Hydroponic Crop Cultivation (HCC) for Food Security in Small Island Developing States

(Technical Report)

The failure of groundwater pumping technologies due to a dominant third-party actor: The case of PlayPumps International in Mozambique

(STS Research Paper)

An Undergraduate Thesis Portfolio

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STS 4600

Socio-technical Synthesis: Hydroponic Farming and Implementing Technologies in Developing Nations

My technical work and my STS research are primarily connected through their relation to developing countries and the implications these technologies have on communities. My STS research is centered around the PlayPump, a technology implemented throughout Mozambique, and my technical work was designing a Hydroponic Crop Cultivation (HCC) system to be used in Small Island Developing States (SIDS), specifically the Bahamas. Both of these technologies were designed for developing nations as an attempt to aid them in gaining access to necessities. These projects differ in the sense that for my STS research, I was studying how this technology's failure to evaluate its implications on the community resulted in the technology failing, whereas in my technical project, we designed our own technology while communicating with the Bahamian community of interest to prevent failure similar to that of my STS research project.

My technical project is looking into a solution to the difficulties of traditional farming in SIDS. Climate change has made high intensity hurricanes more common, which have devastated many SIDS in the Caribbean; wiping out acres of farmland due to extensive flooding and extreme winds. Hurricane prone areas like these would greatly benefit from HCC, which is a method of growing plants without soil by instead using a nutrient-rich solution. The technical portion of this report will discuss the development of a collapsible HCC system specifically created for SIDS. HCC in SIDS can strengthen food security, make the food supply more resilient, and provide livelihood for farmers, especially in the aftermath of natural disasters.

My STS research focuses on the PlayPump, a technology that was designed and implemented in thousands of locations within Mozambique in the early 2000s. The PlayPump was an innovative new approach designed to harness the power of children playing to pump fresh water for their community. These pumps replaced existing handpumps with the intention of improving the groundwater collection process. Though initially promising, the PlayPump eventually resulted in failure that was attributed to technical problems with the device. However, I argue that the PlayPump failed due to an inadequate interpretation of the network of actors and the lack of consequent actions taken to design for these actors. I will use a framework of Actor Network Theory (ANT) to organize my analysis of this case. Analyzing the PlayPump through this framework will give a complete account of why this technology resulted in failure.

Working on these projects simultaneously provided for a mutual gain in knowledge and value. My STS project allowed me to think critically about my technical project, and put an emphasis on ensuring to not make the same mistakes that the initiators of the PlayPump made. For my technical report, I worked with a diverse team including engineers, multi-disciplinary professors, a start-up hydroponic company, a Bahamian spice company, and the Bahamian Ministry of Agriculture. This experience helped me identify all of the actors present, and not present, in the PlayPump network, as it modeled a network of actors for a technology. This communication also helped me to develop a clearer understanding of how to design the most desirable HCC system and structure for Bahamian farmers. This design would not fail due to different goals and lack of communication between the designer and the user, like the PlayPump. Working on my technical project and STS research paper in conjunction has helped me understand this issue from multiple lenses, leading to both projects improving the outcome of each other.