IPRO 325 Final Report
Designing Affordable Energy, Water, And Shelter Solutions For The World's Poor

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Spring 2009

1 Abstract

There are currently around 40 million people living in urban slums without adequate water and sanitation in India. In addition, there is no sewage system in urban slums and water is not being recycled. In a particular slum in Mumbai that we are looking at, people need to walk to the foothill 2km away in order to get water. It takes a lot of time to carry sufficient amount of water for a family for daily use. Water obtained in this way is primarily used for washing. Since there is no private place for people to wash, people often wash themselves on the street and the water is simply wasted. Our team attempted to address two main issues for this semester. Firstly, we tried to provide people with clean and private facility for washing while allowing the water to be recycled. Secondly, we tried to make transporting water easier and more efficient by developing a device that allows you to carry water on your back.

2 Background

- The project will be a joint effort between IPRO 325 and the Acara Institute.

- The Acara Institute is a non-profit organization (NPO) with an interest in creating sustainable business solutions. Since the Acara Institute shares a lot of similarities with the missions of IPRO 325, the Acara Institute and IPRO 325 decided to enter into a collaborative relationship for Spring 2009. The initial focus of the Acara Institute is in providing clean water to slums in India.

- Difficult and largely undefined problems such as "providing clean water" are not likely to be solved by a single person or company. Therefore, the Acara Institute provides a challenge and the infrastructure to allow multiple university teams and industry leaders to work together to explore various commercialization concepts. Acara Institute and its industry mentors provide guidance through the commercialization process to increase chance of success and speed to market.

- The challenge statement is the following: Develop an affordable and sustainable mechanism for reuse and/or recycling of water in an economically disadvantaged area in Mumbai, India.

- There will be multiple teams competing with each other for the challenge. The teams are expected to use design thinking, combined with actual input from field research, in solving the challenge. Teams must develop a product or service, and corresponding sustainable business model for delivery of the product or service.

- Sustainable business model means that the company or organization delivering the product or service can do so by generating revenue.

- It is very important that the final product or service be sustainable because it will allow the product or service to be used continuously in the future without relying on ongoing funding.

3   Objectives

- Development of an affordable and sustainable mechanism for reuse and/or recycling of water in an economically disadvantaged area in Mumbai, India

- Development of a corresponding sustainable business model for delivery of the product or service

4   Methodology

A. Develop an affordable and sustainable mechanism for reuse and/or recycling of water in an economically disadvantaged area in Mumbai, India

B. In order to accomplish the problem set forth in part 1. we listed all the tasks that needed to be done, and grouped the tasks into phases. There are 3 phases. Analysis, Design, and Implementation.

  - In the Analysis phase, the primary focus of the team was understanding the problem and collecting the relevant information. In order to achieve those goals, we did the following.
    - Wrote the problem statement
    - Did some basic research on water situation in slums in India and how water filtration system works
    - Established the connection with the field research team and sent a list of questions regarding the information that needs to be collected by the field research team.
    - Contacted the mentors
  - In the Design phase, the primary focus of the team was designing a product or service based on the information collected in the Analysis phase. We built two prototypes in order to test the design. A corresponding business model was also devised. The prototype was shown to various people for feedback.
  - In the Implementation phase, the final product and business model were prepared based on the feedbacks collected. Based on the feedbacks, we improved our business model. The final presentation and other deliverables were also prepared.

C. A prototype of product was built by our team. Then, It was evaluated by our team and presented to the class for feedback.

D. All the results from research were documented by the sub-groups and team members. Then, those were uploaded to igroups so that everyone could access all the data.

E. Our subgroup and the research team in India evaluated the product design together. Also, feedbacks and advices were sought from the instructor and mentors.

F. Every sub-group was responsible for writing the report. The final team report was generated by simply combining every sub-group's report.

5 Team Structure and Assignments

- Shezami Khalil

  - Major : Biochemistry
  - Contributions : Shezami was responsible for communicating with IIT Bombay team and developing and designing survey questions. Shezami also made some improvements on the designs of the prototype and gave the final presentation.

- Sang Hwa Lee

  - Major : Chemistry
  - Contributions : Sanghwa was responsible for researching and analyzing data. Sanghwa did researches regarding the filtering system for our prototype and also made the brochure for the team. Sanghwa also built the prototype filter.

- Milos Leposavic

  - Major : Computer Science
  - Contributions : Milos was responsible for designing and developing the prototype. Milos also made the drawing of our prototypes using computer software and made the poster for the team. Milos also gave the mid-term presentation.

- Jeonghun Lee

  - Major : Physics
  - Contributions : Jeonghun was responsible for designing and developing the prototype. Jeonghun also gave the midterm presentation for the sponsor and wrote the project plan and the final report.

6 Budget

- Prototype building - $60

7   Results

A. Research findings and state resources

- There are 3 ways of getting water in the slum which differ in cost
- If one cannot afford to pay for water, one should manually carry water from foothill 2km away
- The government has installed facilities for toilet and washing purposes but they are not maintained well and are only used for toilet
- There is no sewage system in the slums and water is not being recycled
- There is no place for washing so people just wash themselves on the street

B. Major accomplishments

- We came up with two prototype designs and built them
- First prototype addresses the issue of lack of a clean and private place to wash
- Second prototype is to make transporting water easier and more efficient
- We also came up with a corresponding business model for our designs

C. Objectives that were met and the ones that were not met

- Both objectives that we set were met

8   Obstacles

The major obstacles encountered while completing the tasks include the following.

- Working with IIT Bombay team

  - Since we were working together remotely, we only had limited means to exchange information and information was not exchanged sufficiently fast enough
  - Since we had different schedules, it was difficult to find a good time for everyone

- Designing the prototypes

  - Lack of team members with experience in designing made it difficult to design and build the prototypes

- Coming up with a business model

  - Lack of a business major in the team made it challenging to come up with a business model

We tried to overcome these obstacles in many ways. First of all, in order to communicate with IIT Bombay team more efficiently, we used email as well as phone. Although our primary mean of communication was email, we sometimes called IIT Bombay team members directly if we needed some information quickly. When we were trying to come up with business model and design the prototypes , we seek advice from our instructor and kept improving our ideas. Our team was polarized in a sense that all the team members were studying science. If we had someone with experience in business or design, it would have been helpful.

9   Recommendations

It would be worthwhile to try to make certain improvements on our prototypes. Notably, the filter for the first prototype (bathing cabin) needs some improvements. Research on cheaper and more sustainable ways to build the filter would be helpful to make the prototype more sustainable. It would be also worthwhile to come up with a material that is strong and also lighter than wood which was used for the current prototype of the water backpack.

10   Resources

- Project Tasks

  - Communicating with field research team : Shezami (20 hours)
  - Developing and designing survey questions : Shezami (20 hours)
  - Research and Analysis of Data : Sanghwa (20 hours)
  - Designing and Developing the prototype : Jeonghun (20 hours), Milos (20 hours), Expense : $60

- Ipro Deliverables

  - Project Plan : Jeonghun (10 hours)
  - Exhibit/Poster : Milos (10 hours)
  - Abstract/Brochure : Sanghwa (10 hours)
  - Final Presentation : Shezami (10 hours)
  - Final Report : Jeonghun (10 hours)

11   Acknowledgements

- IIT Bombay Team

  - Pradip Kalbar
  - Jublee Jasmine

- Mentor

  - Mary Hibbs-Brenner

- Instructors

  - Professor Ken Schug
  - Professor Margaret Huyck
  - Professor Linda Pulik