Thesis Project Portfolio

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

(Technical Report)

Aquaculture as a Tool for Economic Development in North America's Great Lake Basin

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

My technical work focuses on agriculture in developing states, while my STS research explored the potential of using aquaculture as a tool for economic development. The common theme of economic development, resiliency and sustainability ties these two rejects together. Agriculture and aquaculture are both essential components of food production systems and play a vital role in ensuring food security and economic development in developing countries. Moreover, both fields are subject to socio-technical influences, and their success is heavily dependent on factors such as government policies, technological advancements, and social and cultural factors. Therefore, my technical work in agriculture and my STS research in aquaculture complement each other, providing a holistic approach to understanding and addressing the complex socio-economic challenges faced concerning economic well-being.

The 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 demand 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 testing out ideas. Testing has been done through both estimation, and will entail assessments via trial of plant harvesting and flooding resistance. Results will be continuously measured, first in testing the system's ability to deliver water, sun and nutrients to growing modules, next to grow the plants and test the system in water (as described above), and finally when presenting the design to sponsors and potential users. If successful, the project will have a market-ready product that addresses the food instability issues and provides a sustainable food source.

The Science, Technology, and Society (STS) report will detail how the development of an aquaculture industry in the Great Lakes basin of North America can diversify food production and increase food security in the Midwest region of the United States. The report will answer how aquaculture can be economically viable in the Midwest and why creating a thriving aquaculture industry in the Midwest would be advantageous for the region by increasing economic activity and food security. An analysis of a Midwest aquaculture industry through the lenses of actor network theory and technological momentum, two sociological frameworks, will be included. An outline of steps that can be taken by federal and state governments by creating an "open for business" posture, reducing regulations, and passing several tax exemptions that would incentivize investment in a Midwest aquaculture industry will be discussed in addition to an analysis of general economic feasibility.

Working on both projects simultaneously allowed me to develop a more comprehensive understanding of the complex relationship between agriculture, aquaculture, and economic development in both developing economies and developed economics alike. By exploring fields

I was able to identify similarities and differences that can inform and enhance policy decisions and development strategies. My experience in both projects helped me appreciate the interdependence of different sectors of the economy and the need for integrated approaches to development. Agriculture and aquaculture are often viewed as separate entities despite both sectors contributing to food production, employment, and income generation, and they both face similar challenges related to infrastructure, technology, and market access. Thus, a comprehensive approach that recognizes the interdependence of these sectors can lead to more sustainable and equitable development outcomes. I found the value of having worked on both projects simultaneously lies in the opportunity to learn about different sectors and the socio-technical influences that shape them. We as a society can develop more effective strategies that promote sustainable economic development and improve the well-being of our communities.