Stimulating Innovation at Agbogbloshie E-waste Site through Cross-Cultural Co-design

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Agbogbloshie: An E-waste Dump?

Agbogbloshie is the largest e-waste scrapyard in the world[1]. Some would treat it like any other waste dump, as a place where people collect, dispose of, and forget about useless garbage. However, to view Agbogbloshie in this light is a failure to recognize all of the extensive and elaborate systems of manufacturing that take place at the site. From the urban mining perspective, Agbogbloshie is a unique source of numerous raw materials, such as copper and aluminum, and innovative potential.

Currently, e-waste processors extract these resources and sell them to local makers and repair shop owners or ship them to foreign companies for profit. E-waste processors work in grueling conditions where injuries are common and exposure to toxic substances is ubiquitous. A survey conducted by Adanu et al. of 120 e-waste processors, found that only 38% of respondents utilize protective equipment such as gloves. In terms of extraction methods, 23% of the e-waste processors utilize wire strippers, while 100% use methods of hand sorting of scraps, burning, dismantling with stones/hammers, and hitting e-waste on the ground[2]. Although the processors are aware that their working conditions are harmful, they continue to work to financially support themselves and their families.

"It is not that we don't like to have all the good technologies, but, the money to buy them is the problem, however, if we use these crude methods, we don't have to pay for the cost of any machine for that reason we make hundred percent profit"

- Agbogbloshie E-waste Processor [2]

The goal of our project was to establish a collaborative community between students and faculty at both Worcester Polytechnic Institute (WPI) located in Worcester, the United States, and Academic City University College (ACUC) located in Haatso, Ghana as well as e-waste processors at Agbogbloshie. Through this collaboration, we aim to stimulate innovation and generate solutions through co-design to maximize safety and economic value for the waste processors. Our overarching objective for this collaboration is to develop robust, egalitarian partnerships across multiple domains to address the issue of accumulating e-waste, human health, and stimulate the local economy.

Improper community engagement has been the underlying source of failure for many developmental design projects spanning the timeline from the colonial era to the present day[3]. Oftentimes despite good intentions, the superiority complex of designers leads to a disregard of the innovative potential of those that the project aims to benefit. By deeply involving the true Agbogbloshie experts, the e-waste processors, in our design process we seek to develop a project that fully addresses the needs and skills of the e-waste processors. This frames our project in terms of the principle of generative justice, by allowing the e-waste processors to generate their own value and innovation from the Agbogbloshie scrapyard.

Understanding Cross-Cultural Co-design

Design refers to the "culture and practice concerning how things ought to be in order to attain desired functions and meanings"[4]. From a conventional engineer's perspective, a design process is quite straightforward. The five major steps of the engineering design process are as follows; identify the problem, conduct research, formulate many solutions, select the best solution, and finally test that best solution[5].

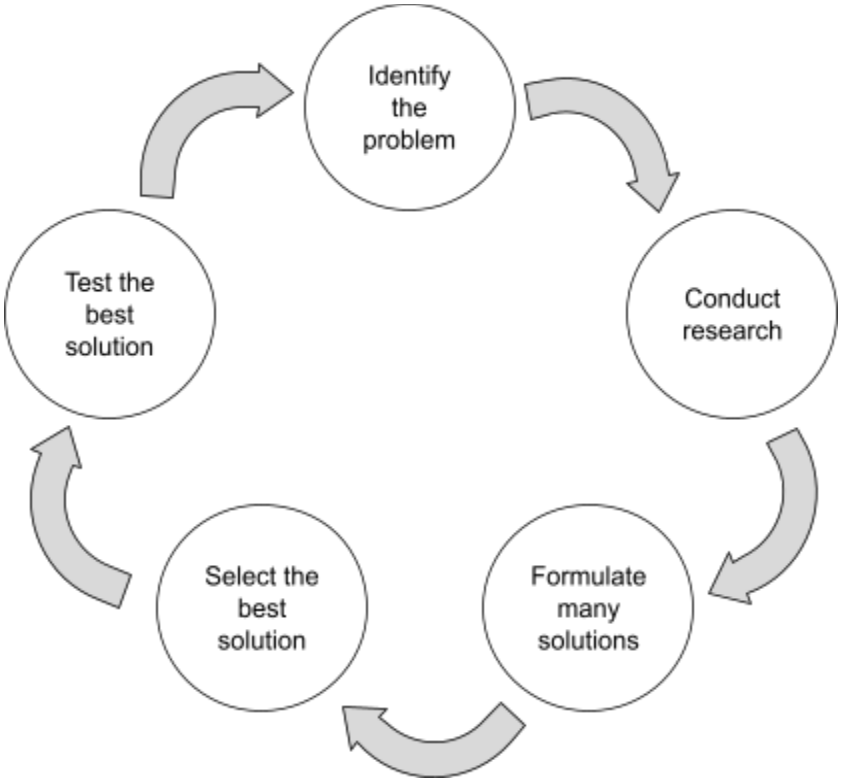


Figure 1. Engineering Design Process

The best solution is often defined by a quantifiable measure like efficiency or cost-effectiveness. However, a project's success is not solely determined by these steps. When a project is introduced to the real world and stripped of the controlled settings of a laboratory or workbench, the context of the project must shift to reflect real world challenges faced by real people. The project is no longer simply addressing only a technical problem, it must be doing so in a concrete social setting. In the real world, there are a lot of additional variables that can impact the success of a project, the most crucial and also frequently ignored are the social and cultural implications of an engineering project. When asking engineering questions we often forget to ask how the solutions will impact the community that they are introduced into, which results in failures even if the project resources are substantial.

International development is a great example of a setting where technical solutions must be implemented with the awareness of their social and cultural implications. Colonialism was one of the earliest forms of international development. As Escobar describes it, colonizers would come to countries using the pretense of humanitarian goals and preservation of freedom when their real motivation was to gain a foothold in the country and monopolize its natural resources. They ignored the local knowledge and technology and imposed the "right" way of doing things on the natives.[3] Natives were supposed to be enlightened by the colonizers and saved from their primitive ways of living but "not much could be done about their poverty because their economic development was pointless."[3] As time has progressed, there has been significant progress in

terms of international relations and the goals of international development have evolved. Nonetheless, “colonial relationships may have dissolved, and yet the history of global dynamics of power, wealth, economic strength, and political influence shape contemporary cultural encounters.”[6] Often the Western way of doing something is considered the right way to do it. Many international development projects failed, as “development was a top-down, ethnocentric, and technocratic approach, which treated people and cultures as abstract concepts.”[3] We need to understand people and their cultural and social norms to create projects that bring value to that community. In short, we need a more human-centered design.

Instead of bringing in solutions from the outside, co-design practices ensure that the local community is involved in the design process and the ideas come from the community itself. The challenges are defined by the people who are facing them, this way, we can make sure that we are looking for an answer to a real problem. Local knowledge and local people are equal partners in the solution generation and evaluation allowing for better solutions.

The design process becomes even more complex when we consider the cross-cultural aspect of it. We are in the United States designing with people located in Ghana, for us co-design entails working with people from a completely different culture than our own. Cross-cultural design introduces an additional set of challenges to an already complex process. Language barriers, unfamiliar customs, and different understanding of social roles make communication more difficult and force the designers to remove themselves from their own social setting to try and understand one another. Although it makes the process more challenging, the outcomes of

cross-cultural design are generally more fruitful, than anything that a homogeneous group of people can create.

"You put people from different backgrounds together, and they can see things from multiple points of view. They cover each others' blind spots. It's a smart move."

- Mike Monteneiro, *Ruined by Design* [7]

Due to COVID-19, we carried out our project remotely, which definitely had an impact on our ability to communicate and co-design with the local community. It is much harder to understand problems and their context just from videos and interviews, without being in the scorching heat, observing workers directly, breathing in the smoke from burning plastics. We couldn't just walk around the Agbogbloshie scrapyard and communicate with e-waste processors directly. We needed to find ways to engage with the community from the comfort of our own homes.

Redesign through Co-design with Sankofa

"I'm saying nothing here goes to waste. You know maybe an engine block is spoilt or is flattened. But the motors...you know… some of the pistons, all those things are good. So they are going to dismantle it."

- Mr. Suale, Computer Repairman from Agbogbloshie, 3/10/21

"You know there are things they use the tires for. They cut them and use them for all manner of things. Sometimes for sandals. Some for other parts of the cars, the shock absorbers … It's used for a lot of things"

- Mr. Suale, Computer Repairman from Agbogbloshie, 3/10/21

Throughout the design process, the goal of the process remained the same, and along the way the means of achieving this goal was redesigned through our engagement with the community. Due to the cross-cultural nature of our design process and us being remote, our project was constantly evolving. Our process focused on finding a way to use robotics to improve one or more stages of the e-waste extraction process at Agbogbloshie. Before the term began we had a seven-week goal planned out where we would begin with communicating with contacts at Agbogbloshie and work with them to start the problem identification stage. Originally it was only going to be a project involving our group and the e-waste processors, however early on we realized that we do not have the technical knowledge to develop a robotics solution that could utilize the e-waste. Additionally, the e-waste processors didn't exactly trust us and were suspicious of people coming over and asking questions. We needed a way to earn their trust and build a relationship with them.

After looking more into Ghanaian culture and reviewing hours of interviews from workers at the site it was evident that there was a sense of repair culture throughout Ghana and especially throughout Agbogbloshie. Sankofa in Twi means “return and get it,” “Sankofa shows us that for a successful future, we have to draw on the past—our own past—to access that knowledge”[7]. Together with the processors, we are linking a foreign word “recycling” with the local concept of Sankofa. Their repair and reusing culture inspired us to start looking into ways in which we could set up or build off of a place for the processors to have the opportunity to use their knowledge to innovate new ways of using the e-waste to make a living.

Sankofa[8]

One avenue, in particular, that we looked into was a makerspace at the site called Agbogbloshie Makerspace Platform (AMP) co-founded by Professor DK Osseo-Asare from Penn State University. The groups developed the makerspace platform to give e-waste processors and repairmen the opportunity to utilize the space and tools provided by AMP to innovate. AMP also focused on a digital network that links recycling with digital fabrication and distributed manufacturing through a phone app. The makerspace might have already been established at the site but there were multiple areas that could have improved upon. The app they developed for example when implemented did not get used by the processors and was soon taken down after launch. The process cycled back around to the problem development to find new ways to help innovate the existing makerspace to make it more accommodating for the e-waste processors and not just the repair shop workers. We made this new shift in the process because it had a much greater potential for achieving the goal of utilizing the e-waste better for improving the conditions. Unfortunately due to being remote, it was looking less likely that we could make these new shifts in the process feasible and we were unable to form a strong connection between the parties.

Our next point of contact were professors at a local college in Haatso; Academic City University College. Academic City was the perfect group to connect with and had ample knowledge and

experience to help make this project a success. To form this new community between WPI, Academic City, and the e-waste processors of Agbogbloshie, our team formulated a competition. Our group built the competition to be teams of Academic City University College students, Agbogbloshie e-waste processors, and WPI students that work together on developing a solution utilizing scraps from Agbogbloshie. The multi-stage competition organized teams and challenged them to identify a problem, generate prototype concepts, and present their ideas through a poster presentation.

Through our partners at Academic City, we were able to connect to the e-waste processors in person and they were able to work together at the site instead of trying to work with them remotely. Community engagement was heavily implemented towards the last two weeks of the process and we were able to communicate with the processors even though it was only indirectly. Going to the e-waste site shifted the students' perspective of what the processors are going through on a daily basis. This is the reasoning behind why community engagement is the most important aspect of the design process in developing a sustainable project that ultimately will support the main goal.

Learning, Unlearning, and Relearning Together

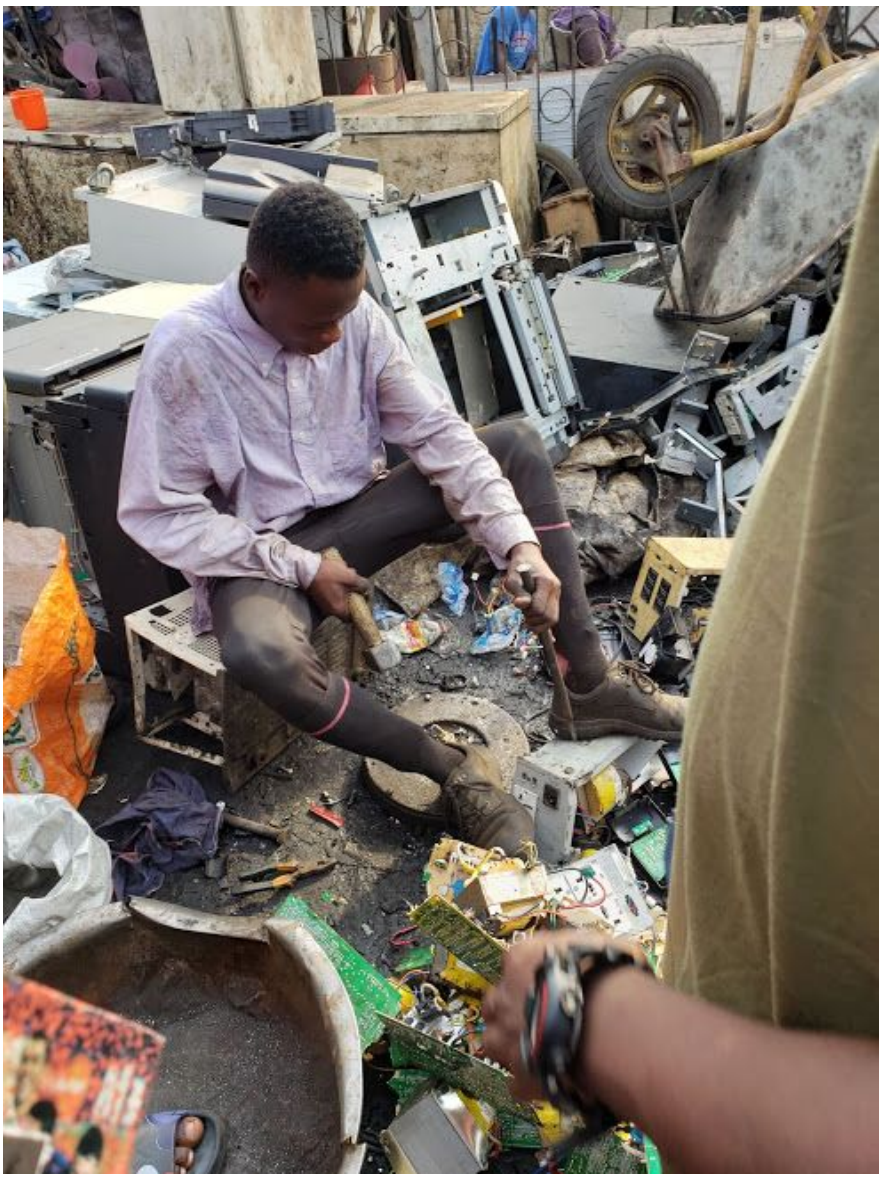
When interacting with an unknown place, one tries to absorb all of the information possible. As a newborn, this information comes in the form of senses. One learns through the information present in their environment. Trying to facilitate a project in Ghana from across the Atlantic, our initial environment consisted of newspaper headlines and academic research. While this was a helpful start to learn about this new world surrounding us, oftentimes the information is not completely accurate. Writings about Agbogbloshie usually attached a negative connotation to the area. People often frame Agbogbloshie as a tragedy where workers utilize e-waste extraction as their main source of income and are forced to undergo inhumane working conditions in order to support their families. While there may be some truth to these words, we wanted to understand the full picture of Agbogbloshie and western literature leaves out pieces of the puzzle. A newborn cannot survive without guidance from their elders and in a similar sense, our group was lost without the aid of people present in Ghana.

Connecting with our partners at ACUC helped fill in some of the pieces our group was missing. The ACUC community is familiar with Ghanian customs and thus was able to guide us through our interactions with other Ghanaians. Despite this, they too had some misconceptions about Agbogbloshie and were viewed as outsiders when visiting the site. First and foremost the e-waste processors made it clear that they did not trust our ACUC partners and that taking pictures and videos was prohibited. The e-waste processors explained that in the past individuals had betrayed their trust by utilizing photographs to frame Agbogbloshie in a negative light. Learning this information made it clear that our group needed to be forthcoming about our intentions. We needed the processors to understand that we want them to be our partners and that their expert knowledge is crucial to a team's project being successful. Upon the visit to Agbogbloshie, we learned some of the cultural customs for the site. While most of the materials are “free” it is customary to gift something to the head of the area. In our specific case, this was the Chairman of the e-waste processors. Following these customs is critical in building trust with the e-waste processors to create a healthy relationship. The feedback received also changed the direction of the competition which was originally geared towards utilizing e-waste to formulate a mechatronic solution to a current problem the processors were facing; however, the trip to Agbogbloshie demonstrated that a mechatronics solution is not solely what the processors need.

“Different processors reacted differently to our presence. Some were open to work with us, some were less so, and most were too busy to speak with us”
-Francis O’Hara, First Year ACUC Computer Engineering student, 3/12/2021

Building the relationship between WPI, ACUC, and the e-waste processors at Agbogbloshie provides an environment for us to learn and grow together. We all possessed perceived notions about one another that presented a barrier for our collaboration; however, by trudging forward each of the three parties slowly built up trust. While the relationship between WPI and ACUC is strong, more work still needs to be done to fully gain the trust of the e-waste processors.

Combating the Challenges of the Remote Co-design



Early in our design process, it became evident that we would stray from our intended timeline. Despite this, our actual design process is nearly identical to our proposed design process. This is because our proposed design process accounts for the cyclic nature of design and allows for multiple iterations through the problem identification and solution identification stages.

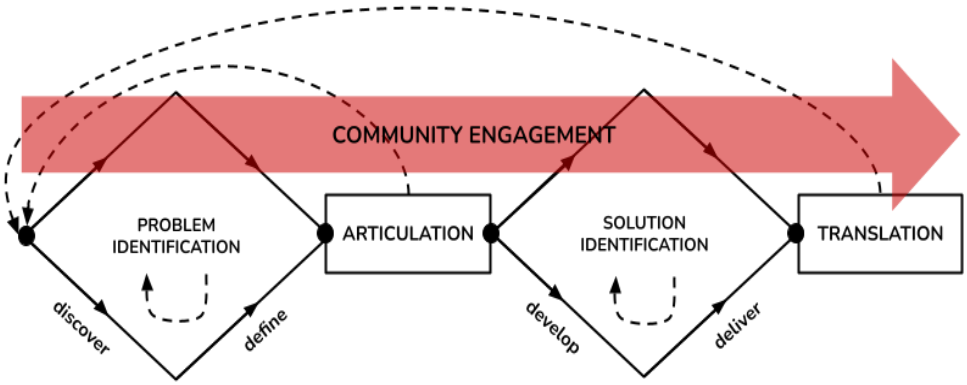


Figure 2. Proposed Design Process

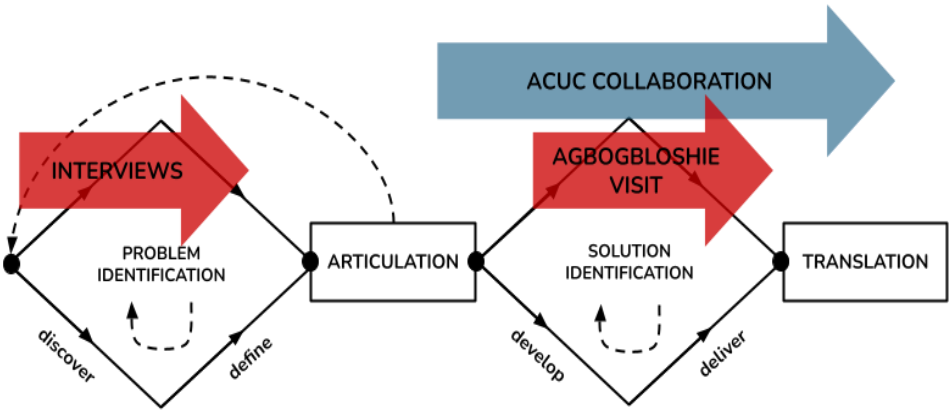


Figure 3. Actual Design Process

Although we aimed to partake in community engagement from the onset of the project, difficulty in obtaining contacts hindered this process and led to the discontinuous nature of our community engagement displayed in Figure 3. During the problem identification stage, we made reference to an hour-long video of interviews with e-waste processors. While the information provided from this video was useful as background and provided context, we were unable to ask our specific questions to the processors. We made contact with the e-waste processors during the final week, however, this communication was indirect as we had to rely on students from ACUC to speak with the processors. This limitation caused the relationship with the e-waste processors to be less developed than we had hoped. More significantly, co-design with the e-waste processors was

inadequate as the processors consulted with the students only once during the design process. The goal of this collaboration was to involve the e-waste processors in the generation of solutions, however, the student meetings with the processors focused on problem identification. In future project iterations, teams should consist of WPI students, ACUC students, and e-waste processors. One way to improve this collaboration would be to organize the relationship with contacts prior to the start of the seven-week term, allowing the focus of the project term to be on building relationships rather than searching for contacts. Additionally, our team can introduce the concept of co-designing with the e-waste processors to the ACUC students at the beginning of the competition to make clear the importance of the e-waste processors' role in the design process.

Other challenges in carrying out the design process stemmed from a lack of a precise seven-week goal. As outlined previously, the project initially had a goal of implementing a robotics or mechatronics solution aimed at benefiting the e-waste processors at the Agbogbloshie scrapyard. As it became increasingly evident that this goal was not feasible due to the remote nature of the project, the time constraints, and the team's skillsets, the project shifted to be more focused on building lasting relationships with contacts at Agbogbloshie. Although the experience was frustrating at times, it is important to remember that design is an iterative process where ideas build upon one another. The knowledge we gained through each direction explored wasn't wasted as it fueled the next iteration. For instance, after contact with the Agbogbloshie Makerspace Platform fell through, we remained focused on the concept of generating new uses for e-waste. We then framed the knowledge gained through the research of the AMP into a new light: an innovative competition that connects WPI students, Ghanaian students, and e-waste processors.

Another means through which we could improve our design process is by working more diligently to ensure that there is sufficient communication between the separate parties involved in the project. At times it felt as if there were a disconnect between the project advisors, ACUC professors, ACUC students, contacts in Ghana, and the WPI team. While the remote status of the project certainly had a negative impact on communication, more effort from the parties could establish clear communication. For instance, the team could send out a weekly email to all involved groups highlighting the accomplishments of the week and the goals for the upcoming week. This way everyone is aware of the actions that each different group is making and also the overall progression of the project.

"I think that we should work together toward blended activities. It is then that we can all learn from each other. We are ALL students in this effort. Innovation occurs not only in static labs but mobile workshops. Let's create mobile workshops that extend our knowledge and lift people out of poverty!"

- Robert Krueger, Agbogbloshie Co-Design Competition, 3/17/21

Upon reflection, it is clear that the design process is an immersive learning experience. The remote status, time constraints, and communication issues challenged us, but also fueled the team's motivation to succeed. Through this process, we learned how to better engage with individuals of varying backgrounds and how to ensure every project participant is able to apply their skills effectively while working toward a shared goal.

Looking Forward

"Agbogbloshie reminds us that making is a cycle. It extends to remaking and unmaking, recovering the materials we need to make something anew. Let's not call Agbogbloshie a dump. A dump is a place where you throw things away and leave them forever. A scrapyard is where you take things apart to remake something new."

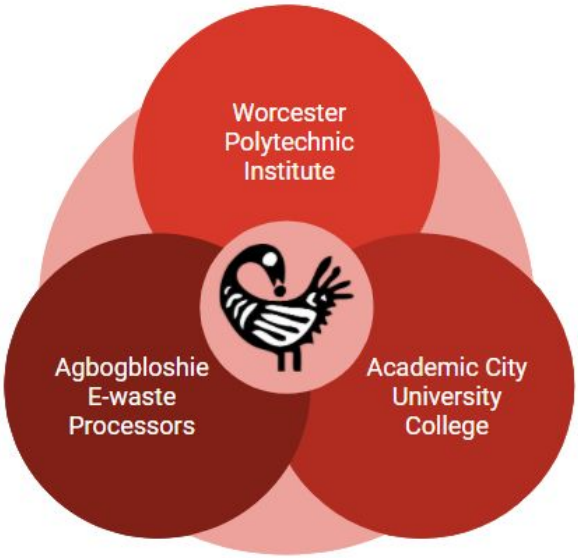
- DK Osseo-Asare [9]

This project established an invaluable connection between WPI and ACUC that works as the backbone to a successful future working relationship. While the competition this year has been limited by time restrictions it clearly sets up a path for the future. We feel that most of the logistic issues faced by our team such as, communication over a poor internet connection and working in different time zones, will not be a problem for future groups. In the short term, we hope that teams will continue to work on their projects. ACUC hosts a yearly Innovation Day on April 21st, which provides an excellent platform to present possible working prototypes. This not only gives the student motivation to continue working, it hopefully promotes the competition and gets more students interested in participating next year. However, before moving to the prototype stage, the groups should focus on strengthening the relationship with the e-waste processors.

Reflecting on our own original goals, our project failed to fully connect with the e-waste processors. We wanted to make the e-waste processors our partners in design. For any of these projects to be successfully implemented at Agbogbloshie, the processors need to possess some ownership over the change. It was unfortunate that in this iteration of the competition student teams were only able to connect with the processors once to influence their projects; however, a lot of progress was made to start to develop trust between all parties.

"Agbogbloshie is not a problem, it's an opportunity we ought to explore!"

- Fred Mcbagonluri, President of Academic City University College



Looking into the future we hope that the collaboration between WPI, ACUC, and the e-waste processors at Agbogbloshie doesn't end here. We see a future where these three parties adhere to the West African principle of Sankofa. It represents innovation in Africa that is often overlooked because it does not look the same as western innovation. We want to have work that continually draws upon the knowledge already present in Agbogbloshie such as in the heads of the e-waste processors. The relationships formed through this project have laid the foundation for the principle of Sankofa to continue and African innovation to flourish.

Credits and Acknowledgements

We would like to thank all the people without whom this project could not be possible.
First off, thank you to our project advisors Berk Calli and Robert Krueger. Your guidance brought this project to the next level.
A special thanks to the professors from ACUC who helped bring the competition to life: Julian Bennett, John Yirijor, & Michael Mensah.
Thank you to the ACUC students that took on the challenge and developed innovative solutions despite very tight time constraints.
Thank you to Osabarima for teaching us Twi and exposing us to Ghanaian culture.
And a final thank you to Hector Boye for helping form connections with processors at the site.

Endnotes

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Appendix. Posters constructed by ACUC Students

WPI

AGBOGBLOSHIE E-WASTE COMPETITION

TEAM ECOTINA

ACADEMIC CITY

ABSTRACT

Electronic waste or E waste refers to electrical or electronic devices that are no more useful or that have either exhausted or nearly exhausted their functionality. The ideal thing to do will be to recycle these electrical or electronic devices through material recovery. Per research, it was discovered that China is the largest producer of electronic waste worldwide yet the world's largest electronic waste dumpsite is here in Ghana, Agbogbloshie. In light of this unfortunate situation, students of Academic City University College in partnership with students of Worcester Polytechnic Institute have envisioned various ways of improving the situation at the Agbogbloshie Electronic waste dumping site.

INTRODUCTION

1. The Agbogbloshie E-waste dump site is the biggest E-waste dump site in the world
2. It covers roughly 20 hectares of land and is home to close to 80,000 individuals.
3. The kind of e-waste present there are refrigerators, microwaves, televisions, computers, printers, cars etc with refrigerators being the most dominant.

AIMS / OBJECTIVES

1. timulate innovation and generate solutions to recover the economic value of the electronic waste.

2. Identify the effects of the living conditions at Agbogbloshie on the health of women living there.

PROBLEM STATEMENT

As a means of livelihood, what most residents at the Agbogbloshie e-waste dump site do is to dismantle electrical or electronic gadgets that have otherwise been known to have exhausted their functionality in search of metal such as iron, copper or steel and sell them for profit. The method of dismantling used leads to the loss of other profitable material which they are not aware of. It is also important to note that these activities such as the burning of copper wires, poses great danger to the health of the people and increases the amount of lead in the soil. This is a challenge that Team Ecotina pledges to undertake by proposing solutions that are believed to aid in achieving the goals of this project.

SOLUTION

PROPOSED SOLUTIONS

1. Build a wire stripper to help in extracting the copper from the wires. It was discovered that the method used for obtaining copper from the wires was by hand stripping. We figured that building a wire stripper would be very helpful to them because it would make extracting of copper safer. However, the wire stripper is very systematic in its functionality and we believe that will not make the workers too excited because they want to work with speed.

2. Build incubators to be sold to farmers. These incubators will be built with materials from the dumpsite such as old refrigerators and microwaves, fans, power supplies, wires, temperature controller(from the microwaves). We proposed this solution because we observed that the dumpsite had a lot of refrigerators and microwaves. We also looked at the possibility of the men at the dumpsite selling the incubators to farmers for profit because the demand for incubators to hatch eggs is high.

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, using old fridges and microwaves to build incubators will not only help in reducing the amount E waste at the site but also provide job opportunities by building and selling locally made incubators to local farmers. Some of the people at the site could consider going into poultry farming which will generate income to improve their lives and contribute in boosting the agriculture sector of Ghana.

TEAM INFO

TEAM MEMBERS

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2. Delasie K. Bansah
3. Linda Arku
4. Wisdom Mahami
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Agbogbloshie Mechatronics Challenge
Team 2

Abstract

This presentation focuses on a means of providing better access to market for the aluminum smelters and providing an augmented custom-order service for them.

Introduction

This is what a regular day at Agbogbloshie looks like for Aziz, a scrap dealer who focuses on stripping computer parts. For most of the electronic components, they take out all the wires and harvest the ICs and Capacitors.

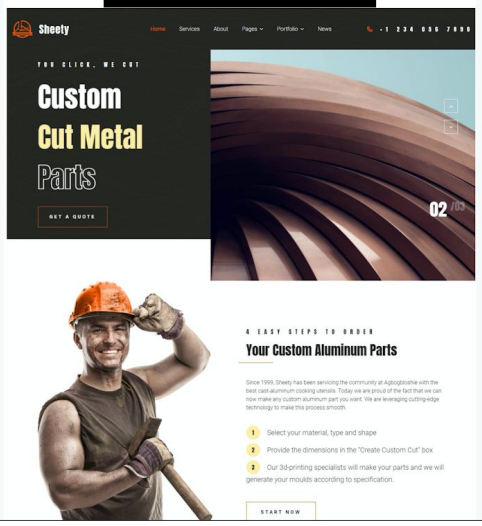
Plastics are discarded or burnt, and other metals, especially copper and steel are sold to foundries. The aluminum parts, however, are sold to on-site smelters who recycle them to make products such as pots and pans for cooking.

On interaction with the smelters, they highlighted *Poor Access to Market* as one of the biggest challenges they face.

Problem Statement

Every day at the smelters' is a busy day. On average, they produce 12 pots a day from pre-made molds. Unfortunately, since they make only one type of product, the market is not very favorable to them because of competition with other smelters.

Solution



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- John Yirijor
- Michael Mensah

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WPI

ACADEMIC CITY UNIVERSITY COLLEGE

The Scrap Workstation

Team 3

Agbogbloshie E-Waste Co-design Competition

ACADEMIC CITY WPI

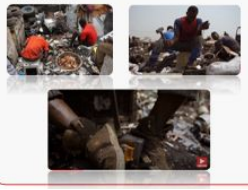
ABSTRACT

The Agbogbloshie E-Waste Co-design Competition was designed to bring together local e-waste processors, Worcester Polytechnic Institute students and the Academic City College community to generate solutions to recover the economic value of e-waste at Agbogbloshie. Teams were tasked with identifying a problem faced by Agbogbloshie e-waste processors and finding solutions aimed at either improving e-waste dismantling processes, or developing a product that e-waste processors could sell for profit.

PROBLEM STATEMENT

Disorganized work space leads to poor posture of workers during dismantling process and decreases overall productivity.

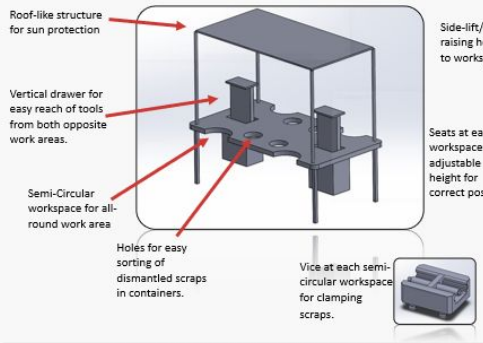
- *Workers often complain of backpains*
- *Miniature scraps are not effectively collected.*



SOLUTION

Ergonomically designed workstation which helps workers organize tools, maintain good posture through out dismantling process, and efficiently collect scrap materials.

CONCEPT DESIGN



CONCLUSIONS AND RECOMMENDATIONS

- Seats are to be adjusted to optimum height to prevent body pain.

TEAM INFO

TEAM MEMBERS

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ACKNOWLEDGEMENT

- Julian Bennett
  John Yirigor
  Michael Mensah
- Suale
- Nuhu

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WPI

AGBOGBLOSHIE E WASTE CO DESIGN COMPETITION

Team ROID

ACADEMIC CITY UNIVERSITY COLLEGE

ABSTRACT

Teams of Academic students, Agbogbloshie e-waste processors and WPI students worked together on developing a solution utilizing scraps from Agbogbloshie. Aimed at improving their e-waste dismantling processes or developing a product that the e-waste processors could sell for profit. We were to understand the challenges faced by the Agbogbloshie e-waste processors, develop a problem definition and outline a solution that would address that problem.

INTRODUCTION

Where we went to:

We went to the agbogbloshie e-waste dump site. we spoke with Mr. Suale a computer repairer who has been working there for 8 years. He took us around to meet other workers in the site.

Over the course of speaking with Mr. Suale, we got to know that they receive the e-waste from the companies(MTN, GLO, etc) in Ghana and also their agents who go out to get electronics appliances which are not of use to their owners.

They then dismantle the appliances to obtain the raw materials such as aluminum, copper and zinc.

After this they sell it to the factories at a price of 2 cedis per kilo.

PROBLEM STATEMENT

In a smelting factory, problem of carrying hot molten aluminum from the furnace across the room to the pot mold is physically tasking and can also cause health hazards. This reduces the efficiency of the whole process over time since the workers get exhausted easily.

SOLUTION

We came up the idea of creating a pulley system which would lift the molten aluminum up in a vertical manner and then transport it horizontally to the mold.

Mechanism:

Applying knowledge from mechanics of machines, the device was as based on pulleys.

How it Works:

There would be a timer that would countdown till the aluminum has melted. Once this has been completed the vertical pulleys would lift it upward and then the horizontal pulley would transport it across the room over to the mold. Once this is done the pulley would be reversed back to the stating position and the timer would be started again.

What would it replace:

This technology would replace the manual hard work put in by the workers. Which makes their working process slow and less efficient.

Advantages:

- It will prevent injuries
- It makes the process faster and efficient
- It makes the whole process less tiring

Disadvantages:

- It costs some money to build

Materials Needed

- Bicycle pulley (From a bicycle)
- 3 DC Motors (From a kitchen blender)
- Bicycle chain (From a bicycle)
- Wood
- Nails

CONCLUSIONS AND RECOMMENDATIONS

Once our solution has been executed, it will have positive effects on the health of the workers and also increase their efficiency. Improvements could be made on the device to minimize its disadvantages.

TEAM INFO

TEAM MEMBERS

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- Papayaw Boakye - Akyeampong
- Listowel Anim Appiah-Kubi
- Seamus Flanagan

ACKNOWLEDGEMENT

We would like to acknowledge the effort of:

- Mr. Suale: A computer repairer at the agbogbloshie site. Who took us around the whole e-aste site introducing us to the people e are working with.
- Members of this group for their immense effort working on the project
- Our Project Advisors: Mr. Julian Bennett, Mr. John Yirijor, Mr Michael Mensah.

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