

Anaerobic Digestion as a Model for Social Entrepreneurship

Enid Partika, University of California Carbon Neutrality Initiative Fellow

MIT Rabobank Food and Agriculture Prize

Rady School of Management StartR Impact

Introduction

It has been observed that the world is entering into a food, energy, and climate trilemma. In the United States alone, over 133 billion pounds of food waste is thrown into landfills, making it the third largest emitter of greenhouse gas emissions and a main contributor to filling landfills throughout the US and the world (1). Meanwhile, 1 in 9 Americans are food insecure, which is only expected to increase with rising energy and food demand (2).

Anaerobic digestion and hydroponics combined have been proven by Enid Partika and Roger's Urban Farmlab to convert food waste into an effective, phosphorus-rich fertilizer that can grow leafy greens, herbs, and a variety of other produce. It has also been proven that tilapia aquaculture can be used as a nitrogen source for the anaerobic digestion system. Biogas has also been produced from this system in enough quantity to power a barbeque on the daily, or power 3 kW of equipment (3).

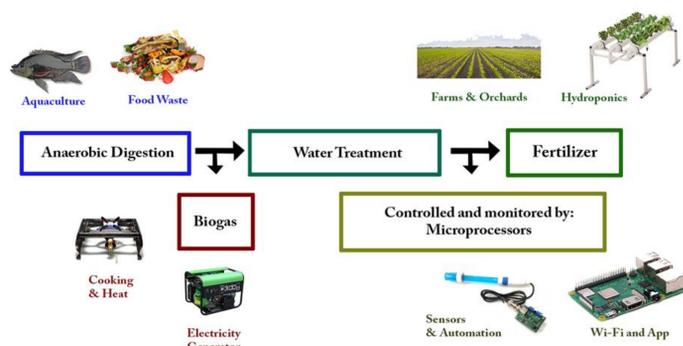


Figure 1: A flow diagram displaying how our Digester-ponics system converts the nutrients in food waste into usable products such as biogas, fertilizer and food.

Project Goals

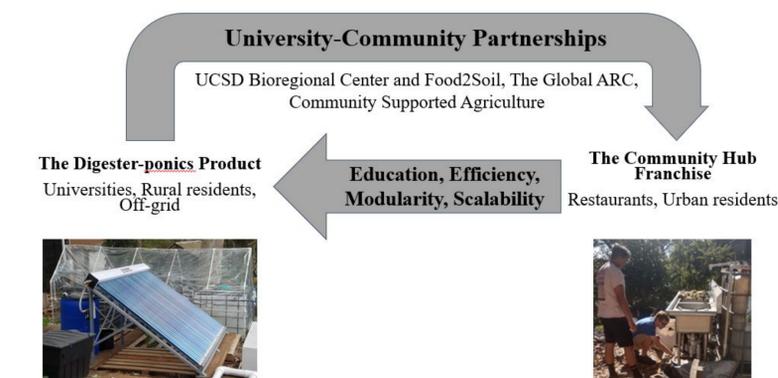
The goals behind this were to:

- Construct a social business model canvas around anaerobic digestion hydroponic systems
- Determine the level of consumer interest and willingness to pay for such technology
- Determine feasibility of a go-to-market strategy for the social business model

Methods

To diversify our revenue streams and fully encapsulate our goal of providing research education and food to food insecure communities, our social business model was developed into three interconnected parts (Figure 2):

1. University and residential products that enable us to gain traction, establish areas where we have a reliable customer base, and gain university - community partnerships.
2. Community Hubs, where we maintain a full scale system to collect food waste from and provide food to the urban residents who need it.
3. Online instructional live streams and videos via Patreon Subscription



Methods Continued

Surveys were conducted online via Facebook, Instagram, Email, and LinkedIn to gather public opinion on our product and community hub business models to determine whether our target markets of sustainability-minded individuals over 21, restaurants, and universities were interested and willing to pay for our product.

The feasibility of our multifaceted business model was examined via a thorough profit modeling over a 10-year period under two extreme scenarios:

1. A \$280,000 loan was taken out to fund our first two years of operations, 7.5% APR over a 10 year payment period.
2. The \$280,000 of start-up costs was financed through crowdfunding and grants such as the USDA SBIR.

Results

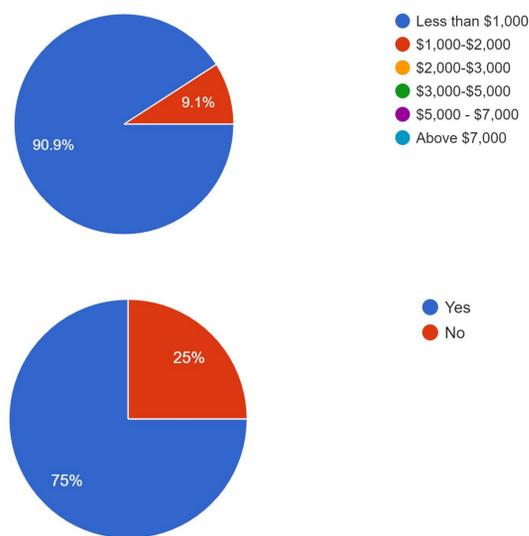


Figure 5: Our preliminary customer survey responses suggest that 75% of individuals 21 and over in urban areas of California would be willing to pay \$0.25/lb of food waste per month to participate in a Community Hub subscription. 75% capacity would be enough to operate our system with at worst a \$3 million profit in 10 years.



Figure 4: Our preliminary customer survey responses indicate that 69% of individuals 21 and older in urban areas of California are interested in a personal digester-ponics system, with 90.9% of those individuals willing to pay less than \$1,000 and 9.1% willing to pay \$1,000 - \$2,000 for this system.

University Survey Responses

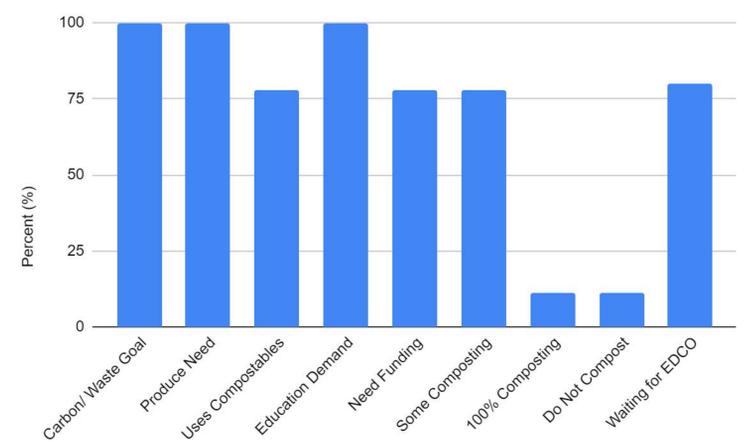


Figure 6: All of the 25 interviewed universities had Carbon and/or Zero Waste Goals, a demand for local fresh produce, and experiential environmental education.

Lower Profit Margin Scenario

\$ 4 million

- Establishes 1 Community Hub, 10 university systems, 240 residential systems in 10-years
- Assumes \$280,000 , APR 7.5% , 10-yr amortization revenue-based financing through Small Business Administration (SBA)

Higher Profit Margin Scenario

\$ 58 million

- Establishes 20 Community Hubs, 10 university systems, 1,800 residential systems in 10 years
- Assumes receipt of TGIF, SIF, Global Social Innovation Challenge and/ or USDA SBIR Grants to cover upfront expenses

Conclusions

- The Digester-ponics Product, Community Hub, and Instructional Videos can provide a stable source of revenue for the social enterprise, in addition to providing social and environmental benefits to the community.
- Our product and Community Hubs were well-received by Californians 21+, with significant interest and willingness to pay for our product and services.
- Our product can provide universities with the educational, waste, and product needs to meet their carbon neutrality and zero waste goals, providing a strong incentive for universities to want a commercial product.

Literature Cited

- "Reducing Food Waste." *Congresswoman Chellie Pingree*, House.gov, 8 May 2018,
- "Food Security and Nutrition Assistance." *USDA ERS - Food Security and Nutrition Assistance*
- United States, Congress, "Food Waste Footprint & Climate Change." *Food Waste Footprint & Climate Change*, UN FAO, 2011.

Future Goals

- | | |
|---------------------|------------------------------------|
| December 2020 | June 2021 |
| First Community Hub | B Corp, Certified Organic, GAP/GHP |
| •Food2Soil | , NSF 350/350-1 Wastewater Cert. |
| •The Global ARC | June 2021 |
| •UCSD BRC | Second university system completed |
| | July 2021 |
| | Residential Product Rollout |

Acknowledgements

Zachary Osborn - Student Community Engagement Specialist, The Bioregional Center for Sustainability Science, Planning, and Design

Joshua Dale - Rabobank Renewable Energy Finance

Kim Davis King - Rady School of Management StartR Impact