**Grenada Vertical Farming Micro Proposal**

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Course 279 Planning and Implementation

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**Background:** St. Mark’s, Grenada, W.I. exists as the most impoverished parish on the island, with a poverty rate of over 50% (Relief Web, 2020). Due to its geographic inaccessibility, minute population, and small land area (Usry, 2015), St. Mark’s often is overlooked for agricultural development interventions. However, these metrics are advantageous when piloting country-wide initiatives; the approximately 4,000 population (Usry, 2015) serves as a perfect sample size to determine the effectiveness of innovative and modernized food security and agricultural methodologies.

While initially an agricultural economy, Grenada shifted after the 1983 United States invasion to promoting tourism and other service-based industries (CSIS, 2013). To increase economic growth in the agricultural sector during this transition, niche crops such as nutmeg, cocoa, mace, and bananas were prioritized over food staple crops (Caribbean Agricultural Research & Development Institute, 2019). Food imports then became normative for sustaining Grenada’s population. Exacerbated by the COVID-19 pandemic and Ukraine wheat supply chain shortages, food insecurity within Grenada remains a pressing challenge, more so amid forecasted extreme climate events, rising world population, and food price fluctuations.

**Problem Analysis:** When surveyed in August of 2022 by the World Food Programme, 40% of Grenadian respondents identified themselves as food insecure (World Food Programme, 2022), nearly double the 2020 results of the World Bank’s food insecurity indicator (World Bank, 2022). Sixty-eight percent of Grenadian respondents admit to utilizing savings reserves to meet immediate food needs (World Food Programme, 2022). With over 40% of survey respondents signifying a continual disruption in livelihood and income, 23% a lack of market access, and 30% a reduction in food consumption (World Food Programme, 2022), food insecurity for Grenada must be swiftly addressed before malnutrition and other health issues become dominoing crises.

A multitude of Grenadian policies and geographic metrics play into modern food insecurity issues within the island. Hurricanes Ivan and Emily in 2004-05 destroyed 90% of infrastructure and crop life (Lewis, 2005), illustrating Grenada’s agricultural vulnerability to extreme climate events. Drought amplified by increasing water usage by the tourism industry (UNDESA, 2012, and annually rising surface temperatures, yields may decrease, (USAID, 2021), which will further aggravate the alarming food insecurity trends Grenada is currently witnessing. With approximately 25% of arable land remaining fallow, Grenada has the capacity to revitalize its agriculture sector. However, the profitability of permanent crops incentivize farmers to pursue the export market rather than local food production, and very few young adults are willing to stake their livelihoods in the agricultural sector despite the harsh unemployment rate of the island (National Plan Secretariat, 2019) (James, 2015).

A reliance on traditional agriculture methods and food imports is not sustainable, nor should it be the consumption method of Grenada’s future. Grenada’s primary stakeholders, its citizens, can achieve food security despite the negating factors listed above, through technical agricultural innovations such as the subject of this proposal: indoor vertical farming.

**Vision of Change:** Concerns raised by Grenadians via consultations and interviews for Grenada’s Growth Diagnostics Study signify the changes the public wishes to see within the agriculture sector (National Plan Secretariat, 2019).

“To attract young people into agriculture, the image of ‘an old man in old clothes’ should be changed through education.”

“We are lacking in applied science and technology...”

 “Our support for agriculture is not based on scientific commercial type agriculture...”

“There must be greater focus on food security and the production of sustainable foods.”

(National Plan Secretariat, pg. 57, 2019)

The Grenadian public recognizes the importance of modernizing the agricultural sector and securing the island’s food supply. While the current National Agriculture Plan focuses on sustainability, economic viability, and resilience, it does little to address increasing production for local consumption or youth integration into the agricultural sector (James, 2015).

**Development Intervention:** To mitigate natural disasters, drought, and temperature increases, indoor vertical farming must be a sizable portion of Grenada’s food security plan. However, the costs, energy, and skilled labor necessary for planning and maintaining these farming methods are not feasible in the immediate future. Incentivizing the youth population of Grenada to pursue the engineering, science, and agricultural education essential to fulfilling upcoming indoor farming occupations is imperative. For this goal, our primary objectives are:to partner with Green Age Farms, a Trinidad-based hydroponics (small-scale vertical farm) supplier (Green Age Farms, 2021), to provide annual agricultural and climate science curriculums for Standards 10-12 to be utilized within St. Mark’s Secondary School over a 5-year project and provide St. Mark’s Secondary School a hydroponics vertical farming unit, and solar panel to be used parallel with the agriculture and climate science curriculums.

Grenada has already implemented a successful youth-focused hydroponics initiative in conjunction with Japan-Caribbean Climate Change Partnership (Caprile, 2017), however, this initiative focused solely on upskilling at-risk youth (Caprile, 2017). If the curriculum created by this project proves to be comprehensive and effective in encouraging St. Mark young adults to consider completing tertiary education in engineering, climate, or agricultural science, Phase II will consist of integration into every public parish school across the island. Similar programs exist within secondary schools in developing nations such as Indonesia’s Sint Carolus Junior High School, where concluding results revealed positive outcomes in the agriculture education, comprehension, and skill sets of participants (Ekaputri et. al, 2021).

The primary stakeholders for this project are the secondary students at St. Mark’s Secondary school, attending Standards 10-12. Student-selected leadership from each grade will serve as focus group members, and key stakeholders throughout the entire initial planning and implementation process, from deciding the inaugural curriculum to the division of harvest, to whether the harvest is sold or donated to the local community. This project posits by giving students buy-in on the micro level is enough incentive to encourage them to view Grenada’s burgeoning agriculture innovations at the macro level as a viable career endeavor.

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| **Logical Framework** |
| **Project Summary** | **Measurable Indicators** | **Means of Verification** | **Important Risk Assumptions** |
| **Goal:**  |
| Reduce food insecurity in Grenada by 75% of 2020 levels (<5.125%) (World Bank, 2022) by 2050 by prioritizing and modernizing local food production through indoor vertical farming and other climate independent technologies. | \*Food staples imports decrease by <50% of 2021 levels ($53,000,000 USD) (World Food Programme, 2022) by 2050\*Vertical farm(s) with capacity to produce 30,000 tons of food annually is operational by 2050  | \*World Development \*Indicator score\*Government statistics\*WFP/FAO statistics | \*Mitigating extreme climate events may supersede this goal when it comes to budget distributions.  |
| **Objective:**  |
| Partner with Green Age Farms to provide an agricultural and climate science curriculum to be utilized within St. Mark’s Secondary School over a 5-year project time frame.  | \*One completed agricultural science semester curriculum\*One completed climate science curriculum | \*Curriculums | \* Coordination efforts make take time between key stakeholders. |
| Provide St. Mark’s Secondary School a hydroponics unit/lighting via Green Age Farms, and solar panel to be used parallel with curriculum over 5-year time frame. | \*At minimum one working hydroponics unit with lighting and solar panel installed in St. Mark’s secondary school | \*Invoices\*Visual verification from secondary school | \*If solar panel fails, energy consumption of hydroponic unit will prove costly to the school. |
| **Outputs:** |
| Agricultural and climate science courses integrated into St. Mark’s secondary curriculum as mandatory for graduation. | \*Students comprehend basic agricultural science  | \*Curriculum test scores | \*Hiring a consultant to teach these courses may be more effective. |
| Hydroponics system is functional and provides vegetation consistently for student distribution. | \*Multiple harvests of student-grown vegetation | \*Harvest records | \*Harvest failure may disengage students if not properly monitored. |
| **Activities:** |
| Focus group with students, teachers, Green Age Farms consultants, Ministry of Agriculture, local climate scientists, local biologists, and local engineers (key stakeholders) to discuss food security for Grenada, extreme climate change impacts, farming innovations, and skilled labor gaps. | \*Curriculum topics defined and agreed upon by key stakeholders, and shared viadocumentation with stakeholders | \*Attendance logs\*Surveys\*Meeting notes | \* Coordination efforts make take time between key stakeholders. |
| Coordinate with Green Age Farms, Ministry of Agriculture, and teachers to create curriculums, install hydroponics unit. | \*Completed ag/climate science curriculum\*Installation of hydroponics unit | \*Meeting minutes\*Curriculum | \*Comprehensiveness of secondary students must be evaluated before rollout. |
| Training and facilitation workshop for teachers designated to teach curriculums, hydroponics system maintenance, and monitoring and evaluation with exit surveys. | \*Completed training and facilitation session with teachers of agricultural science and climate science semester curriculum | \*Attendance logs\*Surveys | \* Coordination efforts make take time between key stakeholders. |
| Focus group with students to determine crops they wish to grow for inaugural harvest, and plan for harvest distribution. | \*Crop choices agreed upon by students and shared via documentation.  | \*Attendance logs\*Crop seed lists | \* Coordination efforts make take time between key stakeholders. |
| Purchase seeds/seedlings, gardening tools, and other vertical farming miscellaneous materials. | \*Purchase of initial seeds/seedlings and gardening tools in bulk. | \*Purchase receipts | \*Seed/seedling purchases will be ongoing throughout academic year. |
| Coordinate an annual key stakeholder meeting to revamp curriculum and monitoring and evaluation methods. | \*Clearly outlined improved monitoring and evaluation framework, revamped curriculum. | \*Meeting notes\*Surveys | \*May be bi-annual or quarterly to ensure curriculum effectiveness. |

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