WPI Campus Farm Feasibility Study Proposal

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Introduction

Food matters. Recent history has seen enormous advancement in terms of human knowledge, technology, and public awareness. The emergence of social committees and organizations related to agriculture and the utilization of technological advances has lead to crucial gains in efficiency and yields in agricultural industry, making it possible to produce and distribute food to larger populations. Yet, there are still many issues to resolve. One important area that must be tackled in order for us to handle these issues is the disconnect between agriculture and education. Through education's isolation from agriculture, ample opportunity has been lost to better educate the people solving the world's food problem. Recognizing and mending this lost opportunity will be important in the years to come, as we face the toughest issues yet. The embodiment of this educational reintegration is a campus farm.

A campus farm represents a powerful opportunity for WPI to take steps to be a leader for global change. With so much potential, campus farms provide the type of project based learning WPI is looking for; globally applicable, interdisciplinary, versatile, holistic, and available for students at all academic levels. Through a feasibility study, we will answer the question of what a WPI campus farm would look like.

Review

The World Food Problem

In 2000, the largest gathering of world leaders in history adopted the UN Millennium Declaration; the document outlined a series of goals the entire world would seek to accomplish (Millennium Project, 2006). Number one on that list was to 'Eradicate Extreme Hunger and Poverty'. Between 2000 and 2007 the percentage of undernourished people in developing countries decreased from ~17.5% to ~16% (FAO, 2010). This 16% in developing countries represented approximately 854 million undernourished people worldwide. Then the underlying trends of agriculture burst through the veil of progress and by early 2008 an estimated 1 billion people were undernourished: 1 sixth of the population (WFP, 2007). By 2014 the number was reduced to 842 million, but, projecting the progress made over the past 34 years, experts say we will fall short of the goal set out in 2000: to halve the percent of undernourished people.

The efforts to tackle this primary international issue have seen a great deal of success and progress, but a simple compare and contrast can show that while we have solved many of the issues, we have ignored and sometimes created others. We will mention here just a few. Miracle crops have been developed that have allowed for the incredible yields that are enabling us to feed the enormous populations on earth, but an unfortunate side effect of these is an increasingly small gene pool that poses a serious threat for long term food security (WWF, 2015a). Although we have had great success in getting the core nutrients like carbohydrates and protein to those who need them, the number of people with micronutrient deficiencies has, if anything, increased from an estimated 2 billion in 2003 **(**Kennedy, Nantel, & Shetty, 2003) to more than that in 2015 (IFPRI, Concern Worldwide, & Welthungerhilfe, 2014). In fact three of the five leading global

mortality risks: high blood pressure, high blood glucose, and obesity (WHO, 2004) are all heavily linked to these micronutrient deficiencies (IFPRI, Concern Worldwide, & Welthungerhilfe, 2014). Finally, while our agricultural advances allow for more efficient production using potentially less land and producing less waste, in the actual implementation, agriculture is having a terrible impact on the environment: devastating vulnerable natural habitats (WWF, 2015b), destroying an estimated one third of the world's arable land since 1960 (WWF, 2015c), and representing the third largest contributor of greenhouse gases, outdone only by industry and energy (IPCC, 2007). Therefore, while the strides taken to solve the food problem are good, many and serious problems have gone unchecked. We will face the most difficult challenges in the next few decades as populations continue to rise. By 2050 the demand on agriculture will double from what it is now, and enormous scientific, technical, and political effort will be required to keep up (Ruttan, 2002).

Working Towards a Solution

So what are we to do if current international efforts cannot seem to keep up, and things are only going to get more difficult? While the answer to this question will likely be extremely complex, one part is clear: we are creating metrics of agricultural success that are narrow minded. Our crops are the best ever, and yet they are still nutritionally deficient, and the practices used to grow them pose a serious threat to their long term stability. We have developed methods that enable us to produce more food than ever but are devastating our local ecosystems and land; land that we will desperately need in the coming years. While the poor are seeing more and better food than they have before, the food that is ending up on the tables of many of those who are financially secure is creating numerous health issues. Finally, with all of our efforts, we

just cannot seem to keep up with population expansion. We have and have had countless numbers of people who understand and work on the problems outlined above. Why then are our efforts resulting in these additional problems? It is because our various disciplines and efforts to solve the food problem are disconnected. Many of those who have been educated to solve these problems have little experience with the big picture that is agriculture. They lack the education that can show them that big picture. As a result, agriculture is in some way isolated from everything trying to progress it (Mayer & Mayer, 1974).

The Need for Agricultural Education

Further evidence for this idea of educational isolation can be seen in the numbers concerning on-campus farms. There are 4,706 degree granting institutions in the United States (NCES, 2015). Of these, only 60 have on-campus farms (Rodale Institute, 2015), that is, the vast majority of institutions that educate the people who will go on to solve these world problems have at most limited practical experience with the actual entity they are trying to progress. In addition there is general public unawareness of what is happening to our food: a study done in 2003 noted that only half of Americans knew GMO's were being sold in stores (Hallman, Hebden, Aquino, Cuite, Lang, 2003) when they had been sold since 1994 and mandatory labels were required by 1997 (Rosebud, 2012). Demonstrating a further disconnect between agriculture and education, even though all farmers take advantage of modern agricultural methods in some way or another (roughly half of the farmed land in the US is used to grow GMOs (Fernandez-Cornejo, Wechsler, & Livingston, 2014)), of the farmers who were in charge of the day-to-day decisions for their farm, only 60% percent of those in charge of high sales operations attended or completed college and the number drops to 38% with low sale operations (Economic

Research Service/USDA, 2007). All of this goes to show that people are not being educated in agriculture. If we want to meet the challenges that are facing us, then one thing we can do, is fix this error and reintegrate agriculture back into the scientific, technical, political, and popular world. And what better place to do this than where all four of those connect - on the university campus.

The Campus Farm

Sixty schools have taken up the idea: with a significant rate, universities of different profiles have been seeking to introduce food courses, experiences and organization into their programs. This trend leads to varied and successful outcomes. Run by different groups of people in different settings, campus farms range from large scale rural operations, to local urban gardens. Management can range from an entirely student run program (United States Department of Agriculture, 2015) to operations run by a farm manager with a variety of staff (Horn, 2010). In terms of money, some campus farms are entirely dependent on their school for fiscal support, whereas many others are wonderful examples of not for profit and for profit business models (Anderson, & Stuckery, 2007). In terms of education, campus farms provide programs of learning that come in a wide range of models. In addition, many farms promote and nurture sustainable thinking, living, and development; something that will continue to be of great moment over the next few decades. Equally as important, campus farms contribute to the campus and the local community at large whether by social events around a pizza oven (Shannon-DiPietro, 2003) or through CSA (Shipley, 2009). Finally, most of these campus farms were not simply added to campus as internally complete units, but rather started small and then grew and developed within the academic and public community it found itself in. With their

versatility and scope, farms provide a myriad of academic, entrepreneurial, and social opportunities including project work in engineering, sustainability research, business, management, agriculture, and urban planning. As such they are some of the most holistic and adaptable educational centers available.

Table 1 (Dartmouth, 2013; Hampshire, 2015; Saik, 2014; Yale, 2015,)

- Environmental Studies
- Sustainable Agriculture
- Agricultural Studies
- Applied Design
- Architecture and Environmental Design
- Biological and Life Sciences
- Business and Entrepreneurship
- Environmental Studies and Sustainability
- Geology
- Globalization/Third Word Studies
- Robotics
- Marine Sciences
- Education
- Engineering
- Geography
- Religion

Educational Value

In terms of degree programs, individual classes, and project work, campus farms provide a rich and diverse selection. There are hundreds of academic programs on campus farms. A sampling of such programs is given in Table 1. In addition to classes listed in the table, campus farms are responsible for at least 30 academic degrees that have been created at campuses around America (Cal Poly San Luis Obispo). An excellent place for hands on learning, the farm assists student learning while showing them that what they learn in the classroom can be applied to real life. For example, at the Central Carolina Community College some of their class "course work was built around the idea of providing hands-on, practical training within a guiding framework of sustainability"(Kohanowich). These ideas are not just recognized by students either. At Evergreen State College, in a section of the master plan dedicated to enhancing their college farm, the authors say the farm is "a place of learning, as well as a gathering place, a symbol, and an experience for many individuals interested in agriculture,

community food systems, ecological building, group dynamics, hands-on work, and a sustainable future."(EverGreen State College, 2014) These and many other examples show that campus farms provide for rich academic opportunity that is appreciated by faculty, administration, and students alike.

Project Based Learning

Incorporating a farm into the setting of a university delivers immersion of students into the project work, and the opportunity to accomplish complete projects – starting from an introduction to a particular subject to a full solution to an issue of concern. Hampshire College Farm, for instance, became a basis for an NSF funded program aimed on introducing sustainable energy technologies into agriculture (Wissermann, 2015). Students working within the program started from evaluating energy demands of the farm, considered potential sustainable solutions, such as photovoltaic and wind-operated power sources that could meet that demand, and delivered a plan on how to integrate that solution into the farm. Then, students moved on to designing, building, and testing their prototypes – all within the on-campus farm that served as an inspiration, testing site, and a common ground between an academic endeavor and practical solution (Wissermann, 2015).

The Dartmouth Organic Farm – another student-operated project on sustainable agriculture – served as a research field and an experimental environment for a PhD dissertation on effects of temperature on ecosystems (Chapman, 2013). Samuel Fey, the author of the dissertation, used the farm to investigate how variable temperatures affect biological environments and their inhabitants, from bacteria to plants (Fey, 2014). As such, the farm served as independent means to conduct research in a complete, yet not isolated environment. It allowed

the investigator to approach the research of ecosystems in a practical context of an actual food system. Entirely within one establishment, he could manage the project all the way through its completion.

The project work on farms is not restricted for upperclassmen, and is not limited to undergraduates. The short review of campus farms presents several examples of interdisciplinary projects that are inspired by agriculture and implemented on farms through graduate student research and undergraduate projects work and volunteering. The environment achieved at the farms facilitates the engagement of students of various interests, career ambitions, and levels of preparation in working on a real problem.

Tying it All Together

The concepts and practices of modern-day agriculture are not well-connected to the university disciplines that can inform and learn from them. Treating the problem requires interdisciplinary, project-oriented, and community-based innovation. By uniting the academic expertise and student enthusiasm within the versatile, rich, and holistic structure of the campus farm, we can take steps to overcome the problem. For those schools looking for distinctive, highly interdisciplinary, project-based programs that challenge students in new ways, allows them to exercise their entrepreneurial spark, and gives them the tools to be able to tackle problems that are essential in any part of the world, the campus farm is essential. So then, what can a campus farm look like at WPI?

Methodology

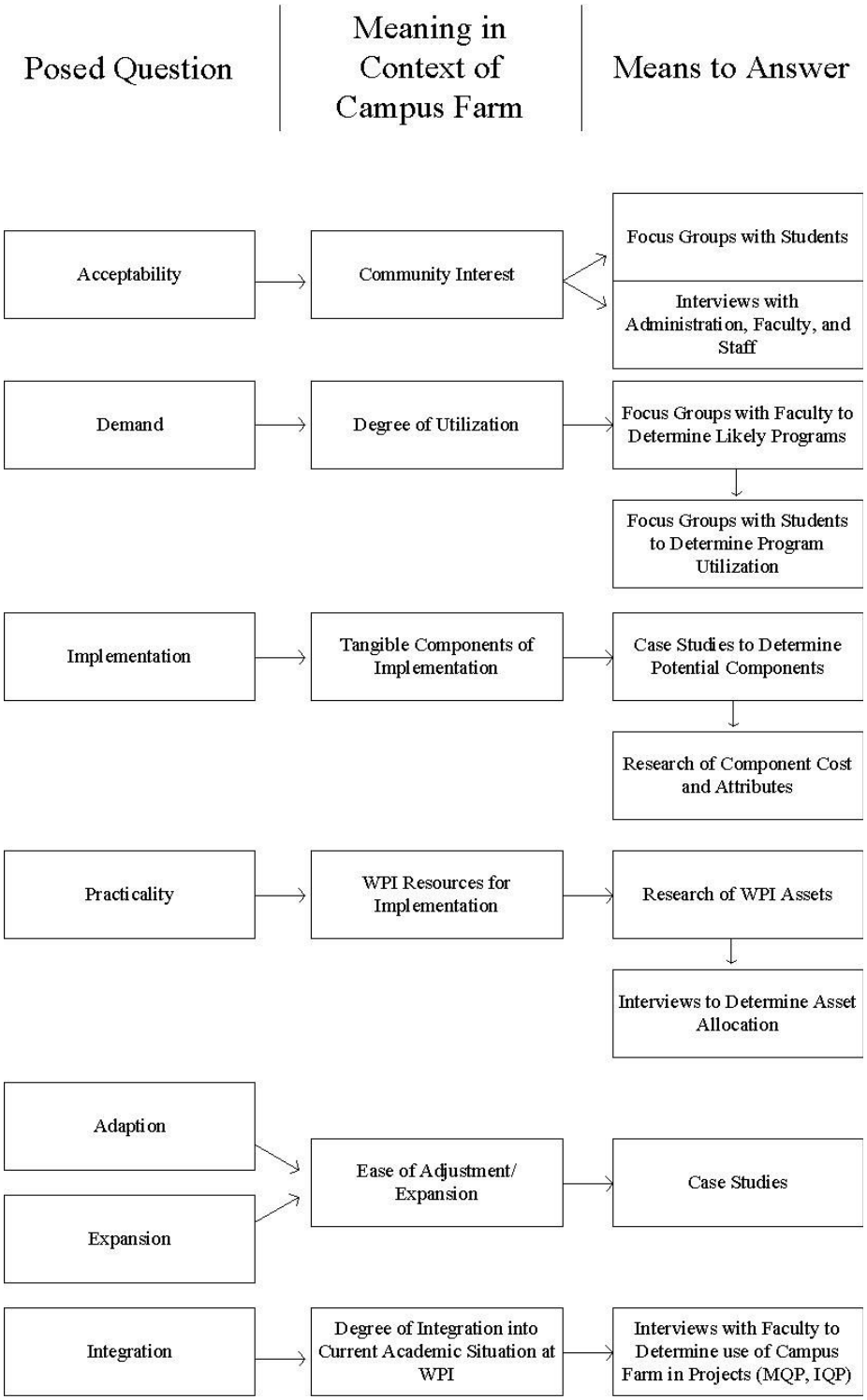
A feasibility study will answer the question of what a campus farm at WPI can look like. A feasibility study is an analysis on whether an idea or project makes sense. It is a way of evaluating if a proposed project is feasible within the given setting, the associated cost range, ease of implementation, and potential profit outcome. In general a feasibility study is a series of questions that when answered provide the information that determine viability (BUET, 2009; Bowen et al., 2009; Daly, 2007). The questions and their meaning follow (Bowen et al., 2009):

- Acceptability: Investigates the aspect of people's interest toward the idea and the willingness to interact with it.
- Demand: The amount of expected use.
- Implementation: This discusses the ways that a project could be created and developed.
- Practicality: Focuses on the possibility of practical delivery of the project under constrained resources of the hosting environment.
- Adaptation: The ability for the project to change according to specific events, rules, or procedures.
- Expansion: The possibility for a project to grow more or be replicated in another location.
- Integration: The ability for a project to productively join with an existing program.

The WPI farm feasibility study will tailor the questions to the WPI-specific context, and then propose and carry out methods to answer them. The proposed study appears in Figure 1, and discussion follows. The figure is structured from left to right. First, there is a question to be answered; then, this question is considered in context and the means to answer it are presented.

Arrows connecting the two rightmost items indicate that one will follow the other in practice. In the written elaboration of the study, we present each question one by one, specify its meaning, and then the approach to answer it.

Figure 1. Graphical Representation of Designed Study



Question Elaboration:

Acceptability. In the setting of our feasibility study, acceptability of an on-campus farm is determined by the interest of the community in the idea. The question will be investigated by two means: first, focus groups with student participant; second, individual interviews with faculty and staff members. We will design a set of discussion topics to reveal the potential levels of engagement of community members with the idea.

Demand. The demand of a campus farm is reflected by the degree to which the farm will be used by faculty and staff. This estimate will be obtained in two steps: first, focus groups with faculty members will be conducted to determine the number, extent, and academic relevance of projects that the faculty will be interested in conducting on a farm. Then, we will evaluate the student interest and potential involvement via focus groups conducted with students.

Implementation. The question of implementation inquires into the individual components required for a farm. We will address this issue by means of case studies and unobtrusive research. Through case studies, we will determine what the typical components of an on-campus farm are, and classify them with regards to the importance of each individual component to the function of the whole farm. By means of unobtrusive research, we will estimate the resources (such as financial cost, required staff, land, and maintenance infrastructure) required to obtain and maintain every individual subunit of a farm.

Practicality. The practicality of the idea concerns with the availability of resources required to implement a university farm at WPI. By means of unobtrusive studies and interviews with administrative staff, we will determine the assets of the university and their allocation, if one is already present.

Adaptation and Expansion. In the context of an on-campus farm, adaptation and expansion are considered in terms of the farm's potential to adjust to the changing conditions within the university, and grow as an academic program. We will evaluate the flexibility of on-campus farms by conducting case studies with farm-based programs established at other universities.

Integration. We will investigate how the integration of the farm contributes to the project-based education model adopted at WPI by interviewing faculty members. The interviews will address the potential benefit of incorporating the farm with the already existing Global Impact Program, IQP, and MQP.

Expected Results

From focus groups we expect to obtain information on interest in a campus farm, as well as a list of programs and courses that could be run on one and the expected use associated with them. Interviews with administration, faculty and staff will produce data on who would run the farm, where it would be located, what resources are available for its implementation, and how it will tie into WPI. In addition, more information on campus farm interest will be obtained from these interviews. Case studies will allow us to gain information on the components used by other campus farms, means to success, and the difficulties that other institutions have encountered. Such studies will also provide further data on the costs of having a farm and the materials needed.

Expected Complications

The major issue expected in the research is access to the information that is not publicly known or readily revealed by academic institutions. This information is especially important to

the case studies that will be performed, and data acquisition on resources available to WPI. The team also expects additional complications due to the novelty of the topic of research, that could be especially prevalent in discerning the utilization a campus farm at WPI could expect. We intend to tackle this latter problem through a series of mock examples that will be used as catalysts for ideas and prompts for opinion.

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