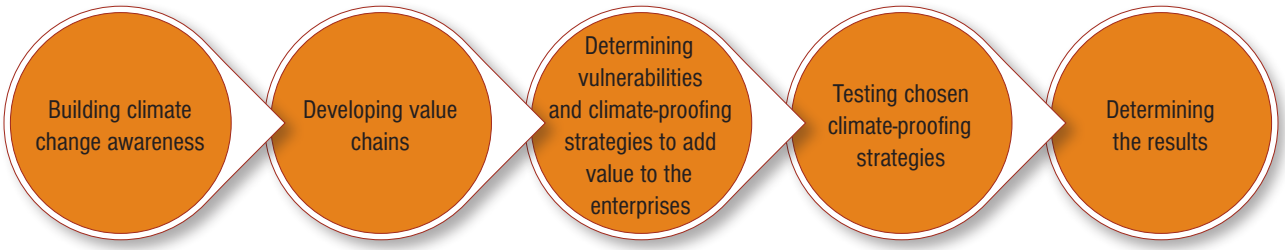
The organisation provides additional social benefits as it employs community members for its activities, even those who are not members. Funds are also set aside and assistance are given to community residents in need (e.g. for food, transport, medical support, etc.).

2.2 Brasso Seco Morne La Croix Farmers Association

The Brasso Seco Morne La Croix Farmers Association has been in existence for more than seven years but has gone through several reorganisations. The current iteration has been functioning for four years. The farmers' association sells citrus, avocado and cocoa seedlings to the public. There are more than 25 members in the group and approximately 10 active members. It recently developed an apiary to produce organic honey through a partnership with the Digicel Foundation. The brand for the honey is called Honey Seco. Honey Seco was the enterprise chosen for the pilot project. The group is determined to develop the apiary and its products in an environmentally-friendly, low carbon way. The group stated that it planned to use the profits from Honey Seco to re-invest in enterprises in the community.

3. The methodology

Figure 2: The methodology to 'climate-proof' LGEs



The methodology is shown in Figure 1. The process began with helping the community entrepreneurs to understand climate change, climate variability and natural hazards. They then worked with a facilitator to develop value chains for the two selected enterprises. A value chain is all the processes and activities done by the enterprise to supply products and services to markets. The value chains provided structure to the discussions about the climate change vulnerabilities and helped them to see where in the enterprise could be impacted by climate vulnerabilities. The entrepreneurs brainstormed and discussed possibly ways to overcome the vulnerabilities through resilience-building strategies while adding value to the enterprises. Each enterprise chose at least one resilience-building strategy to test using a micro grant supplied by the project. The final step was analysing the results to determine what worked and did not work in the process. These steps are further described below.

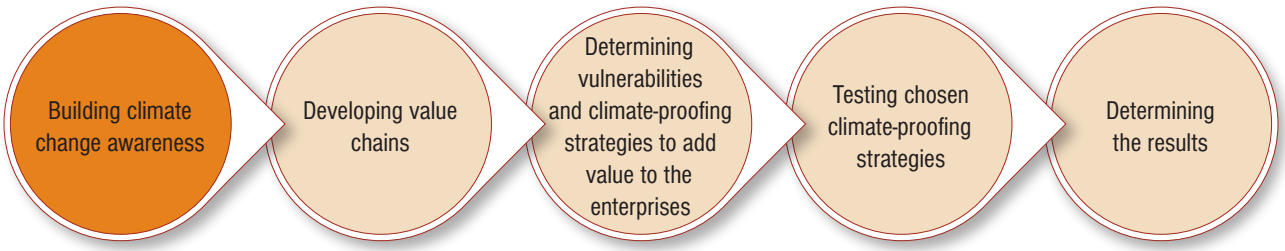
3.1 Building awareness of climate change, climate variability and natural hazards

While most persons are aware of the term climate change, most do not fully grasp what it is. The first step in the process was to help the entrepreneurs to understand what the terms climate change and climate variability mean. Differentiating terms such as weather versus climate and adaptation versus mitigation was also key to helping build awareness of climate change and variability. The main elements of weather and climate were explained. These were **wind, precipitation (rainfall), temperature, humidity** and **clouds**. Expected **climatic trends** for the Caribbean (CANARI 2017) were also explained:

- Increasing temperatures
- Decreasing rainfall
- Increasing rainfall variability
- Increasing frequency of extreme weather events like floods and droughts
- Sea level rise
- Ocean acidification

Facilitators also helped the entrepreneurs to understand if everyday occurrences were in fact because of climate change and variability. For example, most persons attribute pollution and deforestation to climate change

Figure 3: Building climate change awareness



but the facilitators explained that these were not. Entrepreneurs feeling warmer and seeing that there was less rainfall over time were attributed to climate change. Data on the Caribbean and Trinidad and Tobago was used to show the changes in climate projected and being experienced.

3.2 Developing value chains

Both Brasso Seco Paria Tourism Action Committee and the Brasso Seco Morne La Croix Farmers Association developed **simple value chains** for their enterprises. Simple value chains identify the processes and activities in the enterprise that start with the raw resources and end with delivery of final products and services to the consumer. The five key segments of the value chain used were (1) inputs, (2) production, (3) processing and distribution, (4) marketing and (5) consumer.

Figure 4: Developing value chains

3.3 Determining vulnerabilities and climate-proofing strategies to add value to the enterprises

Once each enterprise drew its value chain, each key segment was examined to determine vulnerability. The enterprises looked at each climatic trend (e.g. increasing temperature, increasing extreme weather events like drought and storms) and brainstormed what were the possible impacts on their enterprises due to climate change and variability. For example, facilitators asked both groups what would happen if there was less rainfall than currently experienced (overall drier conditions are projected) and what would be the impact on the enterprises. The facilitators also asked what would happen to the enterprises if there was more rainfall (more intense periods of heavy rainfall are projected). The different types of questions led to discussions on the impact of the climatic element on each part of the value chain. The value chain analysis provided structure to the discussion on the climate vulnerabilities.

For each vulnerability identified, the entrepreneurs determined what possible measures they themselves could implement to overcome them. These were resilience-building strategies. For example, if there were drought conditions, the entrepreneurs determined that a rainwater harvesting system was something that they could put in place to help them get water. They discussed the pros and cons of the strategies for their enterprises and if the strategies would help or hurt the enterprises.

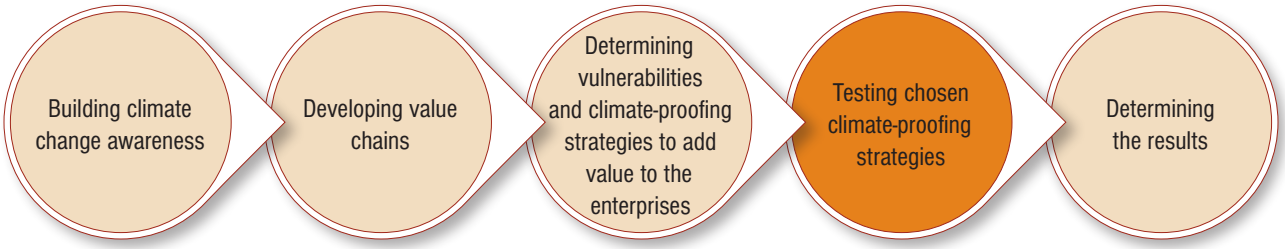
Figure 5: Determining vulnerabilities and climate-proofing strategies to add value to the enterprises

3.4 Testing chosen climate-proofing strategies

Each enterprise was asked to choose at least one strategy to implement using a micro grant supplied by the project. A mentor was assigned to help both enterprises to develop the strategy and implement the climate-proofing measure that would support the enterprises' resilience.

Both enterprises worked with the mentor to complete their resilience-building strategies. The process took a year to fully complete. Each enterprise conducted research on the methodology, sought expert opinion where needed, researched the best prices and then implemented their strategies. They were encouraged to speak with experts so that they could begin to build relationships and understand how to implement no-regret strategies (i.e. strategies that would do no harm to the environment and people). For example, Brasso Seco Morne La Croix Farmers Association chose to install a rainwater harvesting system and invited an expert to visit the enterprise to discuss best options for installation. Brasso Seco Paria Tourism Action Committee invited several solar power experts to its facility for discussions on best options for its operations and planned future operations.

Figure 6: Testing chosen climate-proofing strategies



3.5 Determining the results

Each enterprise was encouraged to note the parts of the methodology that worked and did not work. They were asked if they perceived that the method using value chains to assess climate vulnerabilities helped them to prioritise addressing climate change in their enterprises and if they felt that their enterprises were better for having implemented some strategies through discussions with the mentor.

Figure 7: Determining the results

4. The value chains and results of the vulnerability assessments

A value chain shows processes and activities involved in an enterprise. It shows the enterprise as a logical series of processes and activities. This structure allows the entrepreneur to logically assess the enterprise for ways to improve or add value to it. In the pilot, it was also used to help the entrepreneur to think about each processes' vulnerabilities to climate change. Both the Brasso Seco Paria Tourism Action Committee and the Brasso Seco Morne La Croix Farmers Association created value chains for their enterprises. These were used to show where value can be added so that income is increased and to assess the vulnerabilities to climate change and the possible resilience-building actions.

4.1 Brasso Seco Tourism Action Committee's cocoa products value chain and results

Brasso Seco Paria Tourism Action Committee's value chain for its cocoa products shows the processes and activities from inputs to getting the products to the final consumer. Inputs included land, labour and plants. Production included transportation, drying and roasting beans. Processing and distribution included grinding and packaging beans. Marketing included use of word of mouth, social media and the group's website. Consumers were mainly visitors to the community and persons who visited duty-free stores at the airport. Brasso Seco Paria Tourism Action Committee's value chain for its cocoa products is shown in Figure 9.

The entrepreneurs found that the enterprise was most affected by extreme weather events such as droughts and storms. Heavy rainfall events led to landslides that blocked access to and from the plantation and to and from the community and markets. Reduced rainfall coupled with higher temperatures caused drought-like conditions which decreased the availability of water for plants to grow and for processing the final products. Increased temperatures caused a change in flowering patterns for the cocoa crops and increased the incidences of plant (e.g. witch's broom) and human

Table 1: Vulnerabilities and resilience-building strategies

Vulnerabilities	Resilience-building strategies
Plant pest and diseases	Explore and plant species of cocoa that are resistant to emerging pests and diseases
Human diseases	Use insect repellent mainly from plants growing naturally in the community
Landslides	Plant crops along the mountainside that will stabilise the slopes (e.g. vetiver)
Flowering and fruiting patterns	Multi-crop to ensure that there is always income in the enterprise
Droughts and irregular rainfall	Plant drought-resistant cocoa crops Plant drought-resistant crops such as cassava to ensure there is always an income to the group Practice rainwater harvesting to collect and store rainwater Use drip irrigation systems to use water conservatively
High wind events	Multi-crop; observe the strictest building codes to prevent infrastructure loss
Intense rainfall events	Use alternate sources of electricity (e.g. solar, hydroelectricity and wind) to counteract the loss of supply from grid-connected electricity

diseases (e.g. chikungunya, dengue and zika). These affected crop production and human productivity. High wind in storm-like conditions downed power lines that cut electricity to the community. Because of the community's extreme rural location, it sometimes took weeks for electricity to return to the community. See Figure 9 for the vulnerabilities on each part of the value chain.

The Brasso Seco Paria Tourism Action Committee then looked at each vulnerability and figured out business-smart activities that **they themselves could do** to climate-proof the cocoa products enterprise. These are shown in table 1.

Brasso Seco Paria Tourism Action Committee implemented two business-smart climate proofing strategies. These were planting drought-resistant crops and installing alternate sources of electricity. It also explored using drought-resistant cocoa plants as an option but the group ultimately determined that it was not something they would experiment with since it needed to do more research on quality and taste.

4.1.1 Planting drought-resistant crops or multi-crop

For most of 2016, Brasso Seco experienced very dry conditions, like most of Trinidad and Tobago. The entrepreneurs were concerned that the income from cocoa would be reduced because higher temperatures and less rainfall reduced the amount of raw material and therefore reduced the supply to consumers. They believed that the long-term impact was that they would lose their consumers if their consumers were forced to turn to other suppliers for the cocoa products such as nibs, chocolate powder and chocolate bars. The enterprise decided to diversify its income stream. It planted crops like cassava between the cocoa plants. The plants like cassava were sold directly to the consumer without further processing. They were also cooked and served to visitors to the cocoa processing and visitor facilities.

Business smart solution

- An additional income stream ensures that the enterprise is always generating income, even in drought conditions.

Climate-proofing solution

- The plants grown can produce in drought-like conditions. These can provide food and income to the enterprise.

4.1.2 Installing an alternate power source at the cocoa house

Brasso Seco Paria Tourism Action Committee decided on alternate power for two reasons. Firstly, Brasso Seco's power supply is normally erratic. Once there is heavy rains and wind, the power goes out, sometimes for weeks. This affects the enterprise's ability to regularly supply its consumers. Secondly, at the start of the project, Brasso Seco Paria Tourism Action Committee did most of the roasting and packaging at the visitor facility that gets its electricity from the national power grid. This is located more than a kilometre away from the cocoa house and the plantation. Transportation from the plantation to the visitor facility for roasting and packaging is a cost that the enterprise could eliminate or reduce if those processes were done at the cocoa house. However, the cocoa house had no electricity. Putting stable power at the cocoa house made good business and climate sense.

Brasso Seco Paria Tourism Action Committee looked at two alternate power options for the cocoa house – micro hydroelectricity and solar power. The entrepreneurs felt that, while hydroelectricity was a good option since there was a stream nearby, during drought-like conditions there would not be enough water to power a micro hydroelectric system. This, they felt, would perpetuate erratic power supplies. They firmly believed that solar offered a more stable option for an alternate power supply.

The enterprise installed five photovoltaic panels with a total output of 6,000 kilowatts per day on the cocoa

Figure 8: Solar panels on the roof of the cocoa house. 2016

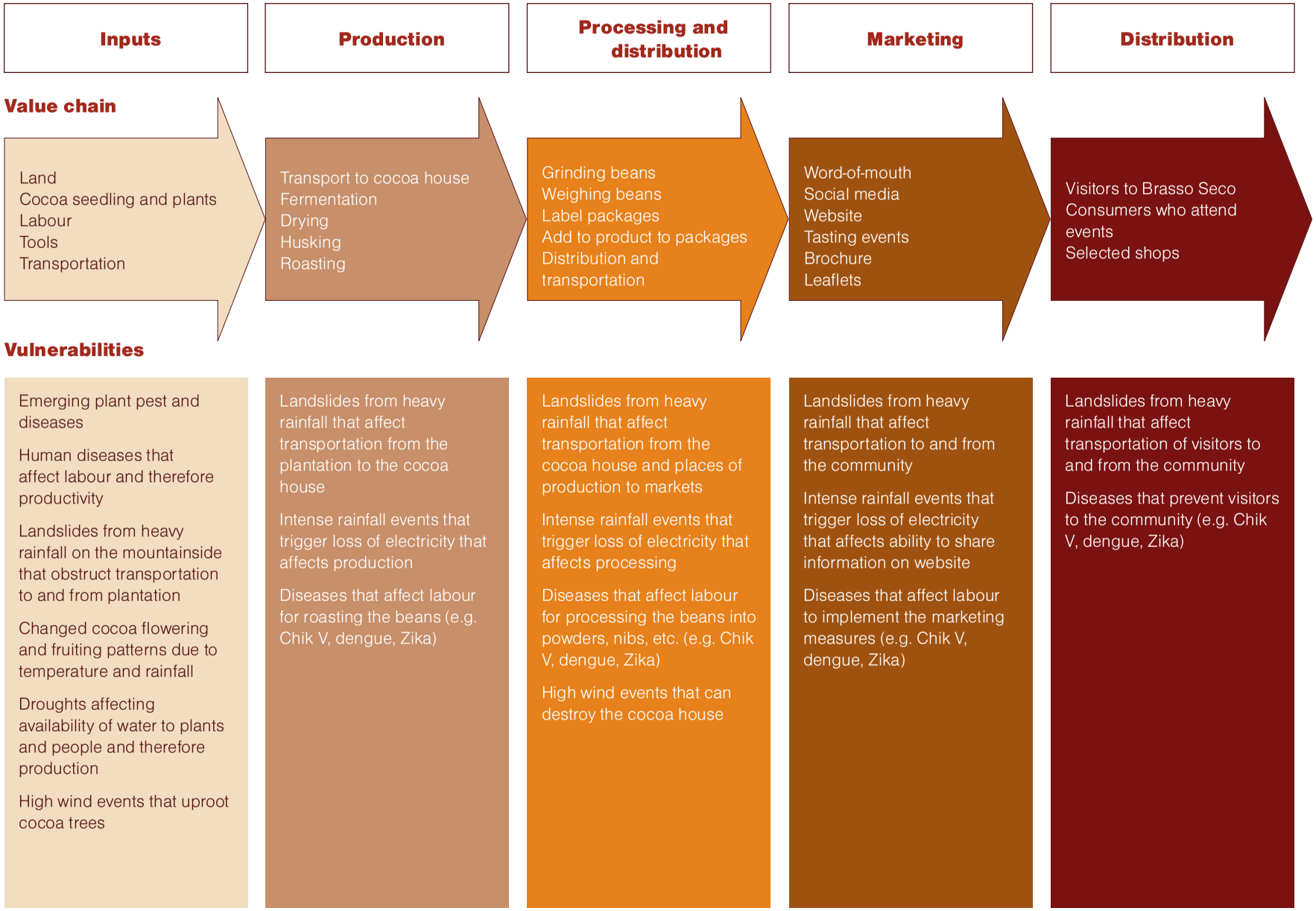


Figure 9: Brasso Seco Paria Tourism Action Committee's value chain and vulnerabilities

Business smart solution

- Transportation costs to the visitor facility for processing are no longer needed. This is money saved by the enterprise.
- There is no need to pay an electricity bill since the cocoa house is not connected to the national grid. The enterprise saves money.
- Solar provides stable electricity so that processing can occur immediately after extreme weather events like storms. Brasso Seco Paria Tourism Action Committee will be able to meet its demands from consumers.

Climate-proofing solution

- Solar offers continuous power that is largely unaffected by weather events while electricity delivered by the national grid can be disrupted by heavy rains and wind.
- Solar is a low carbon way to generate electricity and is a mitigation measure.

house in a position that got the most sun. They installed an inverter to convert the power and batteries to store the power. The equipment the enterprise used needed 2,000 kilowatts per day; the power output from solar was enough for its needs and planned equipment upgrades.

4.2 Brasso Seco Morne La Croix Farmers Association's honey value chain and results

Brasso Seco Morne La Croix Farmers Association's value chain for its honey enterprise shows its processes and activities from inputs to getting the products to the final consumer. Inputs included forested lands with flowering plants, labour and bees. Production included harvesting and extracting honey. Processing and distribution included bottling, labelling and transportation. Marketing included use of word of mouth, social media and the group's website. Consumers were mainly visitors to the community, pharmacies and health conscious individuals. Near the end of the project, the group started selling its Honey Seco brand honey in some Digicel outlets. Brasso Seco Morne La Croix Farmers Association's value chain is shown in Figure 10.

The entrepreneurs found that the climatic elements that most affected them throughout the value chain were rainfall, temperature and wind. Heavy rainfall events led to landslides that blocked access to and from the apiaries and to and from the community and markets. In November 2016, constant heavy rains and winds led to landslides that blocked all access to the community for one week and access to the first site of the apiaries for

Table 2: Brasso Seco Morne La Croix Farmers Association's vulnerabilities and resilience-building strategies

Vulnerabilities	Resilience-building strategies
Pest and diseases in bees	Use bees proven to be disease resistant
Human pest and diseases	Use insect repellent
Landslides	Plant crops along the mountainside that will stabilise the slopes (e.g. vetiver)
Changed flowering and fruiting patterns	Plant different species of crops to produce flowers at different times of the year
Droughts	Plant different species of plants that attract bees Install rainwater harvesting to collect and store rainwater in tanks
High wind events	Place apiaries in areas that are sheltered from high winds and falling trees

four weeks. The apiaries were moved to another site away from the compromised location. Reduced rainfall coupled with higher temperatures caused drought-like conditions which decreased the availability of water for flowering plants to grow, for bees to use to make honey and for processing the honey. Increased temperatures caused a change in flowering patterns of the plants that the bees depended on for nectar and increased the incidences of human diseases (e.g. chikungunya, dengue and zika). These affected production, honey quality and human productivity. High wind events downed power lines that cut electricity to the community and affected bottling and packaging. Because of the community's location, it sometimes took weeks for electricity to return to the community. See Figure 10 for the vulnerabilities on each part of the value chain.

The Brasso Seco Morne La Croix Farmers Association then looked at each vulnerability and figured out business-smart activities that **they themselves could do** to climate-proof Honey Seco. These are shown in table 2.

4.2.1 Brasso Seco Morne La Croix Farmers Association's rainwater harvesting system

Brasso Seco Morne La Croix Farmers Association decided to install a rainwater harvesting system as its resilience-building action. Throughout the latter half of 2015 and much of 2016, the group noticed that there was less rainfall than normal and there was less being sent to the community. They also noted that the rivers had less water than normal. Water is needed for the flowering plants from which the bees collect nectar to grow. It is needed for the bees to use in their honey production. It is needed by the apiarists to collect and bottle the honey. The entrepreneurs felt that lack of water threatened the new Honey Seco enterprise. For this reason, they decided to install a rainwater harvesting system as a business-smart, climate-proofing strategy. They used the opportunity to also invest in water tanks that can store water supplied through the national infrastructure to have for periods when the supply is cut off.

The entrepreneurs invited experts in rainwater harvesting systems to visit the community to advise on things like placement of the system and number of tanks to meet their enterprise's needs. One expert was experienced in installing rainwater harvesting systems in rural communities and offered the most useful advice.

Figure 10: Apiary (top) being supported by rainwater harvesting system (tanks shown below). 2016.

Brasso Seco Morne La Croix Farmers Association built a small shed with a galvanise roof on a hill close to the apiary. They placed PVC guttering around the edges of the roof to collect the rainwater. The PVC pipes connected to five 600-gallon tanks located further down the hill. The rainwater harvesting system used gravity flow to get the rainwater to the tanks where the water would be stored. The tanks were also connected to the water pipes to store water from the national grid.

Business smart solution

- Rainwater harvesting ensures that there is a ready supply of water for production and processing of honey, even in drought conditions.

Climate-proofing solution

- Rainwater harvesting allows the entrepreneur to store water so it is available when the supply from the national infrastructure is cut off and the rivers are low.

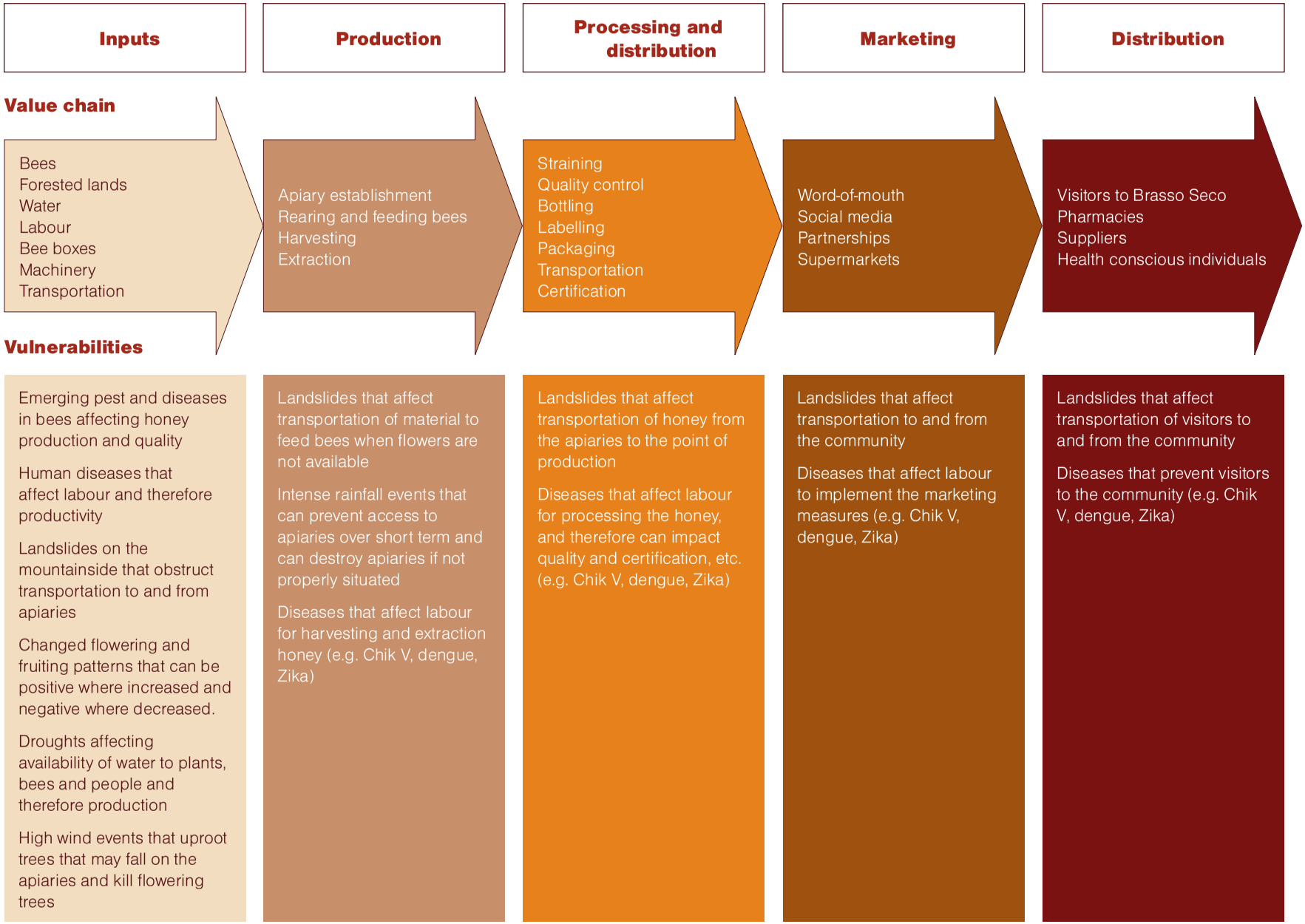


Figure 11: Brasso Seco Morne La Croix Farmers Association's value chain and vulnerabilities

5. Conclusion

Feedback on the methodology from the community enterprises was positive.

- *Simple value chains are easy to follow and use.* The groups found that the value chain exercise was helpful for them to understand where they could make improvements to the enterprises.
- *Value chains offer structure to analyse the enterprises' climate vulnerabilities.* Because the value chain shows all processes and activities in the enterprise, it allows the entrepreneur to visualise the enterprise and frame those processes and activities in terms of climatic elements and their expected impacts. For example, increasing temperatures will increase the incidences of mosquito-borne diseases in humans since environmental conditions are even more favourable for mosquito development. Diseases negatively affect human productivity.
- *Addressing climate change makes business sense.* The methodology allows the entrepreneurs to improve their understanding of the impacts of climate change on each aspect of their enterprises. It helps them to be aware of the impacts of climate change and variability on the enterprises and take pre-emptive measures to address them. This ensures that their business will function and provide an income despite the impacts of climate change.

Figure 12: Green cocoa pod found in the forests around Brasso Seco. 2012

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Caribbean Natural Resources Institute

The Caribbean Natural Resources Institute (CANARI) is a regional technical non-profit organisation which has been working in the islands of the Caribbean for over 20 years. Our mission is to promote and facilitate equitable participation and effective collaboration in the management of natural resources critical to development in the Caribbean islands, so that people will have a better quality of life and natural resources will be conserved, through action learning and research, capacity building and fostering partnerships.

For more information please contact:

Caribbean Natural Resources Institute (CANARI)
Fernandes Business Centre,
Building 7
Eastern Main Road, Laventille, Trinidad, W.I.

Tel: (868) 626-6062 • Fax: (868) 626-1788
Email: info@canari.org • Website: www.canari.org

This Technical Report was produced by the Caribbean Natural Resources Institute as an output of the project **"Building climate-resilient enterprises in Trinidad and Tobago"** with support from Small Island Developing States Community-Based Adaptation (SIDS-CBA) Project, funded by Australian Aid and implemented by the United Nations Development Programme (UNDP) and delivered by the Global Environment Facility (GEF) Small Grants Programme (SGP).

Citation: Sandy, K. & A. Dardaine-Edwards. 2017. *Building resilience and adding value to local green enterprises: Developing a 'climate-proofing' methodology*. Technical Report No. 403. Laventille: CANARI.

ISBN 1-890792-38-1