Thesis Project Portfolio

A Floating Farm for Hydroponic Crop Cultivation in Small Island Developing States

(Technical Report)

How the Implementation of Hydroponic Farms Affects Local Communities

(STS Research Paper)

An Undergraduate Thesis

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

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Ethan Thurmond

Spring, 2023

Department of Systems and Information Engineering, University of Virginia

Table of Contents

Sociotechnical Synthesis

My capstone project addresses the problem of food insecurity in Small Island Developing States (SIDS) due to natural and economic factors. The main factor that our capstone team is trying to combat is natural disasters that can severely damage the crops and agricultural infrastructure of the communities in the SIDS that they hit, creating food insecurity and a lack of job opportunity for many families. In order to help solve this problem, our capstone team is modifying and finalizing an existing hydroponic crop cultivation (HCC) system called the "Fold-out-Farm". The Fold-out-Farm is completely self-sufficient – it has its own water collection system, solar-based power generation, and on-board growing pods. The unit can float to combat disaster consequences from incidents such as hurricanes. Specifically, the project is working to add a rainwater harvesting system and validate the structural integrity of the unit during a flood. Since this technology is being implemented in SIDS where many of the local farming families have low income levels, it is important to consider the human and social dimensions in order to make the system affordable as well as efficient so that the farmers that use this technology can afford to maintain the system. The STS theory of Social Construction of Technology (SCOT) might apply to analyze the problem solving approach of this project as not only does the culture and current economy of the communities that our system is intended to be implemented in affect the way that we design our system, but the implementation of this technology also affects the way that these communities operate and the habits that they form. In order to conduct my STS research I plan on using data and examples from my technical capstone project as well as using literature review from pre-existing articles and data. The data analysis methods in my research will mostly consist of content analysis and case comparison, creating or reviewing statistics from the evidence and data collected in my research. Through my STS research I expect to discover the vast list of benefits of using hydroponic farming methods in comparison to conventional farming. My STS research topic and capstone project are tightly coupled, therefore the findings of my STS research will potentially allow me to help design a better product in the final stages of my technical project.