

## **Thesis Project Portfolio**

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

(Technical Report)

### **Hydroponics: Assessing the Sociotechnical Implementation of Clean Water Resources in the Middle East**

(STS Research Paper)

An Undergraduate Thesis

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## **Executive Summary**

### **Introduction**

The following portfolio contains two projects, a technical capstone project and an STS Research paper, but of which discuss the development and feasibility of hydroponics technology. The capstone project the team I am working on has a mission to develop a floating hydroponics system to be put in the Small Island Developing States to provide food security. The STS research is about the implementation of hydroponics in the Middle East using the STS framework of social construction of technology. Both the research paper and the technical project are related to the technology of hydroponics and the implantation of the technology in areas that are struggling with food security along with other issues that arise from climate change. The research paper provides sociotechnical insight on how hydroponics should be implemented. On the other side, the technical project provides first-hand experience working with a hydroponics unit to emphasize the realities of the technical implementation of this concept.

### **Description of Capstone Project**

This capstone project aims to modify and finalize an existing hydroponic crop cultivation (HCC) system, called the "Fold-out-Farm," to operate on a floating platform in Small Island Developing States (SIDS) that are susceptible to food insecurity due to natural and economic factors.

Specifically, when SIDS are hit by natural disasters, crops and agricultural infrastructure can be severely damaged, causing many people to suffer from a lack of both food access and job opportunity. 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. The farm is designed to use off-the-shelf nutrient solutions to grow a variety of crops and the team will find the most suitable option. The team will also expand the market niche for the HCC system by determining the optimal use for the product in urban food deserts, refugee camps, and rooftop gardens. The approach taken has involved communication and research to understand the needs of those who could benefit from a Fold-out-Farm, as well as various testing methods for crops and structure of the unit. Testing has been done through expert surveys, estimation of structural performance, simulation software analysis, and evaluation of crop yield from the unit relative to a control crop grown in soil. Results will be continuously measured, first in testing the system's ability to deliver water, sun and nutrients to growing modules, its crop yield, and stability in an open water test in the Rivanna river, and finally when presenting the design to sponsors and potential users. Future researchers may build upon these findings to further improve the unit and its potential use to ensure that it is understandable and acceptable to the communities who will be using it. The project will have a market-ready product capable of reducing food insecurity in SIDS and potentially in urban food deserts, refugee camps and rooftop gardens in land scarce areas.

### **Description of STS Research Paper**

The purpose of this study is to assess the implementation of hydroponics technology in the Middle East using the STS framework of Social Construction of Technology (SCOT). The question that guides this research study is, "What is the sociotechnical process of implementing hydroponics technology in the Middle East?" The relevant social groups of this study are the Iranian farmers, the Iranian government, and technology developers. The significance of the

research is that it will shed some light on if hydroponics offers a solution to water-scarce regions and how important the implementation of a technology is to its success.

### **Concluding Reflection**

There has been great value in having worked on these both projects simultaneously. On one hand I am learning about the way hydroponics farming works and can get firsthand experience with the technology. The capstone project is focused on implementing this in a specific area and the team puts a lot of time learning about this one region and mainly just environmental factors. On the other hand, the research paper allows me to see how hydroponics is implemented all around the world and gives insight into the sociotechnical nature of successfully implementing this technology. I was previously unaware of how much goes into implementing a new technology and all the social factors. The application of the STS framework let me gain a much better understanding of these topics and therefore is benefiting my capstone project as well as vice versa.

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