Project Name: Hurricane Resilient Food, Water, and Energy Center for Preparedness and Food Security

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Executive Summary

This project has been completed in conjunction with an international public charity that works with clients in the Caribbean region. This charity designs aquaponics systems and saw a need to be filled in the Caribbean using a large-scale resource center aquaponics design, where hurricanes have severely damaged or eliminated a majority of existing infrastructures and agriculture sites. These heavily damaged sites are the charity’s intervention points in the Caribbean. The Caribbean region faces multiple hurricanes each year, and island nations are particularly vulnerable to agricultural losses and structural damages due to high winds and storm surges as islands are positioned at sea level. A single hurricane can create billions of dollars in damages, especially in densely populated economic centers. On top of this, a particularly intense hurricane season can have several hurricanes following similar paths, devastating nations that are vulnerable to further damages. The Caribbean region is complex, with each island nation having unique situations. This complexity was a barrier to the project, but an adaptive resource center design can address this complexity. The public charity partnered with in this project desired to bring the now completed resource center design to other island nations and adjust future designs using the sustainability framework analysis tool to evaluate both the design itself and each area’s individual circumstances.

This project addresses the sustainability problem of the lack of hurricane resilience in the Caribbean islands while also addressing issues with food security on isolated island nations. With hurricanes beginning to become more frequent and more intense due to the effects of climate change, islands in the Caribbean are especially vulnerable to infrastructure damage and agricultural losses to storms and storm surges. Although hurricanes can be deadly on their own, destruction of infrastructure can slow recovery and response times to the initial impacts from the storms. Many island nations are heavily reliant on imports to provide basic needs for their citizens, and this reliance is one of the complex issues that can create issues when a hurricane moves through the region. The project creates a form of resource independence and will be able
to sustain island countries in the event of a disruption in trade and/or infrastructure. These complex networks of trade and politics create an environment where one simple solution cannot be effective at solving every issue. The resource center design, when constructed, will not solve every issue hurricanes bring, but it will be one of the first solutions that includes protecting agriculture, fresh water supplies, and electrical generation located on the islands themselves.

The hurricane resistant resource center design is a resilient solution to the Caribbean region’s resource needs in the aftermath of a hurricane. The resource center works by producing and securing food, water, and energy within a hurricane resilient building. The resource center design is a tool that can be used to benefit the Caribbean positively economically, socially, and environmentally. An installed resource center would be able to address economic issues seen in the aftermath of a hurricane through the resources it produces, both before and after a storm. The resource center can also address social issues seen after a hurricane, particularly in providing immediate relief and food security. However, this resource center project has never been done at this scale before by the charity, so the exact environmental impacts are yet to be determined. None of these economic, social, or environmental impacts and priorities are entirely mutually exclusive. However, there is a risk of unbalanced priorities that can cause negative impacts in other sectors through tradeoffs and neglecting the other potentials of the resource center depending on the use of this tool.

Future analyses of actual builds using the custom and unique sustainability framework developed for this project would determine the full efficacies of these resource centers. However, the current analysis of the feasibility and potential success of a resource center design is reliant on three categories: Economic, Social, and Environmental dependencies and impacts. The sustainability framework developed in this project has a two-fold purpose: to determine if an area would be a feasible location for a resource center and to analyze how the resource center ultimately impacted the area based on the same three criteria. Its current purpose is to show which adaptations must be made and where the design itself can be improved to bring the resource center design to the desired areas. Thus, the sustainability framework is a necessary method to use in conjunction with the resource center design in order to cause the most sustainable impacts and apply the charity’s future designs more effectively. The intention of the tool was for it to be used beginning in the summer of 2019, and its completion alongside the completion of the resource center design were the final benchmarks for the success of the project.

The main outcomes of this project are the resource center design and the sustainability framework tool for use at the charity, and both were completed by the end of the semester. The charity will be using the resource center design and the sustainability framework tool for their efforts with new projects. When determining where the resource center can be built and what variables to consider before the resource center design is adapted to fit those needs, the charity will now have a guiding sustainability-based framework that will work alongside their best practices as well. The successful completion of the center and the delivery of the sustainability framework tool has validated the success of this project. However, the need for an analysis of
resource centers after they have been completed is now present due to the foundational work of this project. Also, the charity will have the opportunity to adapt the sustainability framework created in this project for this analysis and can utilize those results to improve their designs further into the future.

The sustainability framework tool and the resource center design will help focus the charity’s ongoing sustainability efforts, addressing the needs seen by the charity at the outset of the project. This project was the first stepping stone for further research and sustainability project impacts in the Caribbean through the efforts of the charity and the application of their aquaponics designs. Future projects will be able to continue and refine the work that has begun through the completion of this project. These future projects can be undertaken by reaching out to the charity once a resource center is completed and proposing a partnership to analyze the outputs and impacts of the completed resource center. A sustainability-based analysis can validate the foundational work done in this project and continue refining the sustainability practices of the charity.