


Implementing Sustainable Development

Global Applications of Sustainable Development and the Community Effects

2012 Chicago Circumnavigator's Foundation Scholar and 2012 Senior Thesis

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“All is Connected…No One Thing Can Change by Itself”

Paul Hawken

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Executive Summary

In order to best implement sustainable development universally, it is necessary to identify best practices being implemented throughout the globe. Universal principles for sustainable development can be implemented in a diverse and broad way. This study compares seven sustainable development projects in Ecuador, Malaysia, the United Arab Emirates, Ghana, Denmark, Sweden, and the United Kingdom analyzing the success of their implementation strategies, how the organizations establish goals, and how community interactions are managed.

These projects were included because of the broad range in goals, their variety of socio-economic settings, and the varying size of each project allowing for a spectrum of sustainability projects to be analyzed. As a complex topic, sustainable development is characterized through an analysis of the intersection of economic feasibility, environmental management, and social equity. A triple bottom line approach such as this one allows for a variety of sustainable development projects to be viewed comparatively.

All results from this spectrum point to the power of community building as the key to building long lasting, effective sustainable development projects. Successful stakeholder engagement and establishing community buy-in for a project were universally necessary for successful sustainable development. Additionally, the scope of a project was important to its eventual impact with some organizations taking a holistic approach to sustainability in their communities while others took a more specific cause driven focus. These two options, however, could be implemented together in a way that would establish a lasting organization that is entrenched in key sustainability issues of a community.

In conclusion, a proposed framework for effective sustainable development is presented called Community Oriented Sustainable Development (COSD) which focuses on (1) identifying stakeholders, (2) setting achievable community goals, (3) teaching over leading, (4) cooperative ownership, (5) utilizing technology while focusing on behavior, and (6) starting specifically, ending holistically.

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Acronyms

C2C	Cradle to Cradle Design
CHP	Combined Heating and Power
COSD	Community Oriented Sustainable Development
NGO	Nongovernmental Organization
PPPF	Perpetual Prosperity Pump Foundation
PRT	Personal Rapid Transit
SD	Sustainable Development
SEI	Social Enterprise Incubator
TBL	Triple Bottom Line

Introduction

Sustainability is an increasingly common term in today's society; however, while there are universal principles around the topic, metrics and implementation strategies are widely varied. Traditionally, metrics such as ecological foot-printing, environmental impact assessment and emissions targets have all been used to measure the success of sustainable development (SD) projects. These metrics, and a host of others, measure the achievements of a project based on the environmental impact but there is still little understanding of how these initiatives impact communities and what successful strategies could be applied universally in the future. While principles of SD can be carried throughout communities, this research focuses on the deeper issue of implementation strategies that can be cross-culturally implemented.

In both developed and developing nations, projects as different as agriculture programs and billion dollar eco-cities are using the principles of SD to inspire action and change. Communities of different socio-economic backgrounds, with diverse cultural histories, and varied governmental structures are all undertaking SD projects and provide a vast group of case studies on effective implementation strategies. These differences create a situation where a single path for sustainability is not practical for all communities but a framework or guide for how best to approach these tasks can be developed. By analyzing both developed and developing case studies, this research analyzes a broad range of SD projects in order to identify key commonalities in their implementation strategies.

This report evaluates a project's SD success through a triple bottom line approach. The triple bottom line (TBL), developed by John Elkington in the mid-1990s, incorporates social, environmental, and financial factors into a framework for measuring sustainability[1]. The TBL balances environmental concerns, financial checks, and social equity in order to view

sustainability with a holistic mindset. The approach also leads to a better understanding of a community's needs through a strong focus on the social and behavioral issues. By understanding a project's implementation of TBL principles and the background of that given community, successful implementation strategies can be identified and transplanted in a variety of settings.

TBL evaluations were conducted in seven different countries on a variety of SD projects. Of these countries three were developed (Sweden, Denmark, the United Kingdom), three were developing (Ecuador, Ghana, Malaysia) and one is classified as a high-income developing country (United Arab Emirates) by the International Monetary Fund. [2] Research was conducted from June 2011 to September 2011 through a series of interviews with stakeholders in SD projects in order to analyze perceived accomplishments. From these interviews, as well as site observations, conclusions were drawn to establish the basis for community oriented sustainable development (COSD).

The COSD framework takes into account the community needs first, thereby tailoring the economic and environmental initiatives to these needs. This has been shown to improve stakeholder engagement in the process. In both developed and developing nations, COSD could be used to create the necessary community buy-in and behavioral shifts necessary for change by retooling the meaning of development. This study found that organizations and projects which fit under the model of COSD resulted in greater traction within the intended community and longer lasting success.

This thesis will provide insight on successful implementation strategies for sustainable development with the case studies providing the foundation for the development of the COSD framework. A discussion of the meaning of the term SD is presented first in order to create a

basis of common understanding with the reader. This is followed by a review of the research and the case studies, highlighting the TBL factors and the findings that can be cross-culturally implemented. Finally, the COSD framework is presented and the potential for further research within the sustainable development field is explored. With this framework, project organizers and communities can develop strong community support and participation around sustainability initiatives.

Sustainable Development Definition and Principles

Presently, there are many definitions of SD, often based upon the same principles but with slight differences depending on the source. The first cohesive definition was presented in the United Nations report "Report of the World Commission on Environment and Development: Our Common Future" published in 1987. This report, often referred to as the Brundtland Report, after Gro Harlem Brundtland, the chair of the authoring body, was requested by the United Nations to establish "a global agenda for change." The commission was asked to propose long-term environmental goals and create a plan for greater international cooperation. The Brundtland Report defined SD as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The report states that priority should be given to the essential needs of the world's poor and that the state of technology and social organizations imposes limitations on the environment's ability to meet present and future needs. [2] This report has now stood for almost twenty five years as a general plan on how the international community can move development in the direction of sustainability

The Brundtland Report is not without numerous critics who have expressed concern with how the commission defined and approached sustainability. Many of the critics of the Brundtland Report and SD argue the document may not be as radical and different in thinking

than the present system of development. Tijmes and Luijf state that *Our Common Future* is just an expression of the principles of economic scarcity with the slight addition of environmental ecology. [3] The report, as described by theses scholars, uses the establishment of a "world community" as a way to show that cultural differences are standing in the way of economic solutions to global problems. Their opinion leads them to believe that a global community would reduce the world from a "common heritage" to a "common resource" and very little would actually change. [3] Another group of critics argues that for the environmental considerations to be established in society mass institutional changes will be necessary. As Environmental Economics Professor Kelly Turner puts it, "the Commission's main proposals require implementation, largely though not exclusively at the international community level through multilateral action." [4] These critics question whether this is actually possible given that the report does not demonstrate how the costs of the restructuring will be paid for or take into consideration the many levels of government involved. Finally, critics question whether the economic growth that *Our Common Futures* supports will actually help alleviate absolute poverty and the possibilities of local grassroots projects to more effectively solve these problems. Critics are also concerned with the institutional changes that the Brundtland Report presents and whether these changes would actually create the change that the Commission is proposing.

Although considered the foundation for SD, the Brundtland Commission's definition has evolved over the years with growing sustainability work. *McMichael et al.* presents SD as "transforming our way of living to maximize the chances that environmental and social conditions will indefinitely support human well-being, security and health." [5] Similarly, Douglas Farr defined sustainability as a situation in which the "critical activities of a community are, at a minimum, ecologically sound, socially just, and economically viable, and that will

continue to be so for future generations." [6] These definitions elaborate on the basic Brundtland report in order to reflect our greater understanding of the principles of sustainability. It is important to understand that a person's definition of SD is often rooted in their own personal needs and aspirations leading to different adaptations of the core ideas.

SD work is still just as pertinent in today's society as it was two decades ago and a number of scholars have more recently written about its applicability. One of the greatest challenges to SD is how it is conceptualized and implemented. Some feel that SD is a "watered down" term that does not lead to concrete goals. There is also a growing group of scholars who feel that SD can be conceptually potent and politically effective. This second group of individuals feels that by embracing pluralistic principles of ecological economics, political ecology, freedom oriented development, and deliberative democracy there is a means by which SD can provide substance on both the local and national levels. [7] Additionally, researchers in Germany and the Netherlands have said that there needs to be a set of four prerequisites for instituting sustainable change in society. They listed these main factors as: (1) self-organization, (2) sustainable innovation and cultural regions, (3) global cooperation and regional resource management, and (4) sustainable research by universities. [8] These principles help to establish a guiding foundation for pursuing SD in today's society.

It will be important to look at how SD is defined and what principles are being used as the basis for change before groups take on the mission of SD. The schematic in Figure 1 illustrates the phrase "sustainable development" can be interpreted. The semantics of the term are presented by Repetto, shows that SD can be a powerful tool if based upon "scientific realities, consensus on ethical principles, and consideration of long term self-interest." [9] In contrast, some may look at sustainable development to mean "sustained growth which in turn

could be damaging for the longevity of environmental and social systems. There are great complexities when dealing with SD and in order to provide a good understanding of what is intended, researchers and policy makers will need to consider these all areas in a holistic approach.

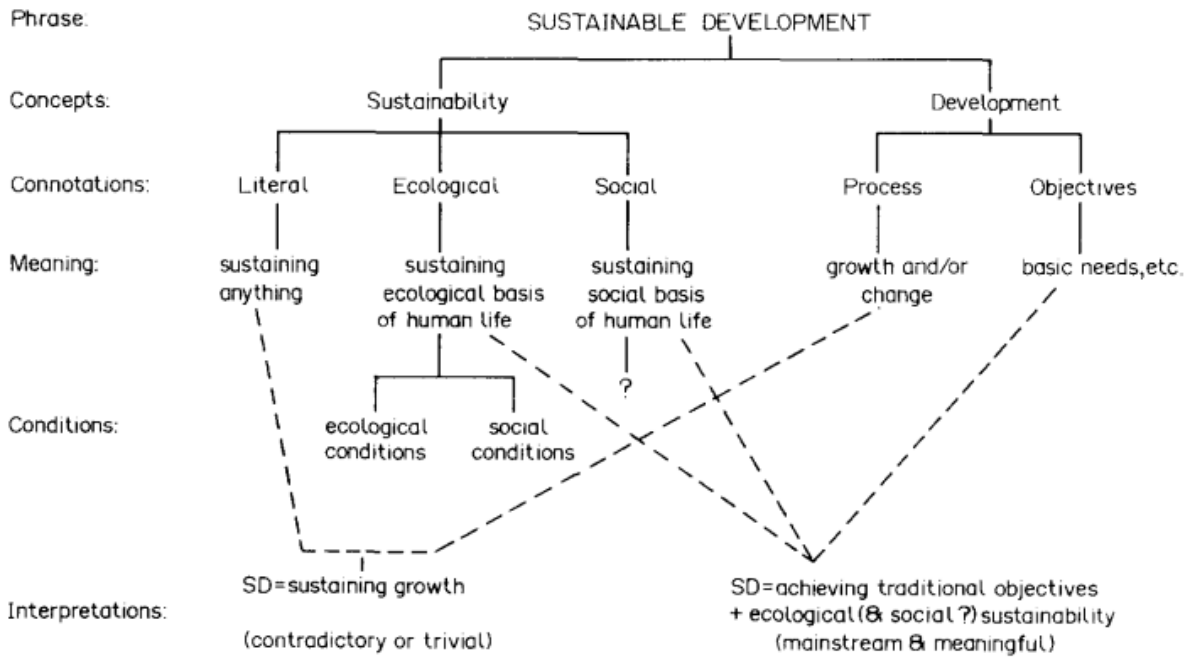

Figure 1: Semantics of Sustainable Development [10]

During this circumnavigation, everyone involved in the case studies was asked how they defined sustainable development and no two definitions were the same. What this indicates is that SD, like most other models, comes in many different forms depending on the individual providing the definition. It requires both a technological shift and a behavioral shift, while utilizing a community-focused approach to ensure acceptance. I would argue that sustainable development does not just require maintaining a standard quality of life but reorienting our thinking on how we consume limited resources and damage the environment. A definition of SD also needs to be adaptable and flexible as no two communities need the same things or need to

take the same steps in order to achieve SD. Based upon this research and my own personal history, Sustainable Development to this researcher means management of our behaviors and environment in a way that maintains economic, environmental and community security.

Once establishing a definition of SD based on the works of past researchers, it is critical to review the principles of sustainability that can be used as guiding principles for project organizers. The most complete set of principles when dealing with design of products processes or systems were outlined by Anastas and Zimmerman in the "12 Principles of Green Engineering." [11] The principles are as follow:

(1) ensure that all material and energy inputs and outputs are as inherently nonhazardous as possible.
(2) prevent waste rather than treat or clean up waste after it is formed.
(3) Separation and purification operations should be designed to minimize energy consumption and materials use.
(4) Products, processes, and systems should be designed to maximize mass, energy, space, and time efficiency.
(5) Products, processes, and systems should be "output pulled" rather than "input pushed" through the use of energy and materials. (costumer demand dependent)
(6) Embedded entropy and complexity must be viewed as an investment when making design choices on recycle, reuse, or beneficial disposition.
(7) Targeted durability, not immortality, should be a design goal.
(8) Design for unnecessary capacity or capability (e.g., "one size fits all") solutions should be considered a design flaw.
(9) Material diversity in multi-component products should be minimized to promote disassembly and value retention.
(10) Design of products, processes, and systems must include integration and interconnectivity with available energy and materials flows.
(11) Products, processes, and systems should be designed for performance in a commercial "afterlife".
(12) Material and energy inputs should be renewable rather than depleting.

These principles are important because they establish a framework by which engineers can design products to meet the definition of sustainability while providing flexibility to apply to a number of industries, products and services. The ideas presented are scalable and apply to a wide variety of systems. These principles are rooted in environmental protection and long term

economic preparation. The green engineering principles demonstrate what William McDonough calls cradle-to-cradle (C2C) design. McDonough lays out three tenets of the C2C framework: (1) waste equals food; (2) Use current solar income; and (3) celebrate diversity. "Waste equals food" is emphasizing the important of reuse and the idea that regenerative systems can exist if engineers recognize that materials can be critical in creating closed-loop systems. Solar income applies not only to solar panels but also to thermal flows and biological processes that are products of solar energy use. This shift in the energy marketplace will be important to implementing SD projects. Learning from nature, McDonough places a larger emphasis on diversity. Variety and mixture is once again critical for creating closed loop systems based on a holistic approach to development. C2C design and the twelve principles of green engineering are important guiding principles in how a value based idea such as SD can translate into altered design thinking that creates business and growth.

Research Questions and Hypothesis for Study

Research Questions

Much of the history of SD centers around creating an effective understanding of what sustainable development looks like and what principles guide it. Many researchers have touched on the three pillars of sustainability - economy, environment, and society - as the focus areas of this movement but few give quality indicators for how this is being approached at the local level and impacting the local stakeholders. In order to look at this, I focused on two primary research areas in the case studies of this thesis.

I was first interested in looking at how SD was defined throughout the world and understanding how differently developed and developing nations approached sustainability initiatives. Based on the literature, the conceptual framework for which people view SD projects

is critical to how they carry out SD in practice. The primary question was whether certain implementation strategies could be applied from one setting to another given the local focus of sustainability and if strategies were identified, could these vastly different communities could learn from each other's early successes?

The second aspect of this research was looking at the community impact of these SD projects. Many of these projects included some sort of technological implementation while others were focused on altering community structure and addressing the societal aspects of SD. This portion of the study became a question about how the local community viewed sustainable development projects. Did they actually see these projects as beneficial to their community or did they view these projects as being based solely upon the motives of a government or NGO? By answering the question of sustainable development's local impact, insights into how to create community engagement and acceptance could be found.

Hypothesis

The first hypothesis for this research was that when looking at discrepancies between developed and developing nations, that broad concepts could be implemented universally but the technology providing the basis for projects would be specific to that site. This theory was due to the large number of differences in culture, geography, and socio-economic status. I felt the critical issues for universal implementation would be the economic backing of these projects and their ability to reach a wide population. Similarly, I felt that the needs of the countries were drastically different and resulted in wide differences in development patterns. These differences would render a detailed, universal approach to SD ineffective.

When hypothesizing about the second question concerning the community impact of the SD projects, I expected to find vast discrepancies in the perception of the SD projects

effectiveness when comparing a project's organizer's views with the views of the intended constituents. Because of difficulties in communication, as well as organizational objectives differing from community needs, I envisioned that it would be difficult to effectively implement programs in which the needs of the community were satisfied while following principles of SD. I expected to find that the organizers of a SD project would overstate the benefits of the project to the community members and would not have the transparency you would want from a community oriented project.

Research Methodology

To answer the research questions above, this study was designed to understand how SD projects were being carried out on the ground level.

Participants and Setting

The research focused on eight case studies carried out in seven different countries. These cases covered a broad range of sustainable development projects, including but not limited to community building, sustainable agriculture, policy initiatives, and housing developments. This broad range of case studies showed the broad range of projects being carried out under the banner of SD. For each case study, both project organizers and community beneficiaries were interviewed. These interviews were intended to gain an understanding of their view of the project, their understanding of SD, and their opinion on the effectiveness of the programs.

Data Collection

The data collection process can be divided into two main segments. Initially, prior to departure, I collected information about each SD project and gained an understanding of the background of the organization, government body, and community setting. This was intended to help tailor the interview questions for the proper setting. Also, preliminary conversations took

place with the SD organizers in order to further understand the project's purpose and objectives. Travel to each country began in June of 2011 and lasted until September of that same year. In each country data was collected in the form of interviews, informal discussions, observation, and collection of primary sources of data. The length of time in each country varied from six days to two weeks and the process of research within each country was similar. The first portion of time spent in each country involved informal discussions, as well as reading and understanding primary materials in order to get a good understanding of the organization's structure and format. Through this process, I was able to develop an understanding of what the objectives and missions of the SD project were on the ground level. This set a good platform and foundation for the next stage of the research.

The second stage of the in country research consisted of interviews conducted with the organizers and community participants. The number of subjects was often limited by the time in the country and logistics of travel. At least one organizer and one community member was interviewed in each country in order to get a comparison between the two categories. A breakdown of the interviews in each country can be found in Appendix B. Each interview followed the same format, although certain questions were modified depending on the scope and focus of the SD project. The questions followed a TBL approach. They began with background on the organization and the subjects, and then looked at the three pillar areas of environment, economics, and social parameters. This was followed with comparison questions looking at overlap between the three pillars. For a guide of questions asked please refer to Appendix C. Below is a schematic of the three pillars and their areas of overlap used as a basis for the interview guide.

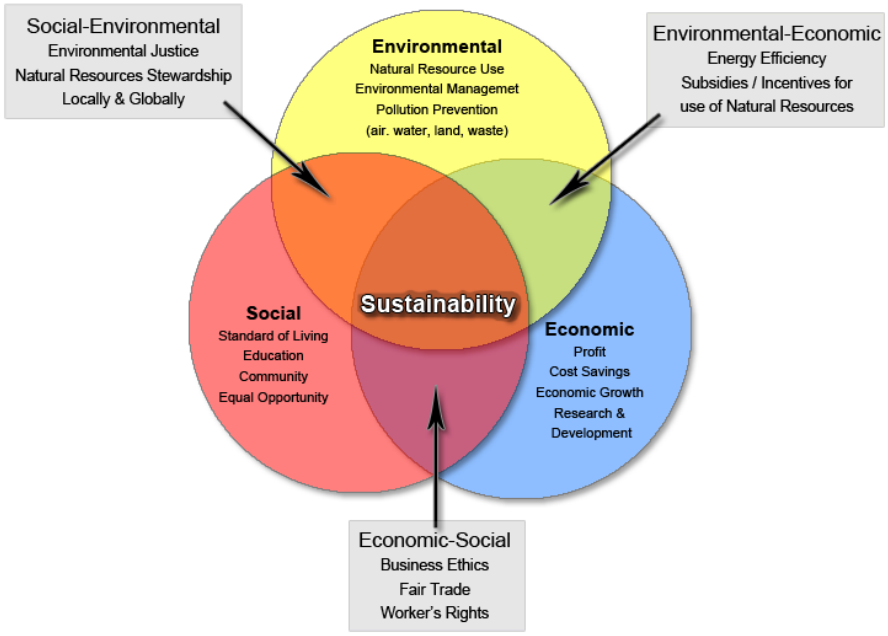

Figure 2: Three Pillars of Sustainability. The Triple Bottom Line (TBL) [12]

Data Analysis

Fifty interviews, numerous informal conversations, and countless observations were made over the period of travel. Interviews were either video or audio recorded with the subject's consent and notes were taken during that time. Field notes were written on the community, the SD project, and the perception of the initiative. Most of the loose notes were written up upon return. Similarly, upon return, key interviews were transcribed and key observations and findings from each interview were compiled. Interviews were assessed for project focus, implementation strategy, developed vs. developing characteristics, community view and community effect. After looking at the data, I created a comparison between SD in developed and developing nations looking at themes from the cases. I then started to build the universally applicable community oriented sustainable development (COSD) framework in order to establish a unified system for implementing effective, impactful SD projects. I then revisited the case studies to look at how COSD could be utilized to both evaluate and improve the eight examples.

Case Studies

Yanapuma Foundation – Estero de Plátano, Ecuador

Background

The Yanapuma Foundation is a relatively new nonprofit organization in Ecuador with just over five years of community development experience. The organization began with six passionate individuals who had all previously worked for what they perceived to be a mismanaged and poorly run NGO. Out of their frustration, the Yanapuma Foundation was formed and their work began. Presently, Yanapuma runs a Spanish language school for tourists as a way of sustainably funding its projects. During 2010, the school had a total of 659 students wishing to learn or improve on their Spanish with 12% of the proceeds going to support the organization's community development work. (1) The rest of the revenue was used to cover teacher's salaries and business operations. The school provides the primary source of funding for the Foundation's work in community development.

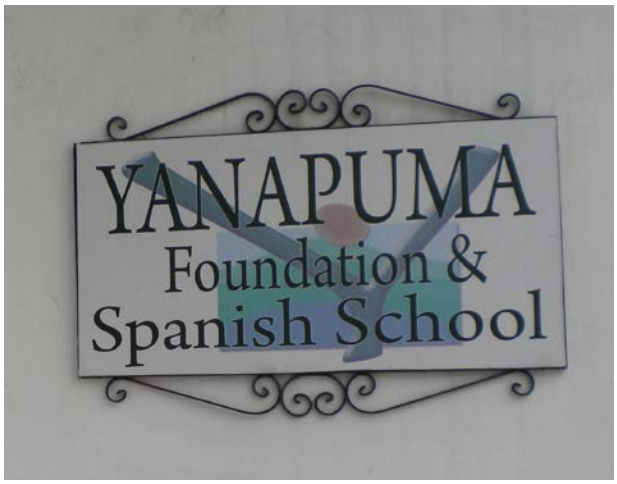

Figure 3: Yanapuma Headquarters

Yanapuma works in villages all over Ecuador using a combination of international volunteers on short term and long term stays in a wide variety of roles. In this research, the primary focus was one village, Estero del Plátano. Estero is a small, remote, coastal town of approximately 600 people, bordered on two sides by cliffs and on one side by the Pacific Ocean. The village is eight hours away from Quito, the country capital and the location of the Yanapuma headquarters. Amelia Brandt, an intern described the town through the following description:

"There's really no paid work; everyone who lives there pretty much has a farm or does a combination of farming and fishing. Some people have small stores or hotels, but there's really no industry, so there's not a lot that people can do." (Amanda Brandt) The village is extremely poor and the low lying setting makes cellular communication impossible in the town center.

Model

Yanapuma uses an integrated and participatory approach to sustainable community development that relies on collaboration over the long term. They work to avoid paternalism between the organization and community and want to develop a partnership rather than a dictator-like relationship. Their methodology highlights seven key elements in order to ensure a sustained, participatory, action oriented and community driven approach to sustainable development. These seven elements include: collaboration, participation and communication, networks, capacity development, sustainability, integration, and evaluation and learning. [13] When referring to networks, the Foundation is trying to form organizational networks for project financing, development and implementation in these marginalized communities. These elements help to create a participatory structure for community empowerment and development in the impoverished areas of Ecuador.

These methodologies are guided by six core principles. These principals are sustainability, social justice, respect, freedom, transparency and professionalism. Yanapuma defines sustainability as "equality between social and economic development in a globalized world with a respect for the environment and cultural traditions as the only way to enact genuine improvement in well-being." Yanapuma works in four main areas of involvement: Agriculture and the Environment, Health, Education and Sustainable Economies. [13] They hope to have a holistic approach to community empowerment as a way of improving lives and increasing the standard of living over the long term.

With a methodology to approach development and principles to guide the group, the team at Yanapuma developed actual implementation strategies. The first and most emphasized strategy is to make the project design participatory and that execution should be done alongside of local partners. The next focused strategy is to motivate and improve the capacity of local members to organize themselves and carry out projects that will create long term change. The organization has invested long term in these villages not in the form of capital but in the form of middle and high school education efforts in the hope that the community takes control of its own destiny. They also work to seek out international resources to carry out the project work in the form of volunteers and aid groups who provide the on the ground expertise and advising to the communities. Finally, Yanapuma intends to integrate the four main areas of involvement in order to improve the community across the board. By integrating these areas, Yanapuma is hoping that the improvements will be sustainable and lasting even without a continued presence of the foundation in the villages.

Project Work in Estero de Plátano

In this small, coastal village, Yanapuma has had traction in a relatively short period of time by providing useful assistance to the community. The foundation organizes a number of volunteers to live and work in the community at different points in the year. The volunteers primarily support the largest development project, a library and scholarship program. Education in Ecuador is free; however, the cost associated

Figure 4: Estero de Plátano

with traveling to and from high school and the required uniforms are not. “That costs about fifty cents or a dollar a day which for a lot of families they can’t afford, especially if they have more than one child that needs to go to high school” (Amelia Brandt). Brandt also stressed the importance of continued support of the volunteers who work and run the library that was built in the town as a way of improving the chances for student success.

Yanapuma also works with a women’s group and an artisan collective. The women’s group sells ceviche, a traditional seafood dish marinated in citrus, and the artisans group runs a workshop and splits profits between the artisans from the sale of the goods. The foundation has struggled to work with these groups as they are highly political organizations in the community. They find that these groups struggle with the cooperative structure and profit sharing. With the new source of profits, social structure is slowly evolving; especially in marital interactions where the women are now bringing home a small contribution to the family. This change creates a complex social situation that has made Yanapuma’s support of the groups difficult as they try to maintain neutrality in the community.

Figure 5: A Typical Home in Estero de Plátano

From the environmental side of the development plan, Yanapuma teamed up with another NGO, Agua Muisne, in the area to bring a clean drinking water system to the community. The system is a filtration system that is easy to operate and water jugs are distributed to community at a low price of 50 cents. Initially,

Yanapuma struggled to get people to use the water system because they were not fond of the taste. Slowly the community has adopted the system after seeing the positive impacts it has had on health. Yanapuma has worked to educate the village members on the positives of the system through promotional materials and educational workshops. The system is maintained by the other NGO and the sale of water is conducted by a local member of the community. The Foundation has been working to ensure that the water system is a success and is maintained through its life cycle in the community.

Perspective on Foundation and Estero de Platano

Organizational Perspective

Andy Kirby, Yanapuma's executive director, describes the organizational objective as "sustainable development in indigenous marginalized communities." To Kirby and the Foundation organizers, it is important that these marginalized communities take ownership of their fates and develop along their own guidelines. They often worry about the villager's inability to organize and manage a project or approach the development agenda. This is where the foundation feels it has the most impact. It focuses on the social aspects and helping the community to take ownership over projects.

In the case of Estero, Yanapuma has realized the complexities in the social structure and how understanding this social atmosphere will help develop sustainable projects. In interviews with the director and staff, I found that Yanapuma feels as though they are effectively addressing problems in the community but have not yet seen that success come to fruition due to the limited time frame to date. They also have struggled as outsiders of the community. One intern working in Estero mentioned feeling as though the community often just deferred to her for development decisions rather than doing what they wanted to do. Yanapuma staff did mention that they are working to become a member of the community which is a much lengthier and more

complicated process then they expected. Kirby and the staff of Yanapuma are aware that when working with Estero, they still have a lot of local understanding to gain and are committed to ensuring that community members learn to organize, learn new skills, educate themselves, and improve the quality of life in the village.

Community Perspective

Overall, the opinion of Yanapuma within the Estero de Platáno community was positive. The villagers were very satisfied with the volunteers and how the community has been progressing. The interns and volunteers in the community have integrated well and are seen as part of the community, although they may still feel at times that they are outsiders. The community members interviewed felt that overall, the programs benefited the whole community and that the success of the program is a result of the open dialogue between the parties. The people appreciated the work being done with the water treatment but stressed the dislike of the taste that had not yet been addressed, although since my return, Yanapuma has addressed the taste of the water by installing new filters. The worker distributing the water was frustrated by the lack of organization related to her position and the slow acceptance of the water system within the village. Community members did understand the improvement in health in the village as a result of the water quality and noticed the decreased number of rashes and cases of diarrhea and vomiting.

Figure 6: A member of the women's group discusses Yanapuma's involvement in the community

The community members expressed concerns about varying levels of communication. Their primary concern was with the community's inability to communicate with the outside world. They saw this as their biggest hindrance to progress. This lack of communication had a direct impact on the success of Yanapuma initiatives because feedback often happened slowly and problems could not always be solved promptly. Also, the members of the village sometime expressed objectives of projects differently from how the objectives were described by the foundation. This miscommunication needs to be looked at if Yanapuma wants to be accepted permanently in the community

TBL Implementation Overview

Yanapuma as an organization was most certainly focused on the social pillar of sustainability. Social institutions and organization has been Yanapuma's greatest emphasis in the Estero community. In their few years of work, they have been able to provide educational assistance in the form of a library and scholarship program. They are working on bringing the community together through cooperatively structured social groups that provide a social framework for addressing capacity building and poverty alleviation. Their success in implementing sustainability on a social level involves their focus on becoming part of the community and letting the community make their own decisions about development, creating a unique sense of ownership and responsibility within the village

Yanapuma's economic model focuses on self empowerment. By not providing large funding to the community groups, the organization is relying on the community members to grow profitable and market ready businesses that will lead to long lasting sustainable growth. The training and organizational assistance provides the basis for economic growth and sustainable economic development.

When dealing with environmental issues, Yanapuma understands that there is a lack of education on environmental protection but there is an understanding on the inherent connection between the environment and public health. They have used this understanding to improve water quality and decrease pollution. They have had success implementing a small scale water system in the village helping to improve stream quality and public health in Estero. They also teach about environmental protection and health in order to help improve the incident of water-borne disease and health related issues in the village. Their implementation success surrounds linking environmental quality to public health through education programs that teach the importance of environmental management and resource usage.

Yanapuma did have a large overlap between the three pillars leading to greater success in their programs. Yanapuma's implementation strategy of sustainability dealing with the cross section of economic and social factors deals with a concern for workers rights. They are presently working against the exploitation of the villagers in cacao and coffee production. They do this by using collective bargaining techniques and community engagement. Once again, education provides a means for them to improve the standard of living in the community and teach ethical treatment of workers while addressing the concerns of the community.

Figure 7: A member of the artisan's group at work in her home

Addressing the social and environmental interaction of sustainability, Yanapuma tackles the local effects of poverty and the environmental justice issues that are present in the community. There are vast discrepancies between those with access to a healthy environment and those without access.

One of the biggest struggles that Yanapuma has faced in the community is ownership rights over land. Yanapuma has had to sort through a large quantity of information in order to address where and how to approach environmental degradation and water quality. However, they have had success addressing the local effects of environmental problems by relating these problems to health, as previously stated. By addressing environmental concerns from a socially conscious perspective, Yanapuma is able to create a more sustainable environment in the community without needing to overcome the lack of knowledge about environmental sustainability issues.

Finally, Yanapuma is able to link environmental improvements with economic benefits to the community. Exploitation of the community's environmental resources, which are plentiful in the Estero community, will not subside unless the cost of changing behavior is reduced to be within the community members' means. With the water system, Yanapuma was able to improve water quality by decreasing the cost of clean water to the villagers to the point in which it was economically viable for them to purchase water from the installed system.

Lessons Learned

Yanapuma has become a part of the Estero del Platáno community through its wide approach to sustainable development. When looking at the Foundation as a basis for other SD projects, the group has shown the importance of engaging the community early and often, as well as working on projects important to the villagers in order to increase changes of success. Engagement in the community by active participation in community events and building projects that are both sustainable and tackle a community initiated objective will improve chances of success in sustainability projects. Yanapuma also showed the importance of educating and training people from within the community in order to ensure continuity and the spread of knowledge to the rest of the members. This helps spread knowledge about simple behavioral

shifts that can be made that help facilitate the transition to a more sustainable community. The foundation emphasized the importance of communication in SD projects and the importance of understanding what the community needed and what they were willing to do to participate in SD. The importance of open, active and continual communication can be applied universally to community focused SD projects.

Center for Environment, Technology, and Development (CETDEM) – Kuala Lumpur, Malaysia

Background

CETDEM was established in 1985 as a training, research, consultancy and development organization with the established goal of improving environmental quality through the appropriate use of technology and sustainable development. The organization was established by Gurmit Singh as a complement to Environmental Protection Society Malaysia, the first organization he had established which had policy oriented goals. Singh saw that everyone was looking at development in the country through technology but doing so at the expense of the environment. CETDEM aimed to be a point of reference on how to merge a concern with the environment with development to create a more holistic concept for building the future.

The six primary goals of CETDEM are: (1) offer training on environmental management and legislation to occupational health and technology transfers, (2) hold seminars on technology and the environment, eco-development, and clean transport, (3) offer monitoring and analytical services, (4) investigating appropriate alternative energy systems, (5) provide scientific and technology consultancy services, and (6) conduct research projects and provide relevant publications for real life issues.

Model

CETDEM has differentiated itself from other environmentally focused NGOs in Malaysia by focusing on brown issues; those related to urban society, as well as having a growing concern over pollution, energy waste, and climate change. They have chosen to work through a demonstration first model. Singh's "challenge to everyone is you live it yourself; don't expect others to live it." Singh lives this mantra every day having given up his driver's license to show his dedication to public transit, retrofitting the CETDEM demonstration home to show how alternative design and technology can be implemented into existing infrastructure, and advocating organic farming through an urban community farm. CETDEM uses these projects to educate and teach in order to empower the local community to make the changes themselves.

One of the main programs that CETDEM has promoted throughout the years has been their organic farming demonstration project. Organic farming is not a well known concept in Malaysia and CETDEM has set out to teach about the benefits while showing the necessary techniques for individuals to take these skills home and spread them to their communities. They promote composting through classes and provide Harikorganic days, similar to a farmers market, where community members come out to support various businesses and community groups focused on organics in Kuala Lumpur. These events have been growing in popularity through the years and

Figure 8: Inside the CETDEM community center where the organization teaches classes regularly

CETDEM organizers see this as an example of how demonstration in the community can spread the necessary knowledge needed for sustainable change. According to Executive Director Tan, SD requires the conservation of resources which he says "may not necessarily be just natural resources, but also it could be in terms of knowledge."

Perspectives

Organizational Perspective

Tan, Singh and the CETDEM team view their organization as one set on promoting real technology implementations to the community. They view CETDEM as a chance for change through promotion of market ready alternatives that are both environmentally sound and economically beneficial. They promote their demonstration projects because they are influential in spreading knowledge and have been successful in helping to change active community member's mindsets surrounding SD. With the organic farming program, Ms. Tan, who runs that program, states that the resident associations that they work with end up having an incredible influence on the success of organic farming because of the influence they have in motivating people. She says that no matter how much they teach and promote the benefits, organic farming is not for everyone and the project has had the greatest success when the participants are actively engaged and interested in the topic.

Figure 9: Ms. Tan, head of the organic farming program discusses the project

Throughout the CETDEM organization, there was a sense that there is still more to be done. Singh stressed the importance of government involvement as the key to future success and that both the local and national governments need to promote "environmentally sound technology" over the status quo of "developing the western way." To CETDEM, the

environment is still the neglected component in development and if they can help more people become conscious of the impact that they can have on the environment, they will have greater success in promoting a sense of responsibility and ownership, something they feel is imperative to future SD. They also felt that the programs they had begun were sparking sustainability changes in other areas of people's lives and that through education in one area such as organics or sustainable transport, they are able to disseminate sustainability throughout a person's values and decision-making process.

Community Perspective

When looking at CETDEM in the community it is hard to balance the scope of the projects they have undertaken with the view and success these projects have achieved. The organic farming project, the program with the longest history, is highly regarded by those who participate as a great environmental demonstration and a great educational resource. CETDEM's team was the first to admit that this project has been disproportionately beneficial to those in the community who have taken an active role in the farming. Those involved were gaining the knowledge to conduct organic farming on their own and learning, while the group was doing very little to outreach to those that seemed uninterested. One community member said that she was happy to share the knowledge she had learned with other people and told her friends and family about the techniques she was using in her own garden. CETDEM ultimately hopes to create hundreds of these storytellers who can disseminate the organization's knowledge throughout the community.

With some of CETDEM's other projects, they have struggled to see the kind of community investment they would have hoped to create. CETDEM often tries to target corporations and the national government to spark change on a larger scale but with the

unfortunate downturn of the economy, this mission has become a greater struggle. The community has a hard time focusing on the environmental and technological issues when struggling to promote economic growth. CETDEM has worked to show the benefits of alternative technologies in improving the economy as well but without the primary knowledge in the community, people often struggle to understand this principle. Education continues to be the most effective way for CETDEM to get supportive and empower community members involved in its programs.

TBL Implementation Overview

When it comes to the TBL framework, CETDEM, unlike Yanapuma, is focused primarily on environmental factors such as energy use and land degradation when promoting SD. They are mainly looking at resource use when it comes to urban energy use. CETDEM has also had great success understanding fertilizer use and environmental management of resources within the city of Kuala Lumpur through their community center. Their implementation successes surround urban agriculture and the promotion of alternative technology such as home retrofitting as means for SD are promoted with an environmental focus.

Economics still supplies an important focus of the work done by CETDEM. They feel that the technology must be economically sound as well as environmentally sound. They want to demonstrate how organic farming, sustainable transport, and retrofitting have long term cost savings for the individual as well as the communities. They are successful in their research and development of SD principles based on the decreased usage of energy in their demonstration project and their robust urban farm and have been able to use this research to promote community knowledge and understanding.

Although the least stressed area of the TBL for CETDEM, social implementation still factors into the SD strategy of this organization. The main focus of the organization when looking at SD from a social perspective is the community building aspect of their projects including their organic urban farm/community center, their organic growing lessons, and their organic community day. They promote neighborhood collaboration and a unified understanding of SD for local environmental benefits. They do not however focus on equity issues with most of those involved in CETDEM programs coming from the middle class.

Figure 10: The CETDEM Urban Organic Farm

Looking at interactions between the three pillars of the TBL, CETDEM's focus lies in linking the environmental focus with the social and economic factors. When looking at the social criteria, they focus on linking the environmental impact on the community by providing aesthetic and quality of life benefits. Interactions between environment and economics were made by looking at the efficiencies that can be made through resource reductions. For example, with the retrofitted demonstration house, CETDEM showed that there were economic gains that could be made while also improving energy and water usage in a standard home in Kuala Lumpur.

Lessons Learned

From CETDEM's work, it was clear that it was important to spread the knowledge throughout the community through creating a base of resources that are clear and practical to everyday life. The training workshops that CETDEM organizes were valuable in connecting passionate people who may already have an interest in the topic and want to connect with others

in the community and thereby grow a network of SD enthusiasts. CETDEM showed the power of education throughout the community and its influence in spreading more environmentally friendly practices by building a network of organic growers and teachers in Kuala Lumpur. CETDEM also showed the importance of demonstration projects and using practical, already commercial technology for improving the SD understanding and acceptance in a community. The CETDEM demonstration home and their sustainable transport report showed the ability for market ready solutions to be implemented today that were both environmentally sound and economically viable. CETDEM was able to show the power of an educated community and the impact it has in creating broad SD on the local and national levels.

Masdar City and Institute – Abu Dhabi, United Arab Emirates

Background

The Masdar Corporation was founded in 2006 as a commercial enterprise that operates in the renewable and sustainable technology industry. There are five integrated units, these being Masdar City, Masdar Capital, Masdar Power, Masdar Carbon and Masdar Institute. [14] Because they can be considered SD projects, Masdar City and Masdar Institute are the focus of this case study. Presently under construction, Masdar City is intended to be the most sustainable city in the world and a clean-technology cluster located about a half hour by car outside of Abu-Dhabi, UAE. Originally designed by Foster and Partners, the city was intended to house 40,000 residents and was supported by the World Wildlife Fund and the sustainability group, Bioregional for its efforts in being a zero carbon and zero waste city. The project when originally conceived was intended to

Figure 11: Rendering of the Completed Project

cost between 18 and 19 billion US dollars although this number has been increased in more recent estimates. The first phase of the project has been completed encompassing six buildings to house the Masdar Institute, and the second phase of construction is presently under way.

The city uses a number of technologies and design elements in order to classify itself as a sustainable city. Energy usage is minimized through best energy efficient practices such as insulation, low lighting, smart meters and an integrated city wide energy management system. So far, the portion constructed has seen a 51% decrease in energy usage. The city is presently fully powered by onsite solar power with the medium term goal to be 20% supplied by onsite sources. The remaining power will come from solar and geothermal heat sites offsite from the city. Onsite solar presently supplies 1MW of power. Water consumption is also minimized with decreased usage from 550 liters to 180 liters per person per day. This is achieved through high efficient fittings, smart meters and smart management. Solid waste is managed in three streams; dry recyclables, wet recyclables (food and organic waste), and residuals with a resource recovery center in Masdar City planned for the future.

Figure 12: Masdar Onsite Solar

One of the most heavily publicized programs in Masdar is the Personal Rapid Transit (PRT), system which uses small personal electric taxis to transport people around the city. This system was planned to be coupled with electric busses and electric cars in order to provide a basis for a sustainable fleet in the city. The PRT system is being reevaluated and may no longer run throughout the city according to a number of the people interviewed due to costs of

construction. Finally, the last major design element in Masdar City was the way the city was designed to be passively cooled using traditional, dessert practices. This is done by placing buildings closer together in order to increase shade and through the use of the city's iconic wind tower which brings the breezes from higher elevation down to pedestrian level. There are a number of other trial programs going on in Masdar dealing with energy efficiency and SD such as and the aforementioned projects were just a highlight of the largest and most publicized.

Masdar Institute was established as a graduate level university for clean technology and sustainability. The university is affiliated with the Massachusetts Institute of Technology and is striving to be a top level university and a hot bed for the growing clean tech industry. The Institute has eight masters programs and focuses on three main research domains. These domains are (1) water, environment and health; (2) future energy systems, and (3) microsystems and advanced materials. [15] The first class graduated this past year.

Model

As the first non-NGO related case study presented, it is clear to see that Masdar is looking at SD from a very different perspective than the previously described projects. Masdar's primary focus is on technology. They are looking to position themselves in the forefront of a movement toward clean-tech. This focus on technology and design is what has led to the development of the city and the organization of a university. Masdar City is being presented as a demonstration project for viable technology even if the creation of an entirely new city is not as feasible in many other countries. The city has also been designed looking at ways to adopt traditional city design of the region with cutting edge technology to create SD in the given setting. This principle of combining old and new has been helpful in creating an integrated design that can be implemented in this desert project.

When it comes to the Masdar Institute's fit within the greater Masdar objectives, the institute is intended to be the source of innovation and technology that can be marketed in the future. It also hopes to utilize Masdar City as its test site for field research studies and to utilize Masdar's wealth of resources in establishing projects around the world. Masdar Institute is looking to research a broad spectrum of SD technologies in hopes of making improvements in a clean tech sector.

Figure 13: Personal Rapid Transit (PRT) vehicle

Perspectives

Organization's Perspective

Masdar is actively working to position itself at the forefront of the growing clean technology movement. As a government initiative, Masdar is intended to send the message that the UAE and Abu Dhabi are serious about investing in renewable energy in order to position itself as a post oil city. The city is intended to be a demonstration project of a sustainable low-carbon usage city and has also helped the public image of a country that is often near the bottom of most sustainability lists. One official stated that Masdar was not intended to be an example of how to build new cities but is really intended as a "test-bed for technologies that lots of different cities could adopt." As for the government control of the corporation, one person in the ministry stated that it offers a lot of benefits in that the overall mission of the country, which largely determines the mission of Masdar, is streamlined and unified. They also stressed the symbolic value of the project for the country and for what SD can look like on a larger scale.

The view of the University is that it is separate from the rest of the Masdar Corporation. A member of the outreach staff compared it to "the thumb of your hand" in that it is part of the same body but sticks out with its own finances, procurements, communications, etc. The goal of the University is to create a top world research institute. They view their project as encompassing the three pillars of sustainability by incubating new ideas and by being technology focused. They admit to having less of a focus on the social side of SD as they appear to be focused more on the elite members of higher education. To those working at Masdar Institute, SD research is imperative to promoting this development worldwide because it will help to create viable business models and competitive technology that can compete with more unsustainable models and technologies.

Community Perspective

The community interviewed in the UAE included Masdar professors, students and facility managers as well as a number of civilians living in Abu Dhabi. The community was mixed on its feeling about the Masdar Initiatives and their success. There were a lot of questions about whether the city would have a real impact on the SD around the world or whether it was just a government publicity move. One Abu Dhabi resident working in sustainability called it an "oasis in the desert" that was more of a publicity stunt than an actual demonstration. Another member of the community retorted that they would rather have an oasis than more deserts. This resident stated that "cities are like a sum of so many moving pieces that the whole model of wholesale will never work" when it comes to applying this model elsewhere but it will provide some transferable technologies that could be used in other cities. She stressed how technologies such as energy efficient technologies, passive cooling designs and renewable energy integration can be implemented into a number of cities, new and old. Thus, there seems to be one sector of the

community that questions the cities applicability for other settings and think it is a frivolous waste of money while another sector sees it as a great way to build awareness about SD at home and abroad even if it doesn't all go according to plan while helping to further develop certain implementation technologies.

Similarly, within the University, there seemed to be a sense of urgency and a desire from Masdar students, professors and facilities management professionals to see the project further along. These individuals had all come to Masdar Institute in hopes of being part of one of the most technological advanced University dealing with the hot topic of SD. They expressed hope that the Institute would reach this point but wanted to see more progress made on the construction of the City which would lead to expansion of the University facilities as well. An outreach manager expressed a desire for greater outreach to the youth of Abu Dhabi in order to help increase the knowledge and behavior of the local population. Many of those working and studying at Masdar Institute are both passionate and concerned with what the future holds for the University, hoping for its continued growth although concerned that it does not lose its mission of being a world class graduate research institute.

TBL Implementation Overview

Masdar City and Institute both focus on technology as a means for SD success. This resulted in a greater focus on the economic and environmental factors of SD with social sustainability taking a more supportive role. Environmentally, Masdar was focused around energy usage and waste, and water management. This resource conservation approach to the city was successful in creating huge reductions in usage and great increases in renewables. Economically, the city had a great focus on showing the viability of certain technologies and the practical application technologies such as smart metering, solar energy usage, and air flow

control can have on creating a sustainable city. There is also a great focus on economic growth and research and development, two key factors of economic sustainability as the Masdar Corporation is looking to produce clean technologies that are market competitive.

Masdar has done little to foster social sustainability which could be a direct contributor of the public's perception that Masdar is trying to convey themselves as an elite company with an elite university. They have eliminated their programs working with elementary age children and are isolated from the larger Abu Dhabi population. They have held only one community day which did allow the community to feel proud of this symbol of sustainability in their backyard. However, the creation of a University helped to create a long lasting community in the first phase of the project and helped to give this community a unified identity that will allow it to continue. The social focus of the project could be improved with more integration of the larger community and a greater focus on educating the uneducated in SD and social equity.

The environmental and economic interaction of the three pillars was the primary area stressed in the Masdar Initiative. The project design emphasized efficiency and the benefits it had for both the environment and economic costs of the city. The government, being the financier of the project, helped to promote SD in a way that renewable and clean-technology becomes more economically viable and is incentivized in Abu Dhabi. Adding social components to the program could likely lead to greater traction in the Abu Dhabi community with greater support and growth of the city and institute.

Lessons Learned

Masdar successfully demonstrated the ability of technology to meet a number of our SD needs. It did show that technology such as solar energy, efficiency technologies, and cooling can be sustainably implemented to decrease resource use and increase sustainability of construction

designs. Once again, it was shown that this does not always hold the complete answer and that without the behavioral side of SD, the goal of a sustainable clean tech city may not be realized. Ultimately, Masdar was able to make huge strides through design toward living sustainably but has also faced a series of setbacks that may have been improved with a better community.

One aspect of the design of Masdar that proved to be incredibly important was the utilization of traditional designs in a modern way. This was primarily seen in building the University facilities in a way that could provide shade and handle the harsh desert environment. This looking to the past offered huge advantages in design because these traditional designs were based off a time where resources were conserved due to necessity and limitations. Adoption of traditional designs can be a valuable way to improve SD projects.

Figure 14: Traditional Elements Incorporated into a modern design

Finally, Masdar City and Institute showed the importance of implementing high technology in a functional manner. For example, using a PRT system seems intelligent and a raised city would benefit from higher winds at elevation but having to construct an entire six square kilometer city two stories above ground may not be practical or sustainable. Planners must balance these new technologies with raw material use as well in order to look at the true sustainability of a project. As a demonstration project, Masdar has shown that research and development, whether it is in a city setting or a university setting, will allow for progress and improvement to implementation of SD but will not be the complete solution.

MORE Food Hub/Perpetual Prosperity Pump Foundation – Accra, Ghana

Background

The Perpetual Prosperity Pump Foundation (PPPF) was founded in 2004 as a way to provide appropriate technology transfer for small rural farms in Africa. The organization works by collecting donated, used athletic shoes that are then shipped to Ghana and sold as the funding source for development projects. Not only does this product stream help fund PPPF's development work and support sustainable agriculture but it also has the environmental benefit of keeping these shoes out of United State landfills. Jim Riordan, the founder and director of PPPF has been using this method to guide Ghanaians down a path of self- sufficiency and sustainable agriculture.

This past year, PPPF opened their MORE Food Hub in Accra, Ghana. MORE stands for modular, organic, regenerative environment which is the overarching model used and discussed in the model section below. The Hub is used as a research facility for optimizing production of organic vegetables and the utilization of low tech farming methods such as drip irrigation. Presently, the Hub has been working on the best varieties of tomatoes to grow in Ghana's climate. They have also had success with the introduction and improvement of mushroom growing techniques and have more recently begun developing chicken rearing practices in order to improve livelihoods in this West African country.

Since the start of the MORE Food Hub, PPPF has worked with two adopted villages and two NGOs as testers for the various techniques in their community. These communities are given the initial supplies to set up their own vegetable gardens using a drip irrigation system and assistance in setting up nurseries. The organization also helped the groups in the community that have been involved, 10 families in one village and 15 families in the other, organize into

cooperatives in order to balance the workload, handle profits, and make decisions collectively. The NGO has also been working to optimize compost production as composting has become a lost agricultural method with the increased presence of fertilizer and educate the villages on the positive impact of recycling their waste for use in agriculture. The hope is to use the Food Hub to increase profits for villages as well as create a self-sufficient research facility that markets its produce to the local community in order to continue to progress this society toward more sustainable agriculture practices for years to come.

Figure 15: Low-tech drip Irrigation system growing tomatoes at the MORE Food Hub

Model

PPPF approaches all its sustainable agriculture practices through the lens of its MORE structure. MORE stands for Modular Organic Regenerative Environment. MORE uses a small scale modular design in order to be adaptable to almost any climate and allow for constant growth while accommodating periodic economic shifts and the growing threat of climate change. Every system is designed to be portable and reusable in order to increase small farm productivity while creating a positive regional impact. This also allows for easy expansion and growth with success and a closed-loop recycling stream that is both sustainable and long lasting.

Figure 16: Cooperative member picking mushrooms from a MORE mushroom hut

Organic farming is an important part of this model. PPPF aggressively promotes organic fertilizers and locally sourced natural pesticides. Similarly when

PPPF approaches organic farming, they include other aspects of sustainability such as renewable energy that will eliminate the need for fossil fuels. To the organization, by eliminating the associated pollution, they are improving the health of the local ecosystem and thereby benefiting the community.

MORE farming promotes a vertically integrated approach where sustainable management of natural resources and protection of natural biodiversity is promoted. The program is set up to be regenerative in that it can be sustained indefinitely without concern for loss of nutrients, resources, or equipment.

Figure 17: Standing around the MORE systems, the cooperative collects their mushroom harvest

Finally, the environment is of the utmost importance in improving the micro-farm environments and the ability for farmer's to continue to sustain their businesses. The MORE systems are intended to be natural living systems that create sustainable growth in the community. PPPF hopes that each system will help enhance the overall environment in the community by working to mimic nature.

Perspectives

Organization's Perspective

The Foundation's formulation of the MORE program was still in the initial phase. The Hub is seen as a valuable research tool that is being effectively utilized to implement best practices in sustainable agriculture. According to Elaine Brown, the director of the Hub, the greatest challenge has been in the education of the community members. The community members are not versed in drip irrigation, water collection or composting. Thus, the process of teaching community members these skills while encouraging them to begin their own sustainable

agriculture efforts at the same time has been a difficult process in the first few months of the research center. Also, the foundation was forced to rethink its strategy of research, when the first MORE system which involved the modular mushroom structures, was not as profitable as they had expected.

Figure 18: Teaching the Anum Cooperative sustainable agriculture techniques

PPPF has developed a relationship with the villages but this relationship has not been without its challenges. Within the villages, the cooperatives have been effective in creating a sense of community but there have sometime been challenges with group decision making about profit sharing and work load. Kaitlan Burke, a volunteer with the organization at the time of my visit, felt that there were often breakdowns in communication. The cooperatives did not always understand the assistance that the NGO was relaying and the community was not always prepared to meet with the NGO when they journeyed to the villages. This has forced the Foundation to have a more hands on approach in the village with researchers from the Hub going to the villages weekly to provide instruction and check on progress. According to staff at the Food Hub this has drastically improved the success of the village trial programs and is translating into greater communication between all parties.

Community Perspective

The community members interviewed for this report felt similarly about the need for greater communication with the organization but felt good strides were being made. When I accompanied the researchers on their site visits, I often found that the community members were unsure about certain elements of the growing process and were confused about how to approach the tomato growing operations. They were however eager to learn and improve on the production of this project. In the village of Anum, one of the two villages, the cooperative was hoping to have enough funds from its mushroom growing operations to expand to have more capacity to grow and had in a sense developed a mushroom market in the village.

The community members were very thankful for work being done by PPPF but it also became apparent that the approaches they were working with were entirely new to the communities. This led to the necessity for a large amount of training and assistance on the part of the Foundation members. Also, one researcher felt that if the Foundation had focused originally on agricultural produce that was familiar to Ghanaians, such as Tomatoes before starting with mushrooms (the organization has since started teaching tomatoes farming first), the adoption time would have been quicker and profits may have been achieved in less time. Also, another researcher felt that instead of immediately going into the villages, the Food Hub should have conducted its research for at least a year, improving its practices and finding the best growth methods for the region, thereby increasing chances of success for the villagers. Overall however, the PPPF organization and the MORE Food Hub were seen as incredibly beneficial to the communities and was beginning to lead them down a path toward self-sufficiency.

TBL Implementation Overview

The MORE Food Hub has successfully shown how sustainable agriculture can be approached in a way that addresses all three pillars of SD. The Hub teaches the power of a

sustainable income by requiring communities and the Hub to prove economic success before assisting with expansion. They are also working heavily in research and development that can be used to improve the productivity of projects. There are four full time researcher's who work at the Hub to improve sustainable agriculture practices. Also, the MORE model requires that the community cooperatives invest back in expansion in order to continue the success of the programs and spread the prosperity to the rest of the families in the villages.

Environmentally, PPPF is focused on using an integrated system that manages resources and preserves biodiversity. They have also made organic farming key to their mission further working to lessen the environmental impact. One can also look at their initial funding through the US shoe collection program as another environmentally sustainable method for promoting recycling and lessening emissions associated with landfills.

As an organization set on "feeding all of Africa" as stated by one volunteer, PPPF addresses the social side of sustainability by promoting standard of living increases through sustainable agriculture as a small business. They also provide the education and training for the community to grow on their own. One researcher reflected on how the communities were even coming up with their own innovations to the process saying that "one of my colleagues went to a community and they saw the same structures we have here [with the mushroom huts], but the doors looked different." They had modified the structure improving the longevity of the modules. The communities have become invested in the projects and feel a sense of ownership as a result of the cooperative structures and the empowerment given to them in the decision making process.

MORE also does a good job in looking at the intersections between these three areas of SD. When it comes to the economic and social interactions, the cooperative structures are a

prime example of how monetary decision making can be done through a social and collective process. This has allowed the projects to flow in the direction that is good for the community with the NGO acting as a guiding overseer. The interaction between this economic focus and the environmental aspects has resulted in improved efficiency when it comes to resource use. Water is a prime example, with water collection an important resource for the Hub that is otherwise forced to buy clean water for potable and irrigation purposes. The water collection utilizes available resources while saving monetary resources for other areas of need. The focus on local effects has a large impact on the intersection of social and environmental responsibility. The project allows for the community to make an investment in the quality of soil and other aspects of the local environment. The MORE Food Hub is successful in linking these three areas of SD around the principles of sustainable agriculture in a way that leads to lasting success, environmental health, and societal improvements.

Lessons Learned

The MORE system has a number of highlights that could make it a very successful model if utilized in other areas, especially in other developing nations. At first glance, the most critical element of the MORE system that has allowed sustainable agriculture to be successful in the communities has been the success of the cooperative structures. Beside the expected occasional disagreement, the cooperatives have allowed the communities to come together around a common goal for the betterment of themselves and their community. Another important aspect of this project that has the potential to be utilized further is the importance of creating a sustainable economic model that anticipates expansion. The MORE system expects continued growth and expansion that is environmentally friendly because of the strides it is making in community development. With these two processes, a SD organization will be able to work on economic growth and continuity in any setting.

Energy Academy/Renewable Energy Island Project – Samsø, Denmark

Background

Figure 19: Samsø Island

The story of Samsø began in 1997 when the Danish Minister of Energy announced a competition for a local area or island to present a plan to become entirely self-sufficient within ten years through the realistic use of renewable energy. A group of individuals on Samsø, a small conservative island of roughly 4,000 people, saw this as an opportunity and submitted a master plan to the competition. The initiative was led by two people, one of which is still involved in the project today, Søren Hermansen. They presented a plan that focused on three major areas: heating, electricity, and transportation.

In order to become self-sufficient with heating, Samsø utilized a resource they had abundantly on this agricultural island, straw. They established four small district heating plants and a pipe network that could utilize the biomass from the island and encouraged those who were not hooked up to the small local district heating facilities to utilize wood-burning heaters rather than oil burners. The local customers of the plant's heat are financial investors in the facilities

further incentivizing this community's use of renewables. Additionally, the community invested in eleven 1-megawatt wind turbines which were installed in three clusters on land to account for the energy use on the island and ten 2.3-MW offshore turbines were installed to offset the amount of CO_2 from transportation with the equivalent amount of carbon-free energy. The energy supplied had an agreed upon purchase price from the Danish government which incentivizes this wind generated power source. Of these turbines, a number of farmers and community members own shares with some members of the communities even owning their own turbines. On the island, there are a number of smaller scale PV and solar thermal installations that help further supplement the community's energy usage. Presently, the renewable energy team on the island is trying to improve the availability of alternative transportation on the island in order to not just offset transportation emissions, but to eliminate them.

Figure 20: Samsø's Offshore Turbines

One of the most influential aspects of this project has been the Samsø Energy Academy which was set up as part of the program to both guide the renewable energy transition and educate both the local and international communities about their efforts. Led by Hermansen, who has become an international representative on renewable energy and effective implementation, the Academy promotes new initiatives such as their present push for biofuel busses, and continues to help manage the renewable energy on the island. A large part of their work has dealt with helping researchers and visitors like me understand how the island's model of SD can be utilized anywhere. Additionally, the islanders have seen the project help prevent

the rate of economic decay on the small island that was in the thick of a localized economic depression after the major factory on the island closed its doors right before the project began. Through their great successes and their work in implementing renewable energy projects on the island, Samsø surpassed the ten year goal to become the world's first renewable energy island finishing the task in eight years and exporting power to the mainland. [17]

Figure 21: The Samsø Energy Academy assisting researchers and visitors to the island

Model

Samsø had a very detailed plan from the onset of this project and has stuck close to it in accomplishing the conversion to renewable energy. This review cannot fully discuss the plan but can provide an overview of some of the aspects of the project that have been most heavily researched and discussed throughout the years. The first aspect of the project is their focus on local resources as well as local ownership. Most of the technologies implemented on the island are owned and operated by the local population many of whom work in the agricultural or tourist industries on the island. This cooperative ownership structure was an important part of the project when looking at the social benefits for the island. By passing along the profits of the project to the community members, the renewable energy island team was able to get a larger buy-in from the community and saw larger support when offering shares for the turbines.

Another important aspect of the project is the importance of using existing and realized technology. Samsø was not trying to implement technology that seemed "new and crazy" They

looked for technology that could be implemented in an economically competitive way at the time the plan was submitted. This helped in the success of the project by allowing the project to immediately move forward without any further time needed for research and development. According to Hermansen, one of the reasons, the master plan was chosen, along with the idea of community ownership, was because of its focus on proven technology.

The final aspect of the Samsø model that is most important to this research is examining the population and confinement to an island for which to implement the SD project. In the case of Samsø, the lines were easily drawn and the community was clearly defined. This allowed for Hermansen and the Academy to more easily target the right demographics and know the community on a deep and personal level, allowing them to better convey what this project would provide for the island when completed. Samsø's success in achieving its renewable energy target can be closely related to the strong sense of local community on the island and the utilization of this community in achieving a key shift in energy usage.

Perspectives

Organization's Perspective

The organizational view of the renewable energy island project is hard to differentiate from the community view as all the members of the staff are residents on the island. By all accounts, the project has been a remarkable success. They were able to convert to 100% renewables two years ahead of schedule and were able to get a great deal of support from the community. When observing and interviewing Hermansen, it was clear to see that for all his humility, he was a driving factor in this process and few felt that it could have been successful without him. The group is also honored to have been given so much respect on the world scale, understanding that although impressive, the island is but a small dot on the world radar when it

comes to emissions and climate change. The project has allowed members of the Energy Academy to explore other areas of SD and work on further improving the quality of life on their small island.

The one area in which most staffers at the Energy Academy still wanted to see improvements was in the area of transportation. To some extent, they felt as though using the off-shore turbines to account for their onshore emissions for transportation was a "bit of a cop out," as one staffer put it. They would love to see more of a push for electric vehicles and alternative liquid fuels on the island. Also, they would like to see more of a lifestyle change from members of the community in the sense of conservation of energy and resources. Although total energy usage of the island as a whole has not appreciably changed in the 13 years of the program, per capita energy usage has increased slightly. This has been offset by a decrease in population on the island. This is something that the Samsø Energy Academy staffers would love to see change through greater education in energy management.

Community Perspective

The community was overwhelmingly supportive of what was being done on the island of Samsø. Many of the people interviewed or who had informal conversations with me had invested in one of the cooperatively owned projects. This was for a variety of reason, the main two being the "feeling that we are doing something good" or "the investment." Although not an investor in the project at first, one resident recalls how it became "more clear to me that it was not just ideas, it was something physically

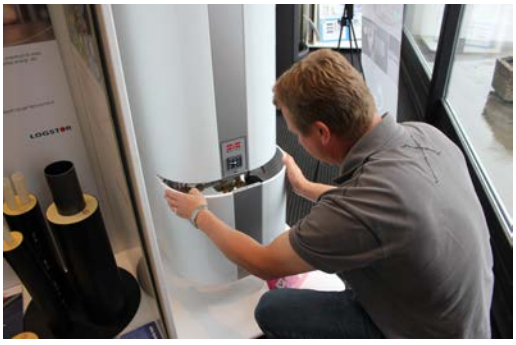

Figure 22: A local plumber explaining a house heating unit that works with the district heating plant

happening, something changing." This resident eventually became so involved that she chaired the board that managed one of the cooperatively run turbines. The community members see this project as both sound economically for the island and a great way to open new areas of business. For example, the island electrician discussed how he was able to help local residents manage their new renewable energy sources and help people integrate the technology into their homes.

Many of the discussions with residents focused on how the project had improved or changed the community. The residents often touched on similar areas such as instilling a sense of pride in the island and making the residents feel as though they were part of something larger than themselves. Few residents, however, felt the project affected their day to day lives. One resident mentioned that the project changed the way they thought but that this thinking was "unconsciously" different because the project has become part of the island's character and has left many of residents with more expendable income and a greater sense of community. More outwardly, a number of the islanders have invested in their own renewable energy projects, wanting to be part of the renewable energy island mission. From solar thermal heating to small wind turbines to rapeseed oil tractors, a number of residents have found ways to decrease their own carbon footprint, with many of the projects putting more change in their pocketbooks. The resident's of Samsø have been able to rally around renewable energy sparking a sort of renaissance for this once decaying agricultural community.

TBL Implementation Overview

The focus of Samsø's renewable energy island started with just that, renewable energy. This would lead one to believe that the project was primarily focused on the environmental pillar of SD, but after completing the case study on the island the economic and social benefits were equally, if not more important, to the success of the implementation of renewables. The project

was able to decrease carbon emissions and prove self- sufficiency in energy through renewable sources profitably with most of the initial costs being recovered, as well as the present profits from the systems going directly into the pockets of the residents. Some have seen this to a greater extent than others, as only a few farmers were given the permits to own their own turbines, and some businesses have disproportionately benefitted from the expansion of the renewable energy sector on the island.

The social side of the project has been one of the largest implementation successes of the project. The team at the Academy was able to create a sense of pride and community around these renewable energy projects. The community came together effectively through structured cooperatives that allowed for a unified decision making process as well as creating a social lubricant for which residents could learn and share ideas surrounding SD and renewable energy on the island.

This led to the integration of social and environmental factors that instilled some with a sense of "good feelings" surrounding what was being done on the island. This interaction can be effectively measured by the large number of individuals who have made an effort to install a renewable technology. One retired school teacher had a pleasure displaying his newly installed solar thermal and PV panels that he installed this last year because "it was better than putting his money in the bank." This conservative farming community has been able to rally around renewables leading to the continued expansion of renewable energy on the island and a more sustainably oriented population.

The interactions of the environmental factors with the economic factors can be mostly seen through the governmental involvement in the programs. The competition and the feed-in-tariffs (the set price of renewable energy, guaranteed by the government for X number of years)

were both effective in ensuring the economical shift to more environmentally sound technology. This interaction between these two pillars can be seen as a large influence in ensuring the success of this SD project.

Lessons Learned

Samsø has a very successful model when it comes to SD projects dealing with renewable energy. Their success can first and foremost be linked to the way in which they created community buy-in as a result of the ownership structure of the turbines. The community saw the power of such a project when the economic benefits were passed on to them. Also, this project showed that large shifts toward sustainability can be made with minimal changes to lifestyles. The energy usage on the island was converted to meet demand but the demand was not restricted. Whether this can expand to a larger scale is still yet unseen but large jumps can be made through shifts that do not affect people's day to day lives.

Finally, Samsø has shown the power of creating unified stakeholders through creating an "island." In Samsø's case this was an actual island, but Hermansen and others at the Academy are working to get people to realize that an island does not necessarily have to be a physical island but can be a group of closely geographically related individuals who when unified in a SD project can see the local benefits first hand. They think this local orientation helps to create a positive change that disseminates through the communities. Hermansen often uses the phrase "think local, act local" as a way in which we can all make positive impacts on our local community toward a more sustainable society.

Sustainable Smaland - Växjö, Sweden

Background

Växjö (pronounced Vequa) has been working since the 1970's on programs that would now be classified as SD projects. Their successes led to a BBC report in 2007 naming Växjö the "greenest city in Europe." The city has a population of 82,000 and is surrounded by a heavily forested area. Växjö has combined its various sustainability programs into the Sustainable Smaland initiative which works to not only continue the policy oriented initiatives but also spur economic growth in the city. The programs and initiatives set up by the city have led to a 34% decrease in CO_2 per capita in the last 15 years with 81% of the city dwellers believing they are environmentally aware and 26% purchasing their food locally. [18]

Växjö has embraced this title as "greenest city" and has concentrated their efforts on a number of effective SD projects. The first project installed in the 80's, was the large scale combined district and heating plant or CHP for short. They have been able to utilize the burning of biomass, in this case locally sourced, sustainably managed timber from the surrounding forest, and utilize it in both the production of heat and electricity distributed throughout the small city. They have also organized a number of other energy related projects such as sponsoring an energy efficient school saving 21% on energy annually, using absorption cooling in the hospital decreasing CO_2 emissions by 4,000 tons, and

Figure 23: The city's CHP plant

working to promote the installation of an urban windmill expected to produce 15,000 kwh annually within the city limits.

Figure 24: A Timber Constructed Apartment Complex

The city has also worked to maintain a number of housing policies that help to improve the sustainability of the city. The city planners have worked to maintain a high population density in order to lessen the impact that the housing stock has on the environment. The biggest effort has been in the area of timber construction. The city is utilizing its local abundant resource, timber, for a number of projects. The largest effort has been in large scale timber construction where they have been able to use timber in many applications where steel was previously the norm. This has decreased transportation, decreased energy use by 35% and eliminated outsourced labor when building new homes and buildings in the city. This, coupled with a number of passive home designs, has allowed Växjö to create a more sustainably oriented city.

These initiatives along with a lake restoration project that began in the 70's and other, smaller, more community oriented projects have led to a focus on SD within the city limits. They, like many other towns and cities in Europe are not yet satisfied with their progress and have been working on increasing small scale wind farms, utilizing bio-gas from food waste, and promoting alternatives to fossil fuel transportation methods.

Model

This section is adopted from the City of Växjö's published Environmental Programme which was approved in 2006 but dates back to work done as early as the late seventies. This programme is a top-down approach to sustainability initiated by the government. Växjö has set targets in three different profile areas: Living Life, Our Nature and Fossil Fuel Free Växjo. Each area has a number of targets for the city of Växjö with a set of follow up indicators, and each target is assigned to a specific city board. The program is intended to work cyclically with the preparations leading to an action plan and implementation process. This would then be followed up with ecological reporting leading to reevaluation of the implementation and further preparations for the next steps. This process is intended to ensure progress and work to prevent lame-duck policy with a lack of follow-through.

When it comes to the three profile areas, Växjö has given very detailed definitions and areas of interest that they are beginning to target in moving toward sustainability. In the area of Living Well, they are striving to make consumption and production resource-efficient and non-poisonous by working for ethical and local food stuffs' popularity and use in the community to grow by 2015. With the city's Our Nature Profile, they hope to further improve the quality of parks and natural water systems by promoting the continued restoration of their major city lake. Finally in the profile area of a Fossil Fuel Free Växjö, the city is working to eliminate fossil fuel use by promoting renewable energy use and improve efficiency in homes while decreasing energy use per capita. These targets lay the foundation for work being done in Växjö and have allowed for a unified mission within the city government.

The Växjö Commune has been able to promote these many initiatives through a combination of early commitment and education that has allowed for continued support for such

programs within the government. Växjö believes in a multifaceted approach to SD that has tackled issues as different as local food and high rise building construction while sticking to a unified set of targets that the community can support.

Perspectives

Government Perspective

The Växjö Commune has been committed to SD strategies since the early 70's. They have promoted a truly holistic approach to the topic. They began with more of the technology side of the issue, feeling it necessary to restore their lake and use locally sourced construction materials and have now added the social and community aspect of the topic. They have felt that by setting mandates and city wide goals, they were able to achieve the most comprehensive advancements in SD. Those working on the Sustainable Smaland project also have worked to promote the city as part of the program looking mainly to attract new industries interested in promoting SD. They feel that this is a good way for the city to take advantage of its early successes and promote community growth. They have had some difficulties, however, with the longevity of its programs. For example, the lake has once again started to be polluted, begging the question of what misguided information was used when planning the project. With these projects, the government feels passionately about promoting SD strategies and working on a variety of projects to promote their success, but the complexities of the various issues are often hard to understand.

Community Perspective

The Växjö community has been supportive of the various SD projects. Many of the community members understand the importance of the projects but feel that it is the government's job to manage and ensure success without affecting the day-to-day life of

residents. Community members often were aware of Växjö status as "greenest city in Europe" but did not necessarily have an idea of the various programs. They were aware that they had district heating from a CHP plant but did not necessarily understand how that made them more sustainable than other cities. Similarly, some residents felt that the promotion of SD in the community was being used as a marketing tool. While they saw some programs, they questioned the overall implementation of the programs. That being said, a number of community members were seen utilizing various community oriented SD projects, such as a local market and the many bike paths throughout the city. Also, in Växjö it was observed that the community was more aware of the environmental side of sustainability. The Swedish culture very much values nature with laws to protect public access while maintaining environmental quality. People in the community embraced this environmental responsibility in their day to day lives. SD while not the primary focus of people's lives, and seen as a government responsibility, did factor into everyday life in Växjö.

TBL Implementation Overview

Växjö's diversity of programs within its three profile areas is what has allowed the city to successfully orient itself in the direction of SD. This began with an environmental focus in the city when the lake needed restoration, leading to a rethinking by the local municipality on how it approached environmental issues. They have been able to move toward environmental sustainability through close monitoring of pollution and effective use of their local timber resources, looking for new ways to utilize their renewable resources. The city has approached this with an economic mindset as well by effectively documenting and organizing these programs under the Sustainable Smaland title, giving them an outlet to advertise the city's benefits to companies looking to relocate. These programs have also been economically

Figure 25: Sustainably sourced local timber used for the CHP plant

beneficial to some residents, even without their knowledge, as the cost savings with greater home efficiency and economic growth in the city have direct individual benefits. Research and development can also be seen as an important part of the SD mission in Växjo. The city works closely with Linnaeus University to improve the efficiencies of their programs. The final pillar of sustainability is addressed in other, more community oriented programs. These programs, such as a promotion of local agriculture and outdoor education have helped spread knowledge of sustainability with a majority of the community on board for further progress.

The areas of SD interact in Växjö in a variety of ways. Through the education on local environment and quality of life benefits, Växjö is able to link the social factors of sustainability with the environmental ones. The concern for the environment has been strongly coupled with the economic incentives of sustainability through government support of projects and efficiency improvements such as with the promotion of district heating and passive homes. Finally, the economic focus of sustainability has been linked to the social factors due to a concern of ethics strongly supported by the municipality. They promote the use of fair trade products and have been promoting locally sourced food with regular markets as a way to both lessen costs while being more equitable. Växjö has been able to do a variety of different projects coupled together to address growing concern about development patterns and have utilized a wide variety of TBL principles to initiate SD in their community.

Lessons Learned

Within the Växjö case study, it is apparent the effect the government has had on the city's move to SD over the last 30 years. The government showed that a top-down approach can often be utilized to create change for a large population. They effectively instituted mandates that pushed for larger focus on timber construction and pushed forward research that led to the large replacement of steel, saving both energy and money. They also showed the power of creating building districts, whereby all building in a certain area had to meet a set of standards. This not only pushed change but it placed a premium on the work being done there, helping to spark interest in the district while pushing forward progress. This top down approach, while often criticized by those who feel grassroots efforts were more sustainable, showed that it can be a powerful approach to sparking change on a larger scale and helped to influence the mindset of the community.

These projects also helped show the power of thinking outside the box and pushing forward research. The Växjö initiatives were often new and untested, but through effective research, both experimentally and in the field, Växjö has utilized the technology to make significant reductions in emissions and resource use. For example, the local university has been instrumental in advancing the use of wood for construction within the community through strength and safety testing and research. Växjö's focus on rethinking the way we design and stepping out of the status quo to move toward more sustainable means is a powerful lesson for any community trying to transition to a more sustainable society.

<u>Bedzed Community and other London Initiatives – London, UK</u>

As the last stop on this research trip and the last country discussed in this report, the United Kingdom's London initiatives were looked at differently than the previous six countries.

Due to time constraints and difficulties in setting up interviews, a community comparison of perspectives could not be gathered. As a result, the following discussion will provide a background and model of two initiatives followed by an overview of the TBL and lessons learned. This section is unfortunately less developed then previous case studies because fewer interviews were conducted as a result of the constraints. That being said, the key findings do factor into the rest of this report and the organization of the COSD framework and are therefore crucial to this thesis.

The BedZED Housing Community

Background

Bedzed is the UK's largest mixed use sustainable community of about 300 units that was completed and occupied nearly a decade ago. The project was billed to be one of the largest and most advanced net zero energy developments, in that the energy usage of the community would equal the local energy generated onsite due to an advanced building design. BedZED was initiated by Bioregional, ZEDfactory, and Peobody Trust who worked together to create a facility where a person's impact was lessened to the point that, if everyone were to reach this level, one planet would be all we would need to sustain the earth. Currently three planets would be needed to sustain the typical London lifestyle

Figure 26: The Bedzed Community

This was a considerably lofty task and through their work,

they were able to reach a point where 1.8 planet living was achieved. Through modern design elements, BedZED was able to decrease energy use for heating by 81% and electricity use by 45%. Unfortunately, their local CHP is no longer in use as the operating company could no longer do so profitably as a result of gumming in the machine caused by lack of proper biomass imput. They were able to reduce car mileage by about 64% and community members knew twenty of their neighbors by name, a much higher amount then in other London communities. Finally, the community saw a 58% reduction in water use, a 60% waste recycling rate and an 86% organic food consumption rate in the 10 year span. [19] These rates are all significantly higher than the local average for the surrounding communities. Although not able to reach completely 100% net zero energy, BedZED was an amazing improvement on modern community development and was able to demonstrate how a holistic approach to both design and community could lead to changes in lifestyle.

Model

BedZED uses a holistic approach to SD in order to create change at all levels of society in this live/work community. They use design to solve resource problems such as heating and water usage. A key component of this was the use of passive solar throughout the complex. They also try to encourage residents to make sustainable choices by designing ways for these choices to be easier on their day to day life. One good example of this is their use of in home smart meters to provide people with better choices on when to use energy and knowledge about how much energy they have consumed. Finally, they have encouraged the community to expand programs and develop their own groups that would further connect them to their local environment. BedZED's holistic approach was guided by ten main principles that worked together to create this SD community. These ten principles are: (1)Net Zero Carbon, (2) Zero

Waste, (3) Sustainable Transport, (4) Local and Sustainable Materials, (5) Local and Sustainable Food, (6) Sustainable Water, (7) Natural Habitats and Wildlife, (8) Culture and Heritage, (9) Equity and Fair trade, and (10) Health and Happiness. [19]

TBL Evaluation Overview

BedZED's holistic approach to sustainability has allowed it to look at all three pillars simultaneously. Bioregional has approached environmental sustainability looking at an overall target of zero. These targets were not completely achieved but they were able to show that through redesign of a typical home, for example having the living room on the second floor which allowed for bedrooms to be cooler while living spaces were heated by greater sun exposure and using air-tight home design, one can save on waste heat. They were also able to reduce living costs by encouraging consumption of local community produce and working to make the cost of living in a community such as this one as close to the London standard as they could. Socially, they focused on keeping a mixed use community, building a sense of community through programming and encouraging neighbors to interact.

This project did seem to struggle however when looking at how these three areas overlapped and how they would interact as they moved forward. One prime example of this is the CHP plant. The CHP plant eventually had to be shut down because the wood that was being locally sourced was causing tar to deposit on the boiler. They could have used further away resources or constantly fixed the machine but these options no longer allowed the small scale CHP plant to be economical. Also, the planners expected lower CO_2 emissions due to a larger decrease in vehicle passenger miles than the decrease observed. This can be attributed to the lack of changes in the outside world which then hindered the development in the electric car fleet, as well in the slow progress of their local car share program. They did have some success in

secondary interactions between the three pillars in their focus on fair trade products and their mastery of efficiency in houses which can be utilized by developers in the future. They saw that in order to truly have these three factors interact however, a number of criteria need to be considered holistically.

Lessons Learned

A study of BedZED shows that even in a relatively small, 100 unit development community, there are complex challenges and a number of factors need to be established in order to achieve a balance. In developed countries such as the Great Britain, behavioral changes may be the hardest and most strenuous process for any SD project. Many people have grown accustomed to a certain lifestyle, and projects need to find effective ways to get the buy in from the community. However, this project also showed that technology shifts do matter and can reduce a bulk of the energy use and emissions if implemented holistically and with a good sense of the community use habits. These technologies also showed that they cannot be used to reach a net zero building in every principal category that the BedZED planners had defined. Despite its shortcomings, BedZED showed that technology developments and an updated infrastructure may be a crucial first step toward a more sustainable community.

Get More – A Sustainable Enterprise Organization

Background

Get More is a sustainable enterprise organization working to promote job creation and community development in London. They have decided to work primarily with disadvantaged youth to foster talent, creativity, and passion into profitable business ideas. They feel that the global recession has been hardest on this group, leading to a lack of work experience for 16-24

year olds. The organization works as a social enterprise incubator (SEI) that fosters the youth's creativity, helping them develop sustainable business ideas and helping the most successful ideas become a reality. After helping the young adults start their business, they allow them to take the reins as the CEO of the organization. Get More was the winner of the National Sustainable City Awards, the UK's largest sustainability awards, for "Sustainable Procedure" in 2011.

Model

This organization operates under a quadruple bottom line. Their four criteria areas are (1) training and development, (2) creating viable businesses, (3) aiding the community, and (4) increasing the employability of youth. They focus on these four areas not only because they feel that businesses can have a social impact on their communities but also due to the belief that by giving youth the skills to work in collaboration with others they can build new opportunities. "Ventures that are aimed purely at economic gain are losing popularity…as the importance of all around sustainability takes centre stage." [20] Their businesses also have a "green" component, which they feel supports their mission of building the community. This can be seen in their first group of ventures; Thrifty Couture, a clothing up-cycling program, GetMoreLocal, an incentive based program for shopping locally, and GetMoreBikes, a bicycle maintenance and training program. Each of these programs has an environmental aspect that allows it to be considered a sustainable business venture.

Get More works though a three phase processes in which they provide youth the skills necessary to take control of a profitable and successful green business. They start with youth as apprentices, helping procure the necessary funds and materials to build a business. They then provide them with training and development through work experience and support and mentoring from Get More's successful business leaders. Finally they allow the youths to step out

on their own to start their own enterprises and build on the sustainability ventures they have begun. [20] This structure allows the organization to nurture successful businesses and then allow the apprentices to become leaders in successful businesses.

TBL Evaluation Overview

Get More is certainly a sustainable economic venture. They are most focused on building profitable businesses that help individuals gain skills to become more successful. In the words of Judith Hunt, the CEO of Get More, "there is nothing wrong with making money." They feel that for sustainable development projects to work they need to be financially viable in the market that exists. They work on economic growth and cost savings while pushing for market ready businesses. They do have a very important social aspect as well, looking at education and community building. Their quadruple bottom line structure focuses on building the capacity of youth in the community through social enterprise. Environmentally, Get More wraps sustainability into their business ventures but it would be viewed as a secondary concern that gives them market credentials. They do feel passionately about using sustainable business models to support environmentally responsible organizations and businesses as seen by their first three business ventures.

Get More's greatest success when looking at the TBL is their ability to merge the economic and social factors of sustainability in order to improve the community while sparking businesses and economic growth. They help provide skills necessary for the workers to become more employable and marketable in a tough economy. The interaction between environmental factors and the social and economic pillars of sustainability is of secondary concern to this organization. They are primarily focused on building local environmental benefits such as reduced waste and strengthening environmentally friendly businesses. The organization takes an economic approach to sustainability as a way to empower a local community.

Lessons Learned

The key finding to come out of my time with the Get More organization was the power of social entrepreneurship to offer successful sustainable businesses. The Get More team showed that it was possible for sustainability to be addressed while sparking new businesses and promoting economic growth. Successful sustainability ventures don't strictly need to operate under a nonprofit model and with the success of the first group of companies coming out of Get More, it is easy to see the success the program has in training successful social entrepreneurs. The program also showed the success in utilizing the talents and ambition of youth in the community as successful agents of change. Get More's program brings social enterprise ideals to youth in London in order to grow sustainable businesses.

Findings

Approaching SD and the TBL

SD can be viewed in a variety of different perspectives leading to a complex and highly differentiated group of projects that can be classified under this movement. This study worked to encompass this diversity in order to demonstrate the wide differences that exist in SD projects. Table 3 provides the focus area of each project and a summary of the key findings. The TBL results are summarized as percentage breakdowns demonstrating the project's focus on the three pillars. These values are based off of the collection of interviews and results found in the research and were ultimately based off my own judgment.

Table 1: Summary of TBL and Key Findings

Case Study	Location	TBL Focus Breakdown	Key Findings
Yanapuma Foundation	Quito and Estero de Plátano, Ecuador (developing)	Env: 20% Econ: 30% Soc: 50%	• Important of early engagement of community stakeholders • education and training of local community members as optimal over foreign volunteers
CETDEM	Kuala Lumpur, Malaysia (developing)	Env: 60% Econ: 25% Soc: 15%	• Need for a base of resources and scientific knowledge when communicating with community • power of demonstration projects to provide understanding to community • success in educating the community can be slower but leads to lasting change
Masdar City	Abu Dhabi, UAE (high-income developing)	Env: 40% Econ: 50% Soc: 10%	• technology can meet a number of SD needs but it needs to be implemented functionally and for the community benefit to be utilized • value in integrating traditional designs into new infrastructure
PPPF's MORE Food Hub	Accra, Ghana (developing)	Env: 33% Econ: 33% Soc: 33%	• success of cooperative ownership for sustainable agriculture • sustainable economic model that includes and accounts for expansion in the future • need for continued and constant communication
Energy Academy and the Renewable Energy Island Project	Samsø, Denmark (developed)	Env: 40% Econ: 30% Soc: 30%	• creation of community buy in through ownership • large shifts can be made with minimal changes to lifestyles • stakeholder engagement around an "island" of similar people
Sustainable Smaland	Växjö, Sweden (developed)	Env: 60% Econ: 30% Soc: 10%	• diversity of programs and targets can lead to overall success • top-down approach from governments can cause institutional large scale changes • need to push research forward to spark economic growth focused on SD

BedZED	London, UK (developed)	Env: 33% Econ:33% Soc: 33%	• even in a small community, SD projects require a holistic approach • technology can led to drastic moves toward SD but is not the complete answer • need for behavioral changes coupled with technology to completely change
Get More	London UK (developed)	Env: 20% Econ: 50% Soc: 30%	• success of social enterprise model for sustainable procedures • education and training can have lasting impacts on community

As is evident from the table above, no one organization or community approaches SD through the same methods. The most successful projects such as Samsø and Växjö included a larger focus on the social aspects of sustainability than those that have not had as much traction in their local communities. These projects also demonstrated the benefits of a clearly outlined set of objectives and a long term plan for achieving these goals and expanding upon them. Some projects such as the Samsø Energy Island project are well through their first phases, have seen amazing success, and the organizational leaders are now thinking about the next step toward a more sustainable community. Another aspect of how one approaches SD is how they set their goals. The first step toward SD, many groups were able to set goals based on their own knowledge of their communities, but the most effective success stories came through constant and continued community engagement in the early stages of a project.

Sustainable Smaland and Masdar City were the only projects in this study that showed a top down approach but this is not to say that SD is more effective from a bottom up grassroots approach. No project has been able to completely achieve a sustainable society because they have not utilized both approaches to effectively engage all the stakeholders who are involved in a community's decision-making processes. While this is a very difficult task, effective stakeholder engagement from both the top and the bottom will lead to a SD plan that is both thorough on a

large scale and supportive of the local community needs. This balance will help to push SD forward into the future.

It is also important to note the involvement that research and development should play in a SD project. Presently, our knowledge base is growing but is nowhere near sufficient. Successful SD projects have worked to balance the need for immediate change with the need for further progress in the future. The changes that can be made immediately are often the easiest to solve and through a long term plan for further research and knowledge sharing with other like-minded groups, projects can have continued traction over a long timescale. Projects that include these far-reaching principles often see greater success than those with more short term goals.

The Importance of Effective Communication

Most of the breakdowns or setbacks seen in these SD projects could be attributed to ineffective communication between various stakeholders. There are a number of different communication breakdowns that were observed during this research. The first was discrepancies in the views of the community and the views of the organizations in the planning and direction of the project. For the MORE Food Hub, the community members were at times distraught by the slow speed of results after miscommunications left them under the impression that the project's time scale was much shorter. Also, like any project, changes to the plan are common and these are sometimes not well articulated to the stakeholders. With the Masdar City project this has often been a problem as the city plan has been modified and redesigned multiple times. These changes have not always been well communicated to the Institute staff. The difficulties in communication were also seen internally in these projects. Often the directors or project organizers saw things differently than the on the ground volunteers or workers and this translated into mismanaged projects and setbacks. Projects facing this kind of difficulty in communication

could likely benefit from a more structured roadmap, offering flexibility while clearly laying out the organizational mission and values of the SD project.

Good communication however is easier said than done. One must first identify the key stakeholders in a SD project and bring them to the table early and often. Identifying overarching goals and making sure that these lie with the community needs will go a long way in ensuring that a project has the investment it needs. If community members are invested in the vision and understand the sustainability focus of the project, they will likely be more motivated and more passionate. Making sure a stakeholder understands the costs and benefits of the project to him or herself and to the other stakeholders goes a long way in providing a good foundation for a successful project. The case studies showed that in order to effectively communicate when it comes to sustainability, education and mutual commitment are critical to success.

Comparing SD Cross-Culturally

When looking at the broad spectrum of sustainability projects explored in this thesis, it is important to note the discrepancies in implementation surrounding the settings of the projects. Let us first compare SD projects in developing and developed countries. As seen in these case studies, SD in developing nations generally focuses on capacity building and economic development to alleviate poverty first, using these two areas as the primary motivation for other moves toward sustainability. Developed nations are often more environmentally or economically focused, using sustainability as a way to continue economic growth and market competitiveness of their community.

This is not to say that there are not similarities between these projects nor that they cannot learn from each other. One key example of this is in the design of passive energy buildings. These were seen in a number of different projects, most notably CETDEM in

Malaysia, Sustainable Smaland in Sweden, and BedZED in the UK. These projects all utilized similar principles to develop a technology solution to benefit the environment. It is important to note that while a passive building design focuses mostly on environmental impacts, it also has tangible economic benefits, lessening the need for heating and cooling. Another example of universal utilization of a principle can be seen in the ability to utilize cooperative organization to implement a project. In both Ghana and Denmark, SD projects are creating community ownership models that help to spur growth and inspire community involvement. These two projects have had success when moving forward because the backing of the community has allowed the organizations to spend less time trying to promote their SD project and more time working toward change.

Different social and economic settings often make it difficult for SD projects to focus on the same social criteria while technology changes are often more universal. Even though these two settings spur SD projects with different motives, projects on a global scale often have an element of universal applicability highlighted by Figure 3 presented earlier.

Discussion of Findings

By using these seven case studies to understand how sustainable development was implemented using TBL criteria, this study takes a very broad look at the ability for SD projects to be successful in a variety of different contexts. When this project began, it was expected that large discrepancies would exist between SD projects preventing a universal implementation structure. After the research was conducted, certain overarching principles were observed leading to a framework for SD that could be used independent of the project's setting. This section of the thesis first discusses the two organizational approaches that can be used when

setting a SD project's goals, and then details the COSD framework that was developed through the analysis of the case studies.

Holistic vs. Specific Organizations

The projects showcased in the case studies could be divided into two categories based on how they define their goals and missions. SD projects take either a holistic approach or a specific approach when defining targets and carrying out plans. In this thesis, holistic is used to define a project that targets a number of different goals over the three pillars of the TBL, while specific is used to define a SD project that is focused on one specific aspect within sustainability, trying to completely transform that element in the society.

Specific SD organizations utilize a deep and thorough knowledge of one area of SD within the TBL framework in order to increase the positive impacts of a change of throughout the community. A prime example of this is the Energy Island Project on Samsø. The Energy Academy team focused on one area of sustainability, renewable energy, when approaching how to transform their community. They used their deep knowledge of the topic and their position within the community to work for changes in the heating, electric, and transportation sectors. Focusing strictly on renewable energy allowed them to gain a good knowledge of the subject matter, effectively learn how to communicate that knowledge within the community, and implement strategies that are realistic given present constraints. This specificity not only eases the amount of knowledge an organization must have but helps limit the amount of new information a community must grasp about SD in order for the community to buy in to the project. Specific SD implementation can be limited by the goal of solving just one problem thoroughly. Because of the broad community specific nature of SD, a specific approach may lead to difficulties in application to another community. Also, when an organization is focused on one

area of SD, they may not be aware of residual effects on other areas of sustainability. For example, if a SD project is strictly focused on agriculture, the organizers may not be thinking about their energy use or water use. Focusing on one area allows for a good understanding of a specific topic but must be done with caution as to prevent damage to other areas that may also affect a communities overall sustainability.

A holistic approach to sustainable development is in essence the opposite thought process of specific SD. While using this approach, organizers look broadly at all three pillars, focusing on more general sustainability criteria in their community. This is more of a cradle to cradle philosophy in that the organization is trying to achieve a completely sustainable society. One example of this is the Sustainable Smaland project in Sweden. The local municipality has created a number of projects in order to address all aspects of sustainability in their community. They have worked to improve housing stock, promote local agriculture, and decrease pollution and emissions. These examples, among others, led this Swedish project down a holistic path to SD. Holistic SD is often more difficult to achieve however, as attacking all areas can be complex and difficult. Often problems arise that organizations had not initially accounted for and the depth of knowledge needed to approach all areas of SD at once is immense. However, if achieved, holistic SD leads to a community that is further along the path of sustainability as SD is complex and highly integrated.

The Community Oriented Sustainable Development Framework

Implementing SD often comes down to the buy-in and traction a project gains within the community. Through this research, I was able to identify a number of strategies that when utilized together will improve SD success. These strategies, while not the only approach to sustainable development, offer the framework for the proposed community oriented sustainable

development, COSD, which utilized the strengths of stakeholder engagement for implementation success. This framework utilized both the implementation strategies seen in the case studies and the positive community impacts observed in order to effectively try and promote sustainable development. The six steps of the COSD framework are: (1) identifying stakeholders, (2) setting achievable community goals, (3) teaching over leading, (4) cooperative ownership, (5) utilization of technology while focusing on behavior, and (6) start specific, end holistic. Further detail is provided for each step below.

Identifying Stakeholders

When beginning any SD project, it is important to know the key players and be able to engage them effectively. Stakeholder engagement should always be the first step in any COSD project. When identifying stakeholders, an organization must look at many different levels, in both local and global contexts, and work to bring these players together under a common set of values and missions. This is often easier said than done as organizations need to balance competing goals, internal community dynamics, and organizational objectives. By identifying those affected by a SD project, organizers will more effectively be able to carry out the remaining five steps while helping to eliminate many of the future conflicts that may arise over who in the community is receiving what benefits from a project.

Setting Achievable Community Goals

While seeming rudimentary, setting achievable goals is often overlooked by many organizations when they begin their SD projects. The goals set by an organization will be the guiding principles by which they approach SD and these goals set priorities for years to come, as observed in the case studies. When setting goals, organizations must first align objectives with the desires of the community. While approaching sustainable development requires a TBL

perspective, it is also incredibly important for the community perspective to be taken into account in order to further improve community engagement and buy-in. Also the project's goals must be achievable and realistic. While some SD projects set lofty goals for our progress, it is more effective to set goals that are reachable using present day technology and strategies in order to advance communities understanding. Often projects set exceptionally high goals for change without thinking about the steps needed for achievement. By setting achievable community goals, the local community buy-in that is needed for a project's success is further enhanced.

Teaching over Leading

When starting a SD project, organizers have two main ways of instituting change. The first option is to lead, meaning becoming integral members of the community that must act as the primary spark for the program to move forward. The other option, the one this framework advocates, is teaching. Teaching, for the sake of this thesis, refers to starting a SD project with community leadership and through education of the local stakeholders. This method makes the community members the leaders of their own SD and provides for better continuity. If a project is eventually run and organized by local community members, with large community buy-in established from the first two phases, the project will have greater longevity and more stability. In case studies where the organization moved into the community and took the lead, the project often faced setbacks because the organization's leaders often did not understand the intricacies of the community or the relationship it would have to take in order to be successful. By teaching instead of leading, an organization trying to spark SD will help create conscious citizens that are aware of the larger global problems while being able to manage the local issues that need to be addressed.

Cooperative Ownership

One of the most successful strategies seen throughout the case studies was cooperative ownership around sustainable development. Cooperative ownership is again another way to enhance the investment and support of the community. By setting up cooperatives, the community can see the direct economic benefits of a project. This is a tangible benefit that is easy to understand and incentivizes change. This also pushes a project to be economically feasible. Many projects often rely on outside funding which is sometimes difficult to sustain in the long term. Cooperative ownership first looks to the community to invest in itself, a key to creating a true shift within the community. This was seen in the Renewable Energy Island Project of Samsø, where the community investment transformed a conservative agriculture island into a community of renewable energy investors and advocates. Cooperative ownership also has a number of benefits for decision making. By giving the power to a large portion of community members, this democratic decision-making process allows for opinions and ideas to be shared and decisions to be supported by a majority of the local population. Cooperatives provide an enhanced way for communities to see the benefits of a project while providing more control over the decision-making.

Utilized technology while focusing on behavior

Technology, while an important part of the solution to a more sustainable world, will not provide a complete answer. This is evident from the inability of BedZED and Masdar City to reach this goal through the use of technology alone. These technology implementation strategies made great headway toward the initial goals but did not ultimately succeed due to complexities of the communities. In COSD, it is advocated that these technologies are implemented as part of a greater goal of changing community behavior. Changes in consumption patterns and

improvements in education on the three pillars of sustainability can often be more effective than just simply implementing technology. Therefore if technology is utilized in ways to enhance behavioral changes toward more sustainable lifestyles, SD will likely have a greater hold in the community and create broader change top to bottom.

Start Specific, End Holistic

The last aspect of this framework for COSD focuses on the scope of the project as discussed in the previous section of this discussion. Both options have their benefits and drawbacks and are therefore good strategies for different points in a community's transformation toward sustainability. When looking at SD, it can often be overwhelming to see the broad area of topics and changes covered under the TBL criteria. Therefore, when initiating a SD project, starting specific allows for a community to embrace a shorter list of goals that are tangible and achievable. Once the community starts to embrace SD through utilization of the COSD framework, the organizations will be able to broaden their focus in order to address the holistic aspects of SD. COSD advocates this slow shift from specific to holistic because it allows for a community to enhance their understanding of sustainable development without being overwhelmed by information and without feeling as though someone is trying to upend their lifestyle. COSD works to ease the process of a transition to SD while pushing it forward in a community by increasing community engagement and buy-in.

Limitations

There were several limitations to this study including the lack of quantitative data, research time and the potential of selection bias. This study is a qualitative study based on a limited group of case studies. While all of these projects were SD projects, they may not have accurately covered the wide diversity of projects in the field. This leads to difficulties in looking

at cross-cultural applications and the implementation strategies. This could also create a bias in what was seen as universally applicable if one type of project was disproportionately represented. The wide variety of projects also made it difficult to compare one project's strategy with another. Some projects were very technology oriented while some were more focused on community development practices. This comparison required a very broad vantage point on strategies and further studies could more specifically focus on one type of SD project in order to get a more detailed view of the SD implementation strategies for that sector.

Another limitation to this study was in data collection as a result of interview time available in each country. For example, in London, travel time and the size of organizations limited the research to only four in-depth interviews and a few informal conversations. This limited time restricted the collection of data on the community perspective. In order to improve upon the comparison in organization vs. community perspectives, further research could be conducted on only one project with a greater depth and time spent collecting interviews.

There may also have been a selection bias within the sample population. Due to the limited time in each country, many interviews were organized with the assistance of the SD organization. This organization may attempt to select the most involved and active participants in the project and therefore the community perspective on a project may have been skewed toward the highly involved. However, I did work to organize my own interviews and informal conversations which provided an added resource to limit the selection bias established by the selection of interview subjects.

Finally, this study may have benefited from more of a long term, longitudinal approach. In order to look at the success of a project instead of having individuals reflect back on the implementation of a project years later, following an initiative through the process of

implementation would have added to the results. By increasing the time period that a project was viewed and analyzed, it would have been easier to see the perspectives of the community and how they changed with SD. SD is also a long-term goal and following this path in a community could lead to new insight into how best to implement a specific project, or SD projects in general.

Further Implications and Potential Areas of Research

Sustainable Development can have a vast impact on a wide variety of communities, helping them transform from resource consumers to resource managers while improving day-to-day life. This thesis describes how SD is being implemented around the world and how a COSD approach could be utilized to create entrenched community empowered projects. It will be important to continue to evaluate an implementation strategy's successes and shortcomings as communities are evolving and the path to sustainability is dynamic and iterative.

SD is gaining increased traction worldwide as nations try to move toward more environmentally friendly and economically viable programs. This study was a good start in understanding what classifies a program as sustainable, how SD is being implemented, and how COSD could potentially be beneficial to an organization's success. This is another step in understanding and implementing SD in a variety of settings and longitudinally looking at how it transforms communities over an extended period of time. The COSD framework could be used to enhance sustainable development implementation by promoting community interaction and involvement in these projects. More work needs to be done in looking at various SD projects in order to understand how they either utilized a COSD framework or whether they use another implementation strategy that is more effective. The framework must be tested on its ability to

effectively carry out the principles of SD and should serve as a design strategy for future sustainability endeavors.

One of the greatest challenges as sustainability moves forward is how we balance the vast differences in social structure between developed and developing countries and establishing best practices for getting these different communities to interact and collaborate toward sustainability around the world. This study focused on comparison between projects and found certain commonalities that could be utilized however identification should not serve as the end point of this research. Research such as this project must be tested, improved upon, and utilized in the field in order to create substantial change on realistic time frames. The key to a sustainable future does not rest on technology fixes nor on our ability to prevent climate change but on organizations abilities to empower communities to make behavioral and structural changes at all levels of society. COSD is a suggestion for how innovators can empower a community to create lasting SD projects. In conclusion, the principles presented in the COSD framework were observed to have the ability to help a community transform itself, enhancing quality of life and understanding of complex issues facing the globe.

Appendix A: References

1. *John Elkington, "Towards the Sustainable Corporation: Win-Win-Win Business Strategies for Sustainable Development," California Management Review 36, no. 2 (1994): 90–100.*
2. **United Nations. 1987."Report of the World Commission on Environment and Development." General Assembly Resolution 42/187, D.R.-.-.**
3. **Tijmes, P. and R. Luijf, *The sustainability of our common future: An inquiry into the foundations of an ideology.* Technology in Society, 1995. 17(3): p. 327-336.**
4. **R.Kerry, T., *Sustainable global futures: Common interest, interdependency, complexity and global possibilities.* Futures, 1987. 19(5): p. 574-582.**
5. *McMichael et al. New visions for addressing sustainability. Science 2003, 1919-1920. Marshall & Toffel. Framing the Elusive Concept of Sustainability: A Sustainability Hierarchy. Environ. Sci. Technol. 2005, 673-68.*
6. **Farr, D., *Sustainable Urbanism: Urban Design with Nature*. 2008, Hoboken, NJ: Wiley.**
7. **Sneddon, C., R.B. Howarth, and R.B. Norgaard, *Sustainable development in a post-Brundtland world.* Ecological Economics, 2006. 57(2): p. 253-268.**
8. **GoÅ„cz, E.b., et al., *Increasing the rate of sustainable change: a call for a redefinition of the concept and the model for its implementation.* Journal of Cleaner Production, 2007. 15(6): p. 525-537.**
9. *Repetto, R., World Enough and Time (New Haven, CT: Yale University Press, 1986a).*
10. **Sharachchandra M, L.l., *Sustainable development: A critical review.* World Development, 1991. 19(6): p. 607-621.**
11. *P. Anastas, J.B. Zimmerman (2003). "Design Through the 12 Principles of Green Engineering," Environ. Sci. Technol. 37:95A-101A.*
12. *Rodriquez, S.I., M.S. Roman, S.H. Sturhahn, E.H. Terry. 2002. Sustainability Assessment and Reporting for the University of Michigan's Ann Arbor Campus. University Master's Project. University of Michigan: Ann Arbor: 1-396.*
13. **Kirby, A., *Yanapuma 2010 Annual Report*. 8 February 2011, Quito, Ecuador.**
14. ***About Us*. 2006 [cited 26 December 2011]; Available from: http://www.masdar.ae/en/Menu/index.aspx?MenuID=42&CatID=12&mnu=Cat.**
15. ***Research Domains*. [cited 26 December 2011]; Available from: http://www.masdar.ac.ae/ResearchDomains.html.**
16. ***Our Approach*. [cited 27 December 2012]; Available from: http://www.pppafrica.org/about/our-approach/.**
17. **Jorgensen, P., *Samso- a Renewable Energy Island*, T. Groth, Editor. 2007, Samso Energy Academy: Samso.**
18. **Unit, V.s.I. *Vaxjo-the Greenest City in Europe*. 24 September 2010 24 September 2010 [cited.**
19. ***BedZED- the UK's largest mixed use zero carbon community*. [cited 27 December 2011]; Available from: http://www.bioregional.com/files/publications/BedZEDbriefingsheet.pdf.**
20. **Hunt, J., *Get More*. 2011, London.**

Appendix B: Interview Breakdown

This list includes only the formal interviews carried out on the trip. A number of informal interviews were also used with research notes taken and utilized in this thesis. Transcriptions of key interviews can be made available upon request.

Country	Name	Description
Ecuador	Amelia Brandt	Intern at Yanapuma
	Andrew Kirby (1)	Executive Director of Yanapuma
	Marietta Lindas	Community Member in Estero de Platano
	Marri Baligoe	Community Member in Estero de Platano
	Marie Sonia Chilea	Community Member in Estero de Platano
	Andrew Kirby (2)	Executive Director of Yanapuma
Malaysia	Gurmit Singh	Chairman of CETDEM
	Lee Moi Yin	Community member and organic farmer
	Anthony Tan Kee Huat	Executive Director of CETDEM
	Ong Kien Elk	Teacher at a local school
	Nithiyananthan Nesadurai	Community Member and head of EPSM
	Tan Siew Luang	Head of organic farming at CETDEM
	Dr. Kalithasan	Staff member of Global Environmental Centre
The United Arab Emirates	Arslan Khallo	Student at Masdar Institute
	Kenneth Volk	Outreach Manager at Masdar Institute
	Scott Kennedy	Professor at Masdar Institute
	Aimee Barnes	Foreign Ministry
Ghana	Elaine Brown	Program Director of MORE Food Hub
	Caitlin Burke	Volunteer at MORE Food Hub
	Carietta Ainofah	Researcher at MORE Food Hub
	Vera Akatsi	Researcher at MORE Food Hub
	Annabelle Osei	Researcher at MORE Food Hub
	Kwashie Darkudzi	Dars Foundation and being taught MORE
	Joseph Haldeman	Volunteer at MORE Food Hub
	Paul Kpai	EPYM Foundation and being taught MORE
	Clara Sarpong	Researcher at MORE Food Hub
	Nash Akoni	Farmer at MORE Food Hub
	Elizabeth Asodji	Chef at MORE Food Hub
Denmark	Jorgen Tranberg	Samsø Community Member
	Soren Stensgaard	Program Manager at Energy Academy and Samsø Community Member
	Malene Lundin	Energy Camp Head and Samsø Community Member
	Soren Hermansen	Director of the Energy Academy and Samsø Community Member
	Casper Nillen	Intern at the Energy Academy and Samsø Community Member
	Brian Kjaer	Samsø Community Member

	Jorgen Hald	Samsø Community Member
	Ole Hemmingsen	Samsø Community Member
Sweden	Jesserina Flores	Sustainable Smaland Technical Visit Coordinator
	Sarah Nilsson	Project Manager and former head of environmental group for Växjö
	Ulf Hedin	Chairman of Cultural Board and member of the Executive Board of Växjö
	Lars Ehrlén	Area Manager of Sandviks CHP power plant
	Johan Thorsell	Business Manager of Sustainable Smaland
	Hans Andrén	Project Coordinator for Välle Broar (timber construction zone)
The United Kingdom	Patrick Feelily	Manager of the Sustainable Development Team here at the Greater London Authority
	David Blair	Project Manager at London Orchard Project
	Judith Paris	Executive Director of Get More

Appendix C: Interview Topics

The interview will center around three main topics: environmental factors, economic factors and social factors. Depending on whether this interview is conducted with a project organizer or community members the questions will be altered. Interviews with project organizer will mostly focus on the decision making process and the reasoning behind the given technology choices. Interviews with community members will center around the impact the project has had on the community.

When discussing the environmental impact of the sustainable development project, the first questions will center on the area being improved. Is the project about natural resource conservation, environmental management or pollution prevention? After that it will be an indepth look at the technology being used. What is being used, how it is being used, and how is it different from the technology that was used before the project? This will provide the foundation for understanding what technology is being used around the world and the reason for implementing that technology.

From this point forward, the interview will transition into looking at the economics behind the project. Does the project create lasting business success or provide savings for certain people? Is there a profit to be made in this development and if so, who is making it?. Also what is the relationship between the economy and the environment? Are these projects viable on a large scale or in different communities? How are they being funded and how long do they anticipate being around? Understanding the economic impact of these projects will be important to understanding their true sustainability.

The crux of each interview will focus on the social impact of these sustainable development projects. How has this project improved standard of living or improved the community? Has the project brought the community together? Have these projects helped families and the community become self sufficient and prosperous? What was the community like before these projects and how has that changed since the development? Has the project had an impact on education or child health? How equitable is the project? The project may only be benefitting those in the middle class or upper class. Who is truly benefiting from the project? Is environmental justice being maintained, meaning that one group does not face a disproportionate amount of harm from the projects? Are workers benefiting from their labor or are the successes not trickling down? How does the subject feel about the project and where does he or she see it going in the future? Has the project changed other aspects of life and has the sustainable mindset of the program spread to other areas of life? Understanding the impact sustainable development has on a community will be important to understanding how it can be implemented universally.

Appendix D: Interview Consent

Northwestern University
Consent Form for Research

Project Title: Defining Sustainable Development: Global Applications of Sustainable Development and the Effect on the Community
Principal Investigator: Kimberly Gray
Co-Investigator(s)/Student Investigator: Benjamin Shorofsky
Faculty Advisor: Kimberly Gray, Jean-Francois Gaillard
Supported/Funded by: Circumnavigators Foundation, Civil and Environmental Engineering, and Supported by Northwestern University

Introduction/ Purpose

You are being asked to participate in a research study that focuses on sustainable development and the effect of on various communities. You are being asked to participate in this study because you are involved in a project focused on sustainable development. This project is part of a larger study that covers eight countries in total-Ecuador, Malaysia, the United Arab Emirates, Ghana, England, Denmark and Sweden. The purpose of this study is to understand how various communities react to different sustainable development projects and how the technology can be translated. There will be approximately 5 other people interviewed you're your sustainable development project

Procedures
As a participant in this study, we will agree upon a suitable interview location. Your participation in this study will last approximately one hour and will involve one visit. I will conduct this interview in a place and time that is most convenient for you. I will audiotape or video record and interview with your permission. At any time in the study, you may decide to withdraw from the study. If you withdraw, no more information will be collected from you. If you indicate you wish to withdraw, I will ask if the materials already collected in the study can be used.

Risks
Your participation in the study involves responding to questions, some of which may cause you to feel uncomfortable or emotionally upset. If you feel uncomfortable responding to questions or wish to stop the interview, tell me that you are not able to continue. If certain questions require you to divulge information that you are not comfortable giving, you may ask to skip that question or end the interview. You may stay in the study even if you skip some of the questions. You may withdraw at any time.

Benefits
There may be no direct benefit to you by your participation in this research study. Your participation in this study may aid in our understanding of sustainable development in a variety of communities and its importance for community growth in the future.

Alternatives
You have the alternative to choose not to participate in this study.

Financial Information
Participation in this study will involve no cost to you. You will not be paid for participating in this study.

Your Research Participation Rights
If you choose to be in this study, you have the right to be treated with respect, including respect for your decision whether or not you wish to continue or stop being in the study. You are free to stop being in the study at any time.

Choosing not to be in this study or to stop being in this study will not result in any penalty to you or loss of benefits to which you are otherwise entitled. Specifically, your choice not to be in this study will not negatively affect your life in the future

If you want to speak with someone *who is not directly involved* in this research, or if you have questions about your rights as a research subject, contact the Institutional Review Board Office. You can call them at 001-(312) 503-9338 or send e-mail to irb@northwestern.edu.

You may choose not to answer particular questions if you do not want to. You may ask that the tape/video recorder be turned off at any point during the (interview, observation) if there is something that you do not want to have recorded.

What about my Confidentiality and Privacy Rights?
Participation in this research study may result in a loss of privacy, since persons other than the investigator(s) might view your study records. Unless required by law, only the study investigator, members of the investigator's staff, representatives of the Circumnavigators Club, the Northwestern University Institutional Review Board, and representatives from the Office for Human Research Protections (OHRP) have the authority to review your study records. They are required to maintain confidentiality regarding your identity.

Results of this study may be used for research, publishing and presenting. If your individual results are discussed, your identity will be protected by using a code number rather than your name or other identifying information. If you wish to be identified with your interview indicate this at the end of the form, where an option will be provided.

Audio/Video Recordings
At the end of this consent form, you will be given the option of allowing us to take photographs and/or make audio or video recordings of you. If you agree, these may be used in analyzing the research data or in scientific publications or presentations. With your permission, we may publish and present photographs, audio recordings, and videos of you including your face and first name. No other personal information about you will be included in the presentation.

Whom should I Call if I have Questions or Concerns about this Research Study?
If you have any questions, problems, illness, or injury during your time on this study, call us promptly. Kimberly Gray is the person in charge of this research study. You can call her at +001-847-467-4252, Monday through Friday, from 9 a.m. to 5 p.m or reach her by email at k-gray@northwestern.edu. You can also call Ben Shorofsky at +001-410-409-3737, Monday through Friday, from 9 a.m. to 5 p.m or email him at bshorofsky@u.northwestern.edu with questions about this research.

Consent

I have read this form and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional questions, I have been told whom to contact. I agree to participate in the research study described above and will receive a copy of this consent form after I sign it.

Initial one of the following to indicate your choice:

_____I agree to be audio AND video taped

_____I agree to be audio taped ONLY

_____I DO NOT agree to be audio or video tape

Initial one of the following to indicate your choice:

_____I agree to have my face and first name used in video presentations

_____I do not agree to have my name and face used in video presentations

_____ _____

Subject's Name (Printed) and Signature Date

_____ _____

Printed Name and Signature of Person Obtaining Consent Date