

Thesis Project Portfolio

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

(Technical Report)

An Analysis on the Replacement of Animal-Powered Farming by the Tractor From 1910 to 1950

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

Investments in technology have always pushed agriculture forward, increasing productivity and maximizing crop yields. The mechanization of the agriculture industry through the invention of the tractor permanently changed the physical landscape of the United States. The replacement of animal-powered farming by the tractor boosted productivity, accelerating rural to urban migration. Contrastingly, hydroponics seeks to employ the concept of vertical farming – the practice of producing food in vertically stacked layers, to reduce land use and move crop production closer to cities and urban areas. By bringing food closer to the people, this new farming concept will allow society to cut down on transportation costs and consequently reduce the carbon footprint. With such hope for this technology, hydroponics attempts to bridge the farming technology gap in developing countries, much like the tractor did in the United States.

My STS research project presents an analysis of the replacement of animal-powered farming by the tractor from 1910 to 1950 in the United States of America. The tractor shows how important technology can be to agriculture, however, it is a more challenging task to be able to relate these changes to how they have shaped society. By scanning the first-person descriptions of life in the early 1900s in the American Life Histories collection from the U.S Congress Library database and then categorizing certain passages by relevant themes, it is possible to identify recurring themes that are descriptive of life on a farm during that period. My paper shows how necessary the invention of the tractor was to boost productivity levels in the farming industry at a time that food demand increased and workers left their farming jobs to join war efforts. The American people didn't experience this increased adoption at a linear rate as society needed a functional tractor quickly to meet its needs.

My technical research project looked at implementing hydroponic techniques in Small Island Developing States (SIDS) in order to achieve food security. The Atlantic hurricane season brings devastation to SIDS each year due to their small size and susceptibility to environmental disasters. These disasters have led to episodic food insecurity and disruption of agricultural livelihoods. In order to address this problem, my team developed a hydroponic crop cultivation (HCC) system for use in the Caribbean as a test case for SIDS. Our design for a microgrid-supported and storm-resistant hydroponic unit will greatly increase the capacity of SIDS to adequately respond to natural disasters and allow communities to reclaim food independence while insulating themselves from the disastrous effects of hurricanes on the food sector.

I believe that implementing technology in agriculture is not only a necessity but an important measure to cope with an expanding and hungrier world. Next steps for my STS research are to identify current promising technologies that could prove to be equally as revolutionary to the agricultural space as the tractor proved to be. For my technical research, we have yet to build and place an HCC system in the Caribbean to confirm the hypothesis sustained by our design. Both projects proved not only to be fruitful to understand the power of technology but their results also show its capability to help those in need. Researchers picking up on my work should aim to look to improve the implementation of hydroponics and search for new equally powerful technologies that can revolutionize the farming industry.