

Thesis Project Portfolio

Assessing the Feasibility of Microgrid Supported Open Hydroponics (MSOHCC) for A Resilient Fresh Food Supply in SIDS

(Technical Report)

**How Businesses Can Exist in the Humanitarian Space:
Challenging Paternalistic Charity and Going Beyond the “One-For-One” Model**

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science
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Bachelor of Science, School of Engineering

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Prospectus

Sociotechnical Synthesis

Intensifying climate change, decreasing amounts of arable land, decreasing amounts of available freshwater resources, and increasing global population threaten the global food supply by disrupting its production, processing, and distribution. If unaddressed, these factors will lead to a global shortage of food by 2050 due to disruptions in conventional land-based agriculture.

Smallholder farmers and low-income urban residents are especially vulnerable to this type of food insecurity because they face limited access to productive land for food cultivation and limited capacity to relocate to more fertile ground. As these climate induced structural changes reduce yields and overall production, disruptions are passed along the food supply chain, resulting in higher food prices and scarcity, especially of nutritious fresh produce.

In partnership with Charlottesville start-up Babylon Micro-Farms, my technical project attempted to assess a complement to conventional crop cultivation (CCC) by researching the viability of microgrid supported open hydroponic crop cultivation (MSOHCC) in securing the global food supply. A solar-powered MSOHCC system has been developed and will be deployed in the Bahamas as a part of their National Emergency Food Plan.

My STS thesis explored how businesses can effectively exist in the humanitarian space, the potential externalities of them occupying the space, and how they can sustainably further their social causes for the betterment of their target population's welfare. By using TOMS as a case study, I explored the "one-for-one" model as one form of humanitarian effort to showcase cautionary moments. Then, a discussion about another social enterprise Project 7 bridges into a conversation of better practices for all businesses and their respective shareholders.

My capstone team was successful in creating a working MSOHCC unit that produced lettuce yields. This model will be shipped to the Bahamas where it will be utilized as a part of their national food emergency plan. Tutorial videos on how to assemble and operate the unit was also created for the Bahamian national government to disseminate to Bahamians participating in the program. We were also able to identify potential areas in which MSOHCC can be implemented as a complement to CCC such as SIDS but also in urban centers. Due to setbacks caused by the COVID-19 pandemic, the group was unable to fully assess the viability of MSOHCC in SIDS other than the Bahamas, which was used as the test case. Future works include completing the comparison of lettuce yields in the MSOHCC unit to that of CCC methods and completing a capacity factor analysis of MSOHCC in all SIDS.

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