

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

Charlottesville Economic Initiative
(STS Research Paper)

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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INTRODUCTION

There is an enormous amount of initiatives in the world today that attempt to provide economic aid. Through emerging technology, humanitarian relief, or community engagement, there is a resolute will to promote equitable opportunities. These projects are only valuable and long-lasting if they can be properly utilized by the entities they seek to benefit. Technologies are being thrown at project at the project without fully recognizing the target audience and their values and beliefs (Carriere, 2008, 84-100). The intentions may be goodhearted, but the result is not always optimal. Yet, whether it be displaced refugees around the world or underrepresented peers in the neighborhood, the world has the capacity at its fingertips to incite change for the better. The lingering question remains to be investigated: how can we utilize homes as a focal point for fostering these self-sufficient economic opportunities?

In an examination of past research and university sponsored initiatives, an analysis suggests there is a trend between the establishment of economic self-sufficiency and the integration of value-oriented design. The exploration of such challenges in both technical and developmental initiatives share the same pitfalls and limitations, as well as need to consider all voices. Approaching these challenges with an asset-based framework provides the insight necessary to justify the claim that equitable opportunities are built on the feedback and iteration of the homes and identities the missions serve to enhance. Through an analysis of the emphasis in quality of feedback that these projects receive, data will provide evidence that homes must not be taken out of the equation when it comes to community outreach. Research and literature suggest a direction and expectation that value-oriented design and development can foster sustainable opportunities. Upon completion of this research, the validity and identification of feedback metrics will be clarified and put to the test.

EMERGING TECHNOLOGIES IN DEVELOPING COMMUNITIES – TECHNICAL REPORT

With the help of Professors Bevin Etienne, Garrick Louis, and Manuel Lerda, the Hydroponic Crop Cultivation (HCC) Capstone team set out to understand how to utilize emerging agricultural technologies in the homes of disaster-prone areas so as to promote food security. Specifically, the team works in conjunction with Babylon Micro-Farms (BMF), a local indoor farming company that has been catering to the needs of small-island developing states (SIDS), such as Dominica and most recently the Bahamas. Natural disasters have time and time again been a struggle for those residents to have a consistent crop yield. BMF's hydroponic solution has been a favorable method for these Caribbean islands to receive disaster relief aid. The hydroponic farms are lightweight, easily deployable, and artificially maintainable. But the humanitarian effort still has some obstacles.

Whether the hydroponic is set up pre- or post-disaster, the farm may not be a viable solution for the homes of many families. The current physique of the hydroponic may be too large for many households. The level of agricultural knowledge required to maintain the farm may be too overwhelming. Not to mention, the dirt and fruit may attract undesirable insects. That being said, the Capstone group has developed the strategy of creating an adaptable hydroponic farm for the SIDS. In cooperation with civil engineers, the team has begun identifying and blueprinting solutions to this in-home remedy. Specifically, the team has been revisiting BMF's attempt to create a collapsible hydroponic. A collapsible solution provides the ability for residents to receive their adequate nutrition only in times of need. On the other side of the coin, they are able to go about their daily activities without the disruption of the farm. In addition, the team has begun investigating materials and pesticides that could be used to deter insects while simultaneously maintaining the integrity of fruits and vegetables grown. Finally, the team is developing a curriculum that colleges, such as Delices in Dominica, can use to teach students how to take care of this technology and enjoy its produce for years to come. The ultimate goal of this system is to provide food security and/or economic opportunities for individuals in their own homes without the continued oversight of BMF or the Capstone.

This project is an interesting case study of how to utilize a home to foster economic growth. As there is with many other initiatives, understanding the values and beliefs of said homes is crucial to the success of the project. In order to identify the technical constraints of a solution, the team needed to grasp the privacy of SIDS households. The Capstone group soon realized the spatial, cleanliness, and education

barriers the hydroponic must overcome. A solution is feasible and is only successful with the open communication between the Charlottesville teams and the households being served. The Delices' community aid via the hydroponic has the capacity to provide food security and an income to many households if the design is able to be an adaptable product within homes. The most important factor is ensuring the comfort of the hydroponic in these homes, as will be seen in trends to come.

IMPLEMENTATIONS IN DIVERSE COMMUNITIES – STS RESEARCH PAPER

Before compiling takeaways from case studies and analyses, it is necessary to first take a look at the valid qualities an approach should possess when attempting to develop opportunities for the homes of families. Whether the goal is to cater to the needs of friends or strangers, the preservation of livelihood is a main concern. Universities in particular frequently attempt to provide solutions to different local and global communities through research and study abroad programs. But seldom do they consistently cultivate tenable change or accentuate the cultural diversity of the groups they are seeking to help. In order to diagnose the successes and failures of these missions, it is necessary to grasp existing approaches and their applications to communities. A review of these methods will provide the means to evaluate relevant university sponsored and international initiatives.

LITERATURE REVIEW

The goal of recognizing value creation techniques leads to an investigation of resource development. That is, reviewing literature, cases and other illustrations of development is first necessary claim a valid approach. Literature focused on improving technology and education becomes particularly relevant in consideration of hydroponic and other engineering initiatives. Julie Belz, an Applied Linguistics Professor, comments on a hindering approach for skill advancement at the Pennsylvania State University in her *Identity, Deficiency, and First Language Use in Foreign Language Education* report (Belz, 2003, 1-42). When diverse groups come together, it is detrimental to the progress of the project when operations are composed by a deficiency mindset. Success is rarely viable when the “helping hand” views the other as an everlasting dependent, as she witnessed during her examination of the advanced competence in multilingual students. Similarly to these attempts at language fluency in higher education, outreach should instead be comprised with open-mindedness and hope. Belz’s research proposes finding merit in the current system, and utilizing those attributes to conform the scope of the project. The emphasis on an approach that promotes the assets on hand was echoed in *Leveraging Students’ Passion and Creativity: ETHOS at the University of Dayton* (Pinnell et al., 2004, 1-11). The Engineers in Technical Humanitarian Opportunities of Service-Learning (ETHOS) program was founded on “the belief that engineers are more apt and capable to appropriately serve the world if they have an understanding of technology’s global linkage with values, cultures, societies, politics, and economies.” In their report, they address the naivete and closed-mindedness of project leaders as a leading indicator to the failure of missions, and highlight domestic and international examples that adhere to a set of core values, including appropriate technology, cultural sensitivity, partnership, cultural immersion, and personal transformation. Belz and the ETHOS program assert that value creation techniques are most self-supporting when they leverage the assets on hand to overcome liabilities and threats and seize opportunities. Researchers such as these go on to refer to this implementation framework as an “asset-based approach” (Kretzman & McKnight, 1993, 1-9).

THE FRAMEWORK

As Kretzman and McKnight suggest in their *Building Communities from the Inside Out: A Path Toward Finding and Mobilizing a Community’s Assets*, community development through means of an asset-based strategy yields self-sustaining results. This framework is built upon recognizing the capacities of communities rather than the endless list of issues. The building process prevents stakeholders from feeling marginalized as destitute recipients of aid, and incorporates them as part of the action. Though our engineering initiatives don’t always focus on community engagement, the merit of this system is reflected throughout. The legitimacy of this system was underscored in interviews with Charlottesville students and

residents. Larkin Mott, a local resident, commented on the utility of an asset-based framework when asked about which community members should lead the development of a “smart city.” Larkin responded by explaining the vast diversity in Charlottesville, and the inherent segregation of ideas. There is no single group in the area that constituents will unanimously align themselves, which leads to a state of imperfect representation. However, when all members are treated as contributors to Charlottesville, a smart city can be developed together. Larkin summarizes by suggesting that when voices are sought out rather than neglected, a system is put into place to ensure the representation of all. This concept begins to underscore the validity in leveraging individuals and their homes for the promotion of self-sufficient opportunities. Whether a mission implements new technologies, education, or ideas, the acknowledgement of all the skills on hand is a crucial step in creating a long-lasting result.

METHODS & DATA COLLECTION

The identification of an asset-based framework highlighted the need to collect and assess data on how current programs and missions at the university level integrate value-oriented design. The University of Virginia (UVA), in Charlottesville, Virginia USA, provides its students ample opportunities to give back. Many of UVA’s aspiring business leaders and entrepreneurs work with a program through Madison House called Creating Assets, Savings and Hope (CASH) that supports local Charlottesville residents in their tax preparation services. CASH provides a well-rounded experience to low income families by applying their qualified student volunteers to obtain their IRS certification, dedicate assistance and follow-up sessions, and thoroughly explain the tax process so as to promote independent tax filings in the future, should a family desire. CASH provides what Kretzman and McKnight would define as an asset-based approach, where the resources at hand are employed to encourage self-sufficiency and independence moving forward. Economic outreach by means of education and technology advancement must maintain an asset-based approach that considers the contributions of the audience and iterates on solutions by incorporating those values. CASH is an outstanding representation of how stakeholders should be part of the action. Yet, even this case study reflects inefficiencies in their approach. Upon interviewing anonymous Madison House leaders about CASH’s and other subsidiary program’s economic engagement as a means of fostering community growth, the members responded with a concern of the program’s comprehensive outreach. Amidst the \$29 million of direct economic impact CASH has fostered for the Charlottesville economy, there are too few identifiers on the extent of its outreach. Local Charlottesville groups often remain underrepresented, and though these communities carry valuable assets, Madison House’s resources are not always fully utilized.

A further case study lending commentary to international, humanitarian efforts points to the University of Virginia-Guatemala Initiative (UVA-GI). Similarly to the self-sufficiency and technical advancement goals in the Hydroponic Capstone, the UVA-GI emerged as a humanitarian mission in which doctors, engineers, and students collaborated to alleviate the poor water quality and supply that many Guatemalan residents faced. The emerging technology has the goal of elevating financial stability via providing fresh water for crops, livestock, and households in general. The envisioned solution was a rudimentary filter that would be placed in homes and communities. Not only does the water filter mitigate health concerns, but it also provides fresh water that enhances the growth of healthy crops that can be sold on the market or placed on the plates of families. However, participants in this mission explained an obstacle when the Guatemalan residents felt uncomfortable letting “gringos” into their homes with this foreign technology. There was widespread refusal to accept daily use of this product capable of saving the lives of their friends and families who were dying from the poor sanitation. Though the UVA-GI was able to overcome this challenge, the situation provides a lens to examine the need to put aside technological expertise, and understand the norms of targeted communities with an asset-based approach. This approach allows for the opportunity to cooperate and propose a solution that utilizes the diverse ideas on the table (Carter & Barrett, 2006, 178-199). In order to foster equitable economic opportunities for desired audiences, solutions must be able to adapt to their homes. There must be a comprehension of the unique values, beliefs, and ideas that can support the longevity and independence of the mission. In short,

existing studies show that emerging technologies and practices are successful when they can function in conjunction with homes. This calls for a need to quantify that conjunction.

EXISTING & FUTURE RESEARCH

The conversations and cases from CASH, UVA-GI, and economic self-sustainability programs have a recurring theme: an asset-based framework. The implementation of projects that enhance economic opportunities should be driven by the resources that each entity specializes. Equitable and successful initiatives are formed in review of the identities they seek to improve. But, the implementers of these ideas still experience significant limitations and failures. This suggests that future studies and strategies should be focused on identifying the proper metrics and steps that teams take to communicate with homes and maintain integrity. When researching this mode of analysis further, data that supports the interaction and feedback of these homes should be highlighted as a promising metric that has yet to be quantified despite its important existence. On the contrary, there should be an expectation that projects and community engagements that fail to reflect this data may become ineffective or obsolete. There is a huge difference between assimilation and acceptance. Assimilation merely suggests the interconnection of two entities. Acceptance adds the element that the interconnection is desired. Accepted technologies, opportunities, and initiatives thrive because they respect the identities of many. It is possible to foster self-sufficient economic opportunities when the homes of the individuals they serve are valued, and the utility of that quantification is emphasized and should be further explored.

CONCLUSION

Economic opportunities are both equitable and self-sufficient when they emphasize individuality. It is easy to get caught up in the mechanics and pride of the project, but research and data show that success is driven by the values of the homes they serve. Self-sufficiency can be achieved when missions become integrative and iterative. Future initiatives should evaluate and quantify communication through feedback, immersion into the environments seeking action, funding towards technological development, and extent of communities involved, in the succeeding discussions. One will find no obvious mechanical relationship between the inventions and methods discussed here or in a future analysis. Rather, the strategies emphasize respectful, encouraging, and ongoing approach. Technologies that promote self-sufficiency must comprehend the stakeholder(s) whom they are helping. When efforts are accepted and open to the identities of the audience, there is the opportunity to optimize the sustainability of these goals. The importance of stakeholder feedback will justify the research claim for feedback metrics and/or steps from the communities involved.

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