ILLINOIS INSTITUTE OF TECHNOLOGY

PROJECT PLAN

IPRO 325

Advisors: Prof. Ferguson & Prof. Schug

Developing affordable products for the rural poor of the world

Project Team

Team Members:

Arturo Aguirre: *Architecture*

Hu Di: *Electrical Engineering*

Thomas Francescanneli: *Architecture*

Justin Harris: *Architecture*

Alex Kircher: *Architecture*

Sara Miller: *Architecture*

Crystal Richards-Jimenez: *Architecture*

Eric Schamber: *Physics / Electrical Engineering*

Richard Sheridan: *Chemical Engineering*

Cesar Sotelo: *Architecture*

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Section 1.0

INTRODUCTION

IPRO 325's reason of being has been to create a program at IIT which looks to make an impact in the most immediate problems dealing with the world's rural poor. This will be a long term IPRO that will last for a few semesters, probably years. During the initial phase of this program, our responsibility has been on researching and becoming familiar with the current trends and events throughout the world which address these poverty issues. We have examined the organizations and universities which are working towards annihilating the world's grossly impoverished areas; we have also examined 10 factors which we selected as being those which impact the world poor the greatest. These ten problems are Transportation, Energy, Shelter, Food, Water, Health, Communication, Employment, Social Structure, and Education. After careful analysis, we narrowed down the list to three main problems that we consider as the most important: access to energy, access to pure drinkable water, and appropriate shelter conditions. Through the research, we have learnt from those who have gone before us in both creating a relevant project, as well as searching out other schools or organizations with whom we might partner in this endeavor.

Section 2.0

PROJECT BACKGROUND

The concept of poverty has been around since individuals of the first societies found it hard to find enough food. The concept of trying to do something about it probably spontaneously generated itself at the same time. Human compassion seems to be ever present in areas of poverty, yet it seems as though no matter what volume of energy is packed into those areas with compassion, merely serves to allow poverty to spring up elsewhere. Jesus himself said "The poor you will always have with you", so what are we to do about this problem if the poor will always be here. Some have been saying that the reasons that charity organizations don't seem to ever make a dent in the problem is merely because their energies are ill-placed. All the compassion has prompted monies to go towards addressing the symptoms which will just keep getting worse unless we start to address the problems which are causing poverty. Realistically, just like Jesus said, we will always have the poor with us. However, with initiatives like the Millennium Development Goals initiated by the United Nations and radically affirmed and agreed upon by every country in the United Nations, bringing up the world's chronic poor to a higher level is definitely a procurable feat. At the present, there is no sponsor for this project; hence our clients are the 2 billion people worldwide who are living on less than $3 per day. Our responsibility is to these people: to look at all of the present research that has been done on the subject and determine what we might do which would make the biggest impact on permanently changing the lives of these people.

We have identified the following as the most immediate problems affecting the world's rural poor: transportation, energy, shelter, food, water, health, communication, employment,

social structure, education. These ten items are making the greatest negative impact right now and they each propose their own complicated technological problems; i.e. different areas of expertise will be needed to address each one. One difficult thing, however, is that none of these problems exist in isolation, so it would be very hard to either research or effect any one problem in isolation, but the flip side of that coin is that any effort towards any one of those items will invariably impact some of the others depending on the project and the project location. Dealing with problems dealing so closely with the lives of people is bound to touch on moral issues. The nature of our project, however, seems to be that the only greatly morally corrupt action would be inaction. It is our goal that the business costs would be very low, so as to be easily implementable, and the societal costs be negative; i.e. raising the level of the societies we impact. This semester, implementation of the project has not been our goal. However, over the next few semesters, the goal is that the program we develop this semester will be developed and implemented, actually making a difference.

Section 3.0

PURPOSE

At the beginning of the semester, we developed the project plan which we have followed throughout the semester. In it, we stipulated the objectives and deliverables that we would accomplish; we identified ten main problems contributing to poverty, research on them for the first half of the semester, and we then had a general meeting in where each of us presented the researched information on the individual problems, and on the universities and organizations involved in sustainable projects for the poor, and we made an informed and educated decision on what the main problems suffered by the poor around the world are.

A report of each of the ten main problems considered, and three reports corresponding to organizations, universities and the criteria utilized to choose the ten problems researched, have been therefore produced and are available for future reference. Therefore, future IPROs will be able to access and consult our reports and letters issued to professors, companies, and organizations throughout the semester.

Once we narrowed our attention to three main problems, i.e. energy, shelter, and water, we started researching in depth about projects and activities that have been or are being done to address these problems. We were able to earn a good understanding of the solutions that other universities and organization have developed / thought, so that we are now in a position to think about the possible path that IIT could take in order to develop a particular and sustainable plan to address the problems.

Bernard Amadei, founder of Engineers without Borders – USA, came to IIT's main campus and lectured on the current activity of his organization, and gave us a down-to-earth and practical approach on possible ways of approaching projects in villages around the world,

and was a unique attempt to create awareness around IIT campus about the problems the poor are facing in actuality. His visit greatly contributed with valuable insight on particular and practical ways on how to address the three problems chosen.

In addition, we have identified possible IIT faculty that could potentially join the project in future IPROs, and potential private companies and organizations with which IIT could possibly partner in the development of the project.

Our main goal for this Fall 2006 semester has been to set the foundations for future IPROs to continue building on this project. We realize that poverty is not a new problem and has been part of reality since antiquity; however, we do know that it is potentially possible that any individual, organization, government, or nation as a whole can contribute with as little or as much as possible as his/her/its own possibilities enable him/her/it. Consequently, we expect that our effort throughout this semester will be of help for future IPROs so that this initiative is seriously considered, and IIT becomes a know institution for contributing on the fight against poverty around the world.

Section 4.0

RESEARCH METHODOLOGY

The problem that has been given to us is to create a program for future IPROs to follow which will seriously address some aspect of the abject poverty of the world.

To solve this problem, the team will first look at precedence and examine their projects, their intentions and their successes and failures. From the research, we will then narrow our view down to the three most relevant problems which we might address and research these in greater depth. We will then be able to make a more informed decision into what we at IIT can do to address these problems.

To do this we must:

- Produce a research paper looking at the problem of poverty as a whole
- Produce a research paper looking at organizations which are presently working on the problem of global poverty
- Produce a research paper looking at universities which are presently working on the problem of global poverty
- Identify three problems which stand out above the rest in terms of both need and feasibility of intervention.
- Produce a research paper looking at each of the three chosen problems
- Produce a proposal of what IIT can do for each of these problems.

In this phase, the only way we can test potential solutions will be to judge the feasibility of our proposal against past projects performed by other organizations and universities. To do this we will establish quantitative as well as qualitative criteria to judge both the prior projects and our proposed projects so that they may be easily compared.

> To do this we must:
> - Establish a set group of quantitative ways which we might be able to compare proposals.
> - Establish a set group of qualitative ways which we might be able to compare proposals.

Our research will be documented in archives of information in igroups. Both our research and our testing will be documented in papers and charts for easy reference to the project and deposited on igroups. This way the members of the present group as well as those who come after us will be able to access and understand every step in our path.

> To do this we must:
>
> - Organizing our problem testing information into comparable charts
> - Take the research papers and the testing papers and put them on igroups

Analysis of testing will be done in a very simple manner. The comparing criteria set up will be utilized to distill the test results down to a white paper which might be more easily understood and distributed.

> To do this we must:
>
> - compare both quantitative and qualitative testing results
> - create a paper synthesizing our findings

Our final product will be one well organized paper which will accurately portray our findings on this subject. This will be composed of all the work done prior in the researching, focusing and analysis phases.

> To do this we must:
>
> - create introduction, conclusion and final proposition pages
> - compile and organize all of the prior research into one understandable report on what IIT can do to help the problem of global poverty

Section 5.0

ASSIGNMENTS

In order to achieve the objectives for this semester, IPRO 325 worked within different subteams throughout the period. Once our assignments for the first half of the semester were completed , we divided in different subgroups so that everyone could work with everyone inside the team, and a better cross of information between members was achieved.

FIRST HALF ASSIGNMENTS

A. Team Leaders

Sara Miller
Eric Schamber

B. Sub-Teams

1. Criteria and definition of problems:

Arturo Aguirre
Hu Di
Thomas Francescanneli
Cesar Sotelo

2. Research on organizations:

Sara Miller
Crystal Richards-Jimenez
Eric Schamber
Richard Sheridan

3. Research on universities:

Alex Kircher
Justin Harris

C. Sub-Teams' Leaders

Arturo Aguirre - Problems
Alex Kircher - Universities
Sara Miller - Organizations

D. Sub-Teams' Responsibilities

Sub-Team 1: Define

- Introduction
- Dimensions of Problem
- Overall-ranking/ precedence of problems
- Organizations

Sub-Team 2: Evaluate Organizations

Considering there are hundreds of organizations currently working on solutions for the poor, we have decided to focus on 11 Organizations, and research their past and present activities. Our criteria for choosing them was the following: affordability, feasibility, scope, and the method utilized in the development of their projects.

Sub-Team 3: Research Topics

- Universities with a specific directive towards issues of world poverty
- Directives specifically looking at issues dealt with by rural poor
- Directives based in classes and/or projects dealing with poverty
- Directives which are Action or Production Oriented
- Directives managed, at least in part, by undergraduates

E. Sub-Teams Individual Responsibilities

Sub-Team 1:

Arturo Aguirre- Introduction, Problem Details
Hu Di- Dimension of problems, Overall-ranking/ presidency of problems
Thomas Francescanneli- Dimension of problems, Overall-ranking/ presidency of problems
Cesar Sotelo- Appendix, Maps, Stats

Sub-Team 2:

Sara Miller - AFH and Red Cross
Crystal Richards-Jimenez - Habitat for Humanity, Food for the Hungry, and UNICEF

<u>Eric Schamber</u> - Engineers without Borders, Doctors without Borders, and Heart to Heart
<u>Richard Sheridan</u> - IDE, The Hunger Project, and WHO

Sub-Team 3:

<u>Alex Kircher</u> - UC-Berkeley, Columbia University, Cornell University
<u>Justin Harris</u> - Rural Studio, EWB schools

SECOND HALF ASSIGNMENTS

F. Sub-Teams

1. Energy:

Arturo Aguirre
Hu Di
Eric Schamber

2. Shelter:

Sara Miller
Crystal Richards-Jimenez
Thomas Francescanneli
Cesar Sotelo

3. Water:

Alex Kircher
Justin Harris
Richard Sheridan

G. Sub-Teams' Leaders

Eric Schamber- Energy
Sara Miller - Shelter
Justin Harris – Water

H. Sub-Teams Individual Responsibilities

Sub-Team 1:

Arturo Aguirre- Solar power & Human Powered Generators
Hu Di- Biogas & Hydropower
Eric Schamber – Wind energy & Ethanol

Sub-Team 2:

Sara Miller – inadequate shelter
Crystal Richards-Jimenez - transitional shelter
Thomas Francescanneli- community buildings
Cesar Sotelo- homelessness & permanent shelter

Sub-Team 3:

Alex Kircher – Water Filters
Justin Harris - Access to adequate Water
Richard Sheridan – Drip irrigation

I. IPRO DAY ROLES

Abstract: Justin Harris and Richard Sheridan

Booth: Hu Di**,** Sara Miller**,** Crystal Richards-Jimenez**,** and Cesar Sotelo, Arturo Aguirre

Final Report: Arturo Aguirre and Eric Schamber

Presentation: Thomas Francescanneli and Alex Kircher

DESIGNATION OF ROLES

A. Assign Meeting Roles

- **Minute Maker:** Thomas Francescanneli
- **Agenda Maker:** Sara Miller & Eric Schamber
- **Time Keeper:** Sara Miller

B. Assign Status Roles

- **Weekly Timesheet Collector/Summarizer:** Justin Harris
- **Master Schedule Maker:** Alex Kircher

C. Research Roles: Problems Affecting the Poor

- **Nourishment:** Arturo Aguirre
- **Health:** Hu Di
- **Transportation:** Thomas Francescanneli
- **Communication:** Justin Harris
- **Income:** Alex Kircher
- **Shelter:** Sara Miller
- **Social Structure:** Crystal Richards-Jimenez
- **Energy:** Eric Schamber
- **Water:** Richard Sheridan
- **Education:** Cesar Sotelo

D. Other Roles

Contact Guest Speakers: Hu Di & Crystal Richards-Jimenez
Define Paper Layout: Eric Schamber
Define PowerPoint Layout: Crystal Richards-Jimenez

Section 6.0

OBSTACLES

A. Values:
Throughout the semester different obstacles emerged and were addressed appropriately. The first major obstacle in our group was a difference in work ethics values. Many group members believed that being on time and showing up was very important and also keeping up with ones responsibilities when assigned tasks. Our team rapidly addressed this issue during regular meeting and established importance to several aspects of work ethics.

B. Time:
Time became an obstacle as we researched poverty in depth. Midway thru research our team realized that poverty was a huge issue in the world and could be split in many different aspects and studied separately. Our group met and addressed this issue and adjusted the project plan and end of semester expectations. We all

agreed that in order to create an efficient and feasible solution that could fit IIT we would have to allow more time and therefore instead of having a solution by the end of semester have several possible solutions fitted to IIT for future IPROs.

Section 7.0

RESULTS

There were several results achieved during the different phases of IPRO 325. During the first phase, group members had the opportunity to research first hand the general scope of poverty during witch many astonishing and disturbing facts were unveiled to them. During this phase groups members were assigned each of 10 "facets" that had previously been identified. The result of this extensive study was to identify those aspects of poverty that had the greatest impact and at the same time remained feasible and consistent with IIT criteria. As three "facets" were identified as fitting the criteria we decided thru out the semester. One of the most important results achieved during our IPRO was the knowledge gained throughout the semester. We have learned key elements in becoming a strong presenter and also experienced first hand what it would be like to work thru time constraints and as part of a team. Also peer reviews and other aspects of being in a group were gained.

Another important result from this IPRO is the fact that we successfully book Bernard Amadei founder of Engineers Without Border. Bernard Amadei was able to help us achieve a major obstacle of our IPRO group. Creating Awareness helps our program to continue as we have proposed.

Thru the information gathered thru= IPRO 325 was able to be compiled and analyze setting the path for future IPROs who want to continue this IPRO.

Section 8.0

RECOMMENDATIONS

Considering poverty is such a broad problem and that there is not an specific solution to it (if there were it would have been solved centuries ago), we have developed several recommendations, each and every one of them compatible with each other, and that if considered and pursued, a significant difference will be noticed in the reduction of poverty in the place chosen.

We believe these action steps should be followed so that more effective or less costly research results can be obtained if the recommendations are followed. Findings and consequent research can be used in conjunction with the recommended steps to further research in the area, design, develop and implement sustainable projects to help the poor.

ENERGY recommendations

- Alternative form of power generation to be used should be chosen based on the geographic and demographic characteristics of the village.

- The best solution would be to combine different technologies to get the most from the available energy sources in the place.

- Clearly, hydropower is the most cost efficient form of energy generation.

- If a river is not present, however, wind power should be the way to go.

- Biogas is a viable solution for most geographic locations, even though it needs water and moderate heat to operate.

Possible ipros are

* the design, production and implementation of a biogas production system

* design of solar panels produced with local materials found in the community

* design, production of a wind / hydro power generator, considering the lowest cost possible, and easy to find materials

Also, after the design and production of this power generators, a possible IPRO or a

responsibility of an IPRO could be setting up a criteria and analyzing possible rural villages, and according to their geographic and demographic characteristics, determine which is the best method of energy production to be applied in the place.

WATER

Possible IPROs

Criteria

- Involve multiple disciplines
- Foster education for end user
- Low-cost
- Sustainable, easy maintenance

Rainwater catchment system

- Includes collection area, a conveyance system and storage facilities.
- Roofs should be of inert material preferably away from trees etc.
- Cisterns should filter out debris
- Cisterns should have opaque walls to stop algae from growing
- Possibly used in conjunction with colloidal silver filters

- Rainwater is much cleaner than well water or estuary water
- Great for places where there is no government water bureau or where groundwater is not safe

- IIT Department/Personnel possibilities:
    - CEE Dept.
    - Dr. Ali Oskouie Chemical Environmental Engineering
    - Dr. Paul Anderson, Environmental Engineering

Solar Distillers

- Simple concept, no chemicals involved
- Ideal for sunny regions, brackish water source
- Variety of inexpensive materials can be employed
- Ease of knowledge transfer

Goals
Semester I
- Select a region/community
- Research – Geography, climate, customs
- Study/investigate different viable materials

Semester II
- Select most suitable materials
- Design and test prototypes – select best one
- Develop price estimates for implementation
- Raise funds for travel, material, etc.
- Select travel team, get 'er done

Composting Toilets

- Sanitation achieved while providing fertilizer   food
- Local materials can be utilized
- Highly sustainable
- Very cheap - $7-$17 (ArborLoo est.)
- Excellent design/engineering, ergonomics opportunity,

Goals
Semester I
- Select a region/community
- Research – Geography, climate, customs, local vegetation trees
- Study/investigate different viable materials

Semester II
- Select most suitable materials
- Design and test prototypes – select best one
- Develop price estimates for implementation
- Raise funds for travel, material, etc.
- Select travel team, get 'er done

Wastewater reuse
- Fertilize and irrigate crops with sewage
- Already done in US and Europe in the form of caking... $$$
- Cheaper version done in Australia
- Idea: save money by using as little treatment as possible
- Good for chemists, ChemEs, biologists, and MBBs.

Drip irrigation

- Already being done/ Not unique
- Good IPRO anyway!
- Locate a site, plan and build system

SHELTER

Root causes of inadequate shelter

1. Unemployment.
2. Loss of/or inadequate income
3. Loss of housing
4. Being victimized
5. Health problems.
6. Personal choice.
7. Breakdown of the family unit
8. Mental illness.
9. Substance abuse.
10. Detrimental lifestyle choices

- Shelter humanitarian efforts happen in response to disasters.
- Two forms of shelter relief are needed after a disaster; immediate temporary shelters and transitional housing.
- Transitional housing is only designed for short term use but many times people end up living in them for years.
- Transitional housing and rebuilding needs to be done with consideration to the climate and culture where it is being placed.
- There is no one solution for every situation.

Shelter recommendations

Disaster relief shelter
Modular systems
Bicycle ambulance
Community shelter buildings
Portable collapsible school desks

Shelter in a Cart?! Designboom recently held a worldwide competition to redesign a "shopping cart" to maximize usability by the urban homeless.

The ideas that the Fall 2006 team is currently working on will hopefully spawn several future IPROs that develop affordable products addressing shelter, water and energy problems faced by the world's poor. It is all well and good to design such products, but the real goal should be to implement these products where they are needed most. IIT Affordable Village [IITAV] represents the concept of an incubator or umbrella under which these design IPROs will be housed.

IITAV will manage the design and implementation of affordable products for the world's poor. The goal for IITAV would be to network with such global organizations as AFH, EWB and IDE, and develop ties with poor villages all over the world. We would then work with these villages to identify and attempt to solve their energy, water and shelter problems and deficiencies. The goal would be to work with these villages, not just providing them with boxes of products, giving students a chance to interact globally and gain perspective not generally provided in a university setting. Given the proper funding and support, IIT Affordable Village has the potential to positively impact everyone involved. The villages will benefit from improvements designed by IIT students, the students will benefit by gaining a global perspective and experience and will have the chance to actually make a difference in the world.

Section 9.0

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Section 10.0

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