PLASTIC REcycling -Waste

B49CB Business Awareness, safety and sustainability

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Course director : Reza Mohammadi word count:

**Abstract**

What we are-……… is a company based in Lobitos and Piedritas with the main goal of reducing plastic waste.

Our aim-We aim to do this by recycling plastic into several different items ranging from household products and souvenirs to roads and paths to create solutions to a range of problems the communities face. This process will be carried out by initially collecting waste from the ‘plastic forest’ (an area littered with so many plastic bags it has been named by locals) and the nearby coast which has built up a significant amount of waste, the plastic will then be shredded to a uniform size before being melted and then placed into a mold to create the item.

Long and short term plan -The vision of the team is that with this cheap solution we will be able to reduce waste in the area significantly while also solving a number of additional problems related to our main design topic of waste.

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# 1-Introduction

## 1.1-Peru

The communities of Lobitos and Piedritas are located on the northern coast of Peru, they have respective populations of around 1300 and 400. Despite profitable tourism industries in both communities, most notably the surfing attraction of Lobitos, both communities still have high levels of poverty as much of the money made from these tourists does not go to locals or the community. In order to help improve the quality of life of the people of these communities we intend to not only directly address their growing waste issue but also recycle the plastic portion of this waste to benefit the community. Plastic pollution has become a global issue in recent years as the extent to which we have polluted, especially our oceans, has become evident. It is therefore crucial that global action is taken, however without the ability to implement country wide recycling schemes paired with the necessary recycling education to make them successful in regions such as these, innovative engineering and business solutions are needed.

A large portion of waste plastics can be recycled and doing so not only reduces the local issue of the eyesore which is deterring tourists but also removes a danger to wildlife and prevents locals from burning their plastic waste and adding to climate change issues. Previous attempts to implement recycling in the region haven’t been successful but we hope as we will be recycling plastic into products which the community can actively see benefitting them, this will help to create a community ethos more positive towards recycling.

As plastic can be used in a large variety of ways it can be used to address a range of issues these communities are facing. Both regions don’t have consistent access to safe, clean water and while some people can afford rain collection tanks or ways of storing water when there is available, the poorest cannot so we plan to build rain collection tanks to give to these people. We will be increasing the ease of which the community can recycle to ensure this doesn’t become a reason why people stop recycling, we plan to do this by building recycling bins and also general waste bins. Schools in the region need more classroom supplies, many of which can be made using plastic, this will make it easier for the youth of the community to become more educated, allowing more of them to escape poverty. It will also hopefully make them aware of the benefits of recycling from a young age, which will be essential to the longevity of the project. In addition to creating plastic items which can help the community we will also be selling certain products to tourists, allowing us to reinvest more money into helping the community and is a good way for the community to profit more from the tourism.

As well as existing problems which have been identified, one of the benefits of our incredibly versatile solution is it can be used to tackle new issues and be scaled up into new projects and continue to be useful even after all these issues have been addressed and solved. An example of this can come in the form that if this solution had been implemented a year ago no one would have thought to address the now crucial issue of covid-19 transmission, however it would have been easy to start producing face shields using this solution.

## 1.2-original designs

Lobitos and Piedritas face a number of problems which are all vital to creating a well ran and maintained community however we deemed that waste was the most vital category to focus our attention to as a number of other issues such as food, sanitation and build environment are closely intertwined with the bigger issues created by the waste problem.

* Need to decide a name
* What Type of company are we
* Product name

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Criteria 1** | **Criteria 2** | **Criteria 3** | **Criteria 4** | **Criteria 5** | **Criteria 6** |  |
| **CRITERIA DESCRIPTION** | **Cost** | **Build Difficultness** | **Sustainability** | **Practicality** | **Safety** | **Effectiveness** |  |
| **OPTIONS** | **Score** | **Score** | **Score** | **Score** | **Score** | **Score** | **TOTAL** |
| Omni processor | 1 | 2 | 8 | 4 | 6 | 10 | 31 |
| Transport link | 2 | 2 | 7 | 5 | 9 | 8 | 33 |
| Bio farm | 1 | 5 | 8 | 6 | 9 | 7 | 36 |
| Plastic recycling | 7 | 7 | 6 | 7 | 6 | 7 | 40 |
| Desalination | 1 | 5 | 7 | 5 | 8 | 8 | 34 |
| Human Power | 7 | 6 | 7 | 4 | 7 | 3 | 34 |

Table 1

Table 1 shows our initial ideas ranked on a scale from one to ten, the lower the number the worse the design performed in that specific category. The designs were ranked over 6 criteria’s and the option with the highest total was chosen to be our final solution. As a result ….. was the solution we would use.

## 1.3-why we chose this solution

Peru as a country faces a crisis regarding recycling, 90% of Peru’s waste is not recycled and when compared to the UK’s 45% it highlights the extent of how far behind they have fallen. Furthermore, one in every ten kilograms of this waste is plastic! As of now Both lobitos and especially Piedritas have outdated waste management systems which mainly consist of either throwing waste to blow away or burning it. This process is unsustainable and results in the large collection of waste in the ocean and nearby forests, devastating the wildlife and surrounding landscape.

This solution not only relives the communities of their waste problems but can also provide solutions to their sanitation, food, pollution, and housing issues

# 2-Our Design

## 2.1-How does our idea work

Plastic recycling is not just the only aim of how this design will work. The idea of this design is not only just solving the plastic waste in Lobitos and Piedritas, the plastic which are collected can be re-used in a feasible manner. Plastic can be processed and produce useful products such as classroom supplies – rulers, protractor, skipping ropes etc. With the COVID-19 global pandemic, protection kit such as face shields and/or face mask clips can be made from recycled plastics.

## 2.2-Sourcing plastics

Plastic waste will be collected from around the local areas in Lobitos and Piedritas beside the coast. With respect to time, plastic waste will eventually run out around the area therefore a problem will arise. With considerations to make the idea bigger in the future, plastic recycling bins will be placed around Peru for residents to put their unwanted plastic waste in these bins and collected after a specific amount of time past. If plastic wastes collected from Peru is still not enough, this could go worldwide where plastic wastes from other countries are transported over.

## 2.3-Preparing plastics for melting

Plastics does not just come in one kind, there is many types of plastic such as polypropylene, polystyrene etc. When in preparation of melting plastics, they need to be separated in their own kinds as they all have different properties, behavior and melting temperatures. Separating plastics into their own kinds can be difficult as they may have the same color, texture, and appearance but they can be two different types. Some ways of identifying the difference can be:

* Look for the recycle logo on the plastic, it will identify which type of plastic was used to make the product.
* Memorizing – most of the time, same products are made from the same type of material, for e.g. legos are made from ABS and bottle caps are made from HDPE.
* Visual and physical properties – different plastics has different properties such as polystyrene has a breakable sound when ‘squashed’ whereas polyethylene has a more flexible and tough behavior.

After identifying the plastics, it will be put into a shredder so that it is smaller in size and ready for the next stage in the process.

## 2.4-Melting plastics

## 2.5-containing emissions

## 2.6-moulds

## 2.5-materials

# 3-economics

## 3.1-assumptions

Before discussing the initial costs of the project, there were some assumptions made.

In terms of all the initial costs, a worst-case scenario basis was assumed. This means that for any cost that had a varied estimate, the higher estimate was always assumed as the cost. For example, in terms of molds, for a water bottle, it was estimated that a mold would cost between £1,000 and £2,000, so when calculating the costs, it is assumed that the mold would cost £2000.

Lastly, we also assumed that all the materials are purchased in the UK, and machines are built here, and are then shipped to Peru by cargo boat, the cost of this is also estimated based of costs found online.

## 3.2-initial costs

A list of the costs are as follows:



## 3.3-funding

A few options were considered as a funding source for this project.

The first was an organisation called the ‘Global Environment Facility’ (GEF). This is an organisation that gives grants to projects that help to protect and restore the environment. This project would meet the eligibility criteria to be considered for a grant and would be defined as a medium sized project as we are asking for less than $2 million.

Another possible source of funding is setting up a GoFundMe account and asking for donations. The only problem with this source of funding is that the amount that we would receive to start this project would not be guaranteed and we would need help from Engineers Without Borders and social media to help raise awareness. Whereas going with the GEF would guarantee us the costs we would need to start this project.

The Coca – Cola company was also another potential source of funding. With over $216 million invested in projects from all over the world that protect the environment, they could invest in this project. The reason this project could be appealing to Coca-Cola is because we are recycling plastics and creating new items. As a large percentage of their goods are sold in plastic bottles etc., they may see this as a good marketing tactic and could sponsor the project.

A couple more UK based options to consider were the Small Charities Challenge Fund (SCCF) and UK Direct Aid. Both were established to create a better standard of living for those in poverty across the world. This project would be eligible for consideration for both funds.

## 3.4-feasibility and sustainability

With all funding options of funding stated above, this project is entirely feasible. Once the initial funding is sourced, and the project is fully established, the project should be self-sustaining. Some of the initial items made will help to tackle problems surrounding the Covid -19 pandemic. This will encourage tourists to return as it will be a safer environment. The factory itself will encourage new types of tourists to visit the area and buy novelty items that will be made at the factory and sold at the factory and the local hotels and restaurants.

# 4-short term plan

The purpose of this project is to provide a sustainable way to improve the communities of Lobitos & Piedritas through a scheme that can be permanently implemented into their communities. In the early stages of the project, Plastics for Peru aim to set up a production station on the outskirts of Lobitos, along with 4 collection points. The locations of which shown in figure x.x.



The location of the plastic production will begin with one Plastic shredding machine and one Injection molding machine, along with the molds required to produce the Face shields and classroom supplies. Each machine is to be pre-built and then transported to Peru. The required solar panels set up too, this role trusted to a local, Peruvian, expert. With this equipment in place, the last required variables include a training scheme, and the collection of the raw material, plastic.

The collection of the plastic, in short term, is entirely dependent on the locals through the strategically placed collection points. These ‘Bin locations’ are to contain a large recycle bin to collect all plastic waste, along with information about the project to help advertise the scheme to the locals. This advertisement is, ideally, to encourage them to recycle their plastic waste, and of this plastic waste, hopefully recycle it through the use of the machines provided by this initiative.

A short-term aim of the project is to partner with Engineers without borders, knowing that this initiative has a plethora of talented and experienced engineers onboard. It is the hope that they can aid the project in supplying Engineers experienced enough to train locals within the community, really strengthening the sustainability of the project.

A large part of the short term plan is to measure the success of the project, weighing in on a number of factors; including, the amount of plastic being deposited, the impact the produced items are having, and the popularity of this project with the locals. These factors all influence whether the scaling up of the machinery and energy production is plausible. Only once it is a guarantee that this project can move forward efficiently will the next stage be implemented.

# 5-Risks and safety

## 5.1-Health and safety issues

Although to help Lobitos and Piedrita to be a better environment for the residents to live a better life is top priority, health and safety issues was also considered in the process. When products are manufactured, processes such as the preparation of plastics and the manufacturing process involves high power machines which could cause hazards. A list of machines with its risk assessment and prevention will be described in detail.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Machines | | | |
|  | **HARM** |  | Injection Moulding | Plastic extrusion | Plastic shredder | **PREVENTION** |
| Heavy Lifting | Strain injury |  | ✓ | ✓ |  | Lift suitable amount of loads and/or use mechanical conveyors |
| Pouring granules into hopper | Risk of cuts to hands |  |  | ✓ |  | Wear hands protection |
| Molten plastic/heat | Risk of burns |  | ✓ | ✓ |  | Put machine guard down and stay at safe distance |
| Contact, impart or trapping | Serious injuries/deep cuts |  |  | ✓ |  | Machine guard must be down at all time and switched completely off when not in use |
| Entanglement | Serious injuries/deep cuts |  | ✓ | ✓ | ✓ | Never wear loose clothing and/or keep emergency stop within reach |
| Hazardous substances | Breathing problems/health issues |  |  | ✓ |  | Use temperature low enough to prevent toxic fumes |
| Noise | Hearing damage |  | ✓ | ✓ | ✓ | Wear ear protection and/or have noise reduce barriers |
| Slip, trips and falls | Cuts and bruises |  | ✓ | ✓ | ✓ | Keep workshop cleared and distanced |
| Contact, impact or entanglement from unexpected movement (during maintenance, cleaning and repairs) | Bruising and/or crush injuries |  | ✓ | ✓ |  | All machines should be switched off at all time if not in use and machine guards must be down |
| Toxic fumes | Breathing problems |  | ✓ |  |  | Use temperature low enough to prevent toxic fumes and/or provide ventilation |
| Dust | Eye irritations, breathing problem, risk of fire |  | ✓ |  | ✓ | Use of extraction equipment and/or keep machine clean and dust free |
| Contact or impact from ejecting plastic | Cuts and/or bruising |  |  |  | ✓ | Keep machine guard down for prevention of plastic ejection |

*(Table of risk assessment and harm preventions [1])*

Personal protective equipment (PPE) should be worn at all time when in the workshop, these are such as:

* Ear protections – ear defenders’ headband
* Eye protection – safety goggles
* Face protection – face shield/mask
* Hand protection – safety cut-proof gloves
* Workshop apron and/or boiler suit

## 5.2-solutions

# 7-Sustainibility and Ethics

## 7.1-Social

At plastics for Peru we don’t focus on how little negative impact we have on the environment but rather what we can do to ensure the environment strives back to its former glory. As the last generation able to put a halt to climate change we believe drastic steps need to be taken, which is why our entire design process and final solution has been carefully crafted to fight the biggest waste problem the world has ever seen. We achieve this by using only renewable energy sources and cleaning waste plastics from areas where wildlife and ecosystems are being destroyed as a result of plastics intrusion and converting this back into useful items for the local community.

7.2-Economic

As a non-profit charity our main source of income will be from donations however, we will also raise revenue by selling ‘tourist’ items such as beach toys and through Kickstarter events like our marathon. The profit from the tourist items will be completely reinvested within the business and used to create further supplies for the community. The design includes a large initial cost due to the use of wind turbines however this energy source is proven to be more economically sustainable in the long run. Currently only 90% of waste is not recycled in Peru and of that every 1 in 10 kg is plastic [2] therefore there is a massive way for Peru as a country to improve on their recycling measures and gives Plastics for Peru great opportunity for expansion.

7.3-Environmental

Plastics for Peru will aim to employ local residents which will be initially trained by a experienced mentor before management is passed on. This will provide much needed jobs in Lobitos and Piedritas which have poverty levels of 30% and 70-80% respectively [3].The design will be located in an area far from tourist hotspots as we realise our design can be an eyesore and we do not want to negatively impact tourism. The land for which we locate our design on will also be sourced ethically by paying a fair price and not forcing the owner into a deal.

# 8-Long term plans

Plastic for Peru aims to have the greatest impact in as short a time as possible however we also realise that some goals of ours need careful consideration and planning meaning they cannot be implemented in a matter of days or even weeks.

## 8.1-maintaining the design

It was discussed earlier in the report the methods and information that would be provided to the community to help them maintain the design in basic maintenance procedures and common scenarios however we also realise that although we have made the instructions as clear and easy to follow as possible that some maintenance can be dangerous or skill rigorous. We will aim to provide additional training programs throughout to ensure the employees and volunteers maintain and further their skills until they are at a level where they can independently operate the design

## 8.2-Future Management

Our vision of the future of management is completely in the hand of the community.

After have completed our short term plan we will hand over the first responsibilities in which the employees will individually complete. These responsibilities will constantly increase until no external help is needed by the locals. As highlighted above this will be a slow but constant process to ensure employees are confident in maintaining the design.

## 8.3-expanding our reach

As highlighted throughout the report we see our design as a solution to not only the issues in Lobitos and Piedritas but Peru as a whole. We would like to initially implement our design into communities similar to Lobitos and then expand into larger cities to create large infrastructure such as houses made of plastic ‘Lego’ style blocks

# 9-improvements

## 9.1-using other types of projects

## 9.2-creating more molds

## 9.3-reducing emissions

# 10-Refrences

[1]

[2] [**https://www.wwf.org.pe/en/?uNewsID=328834**](https://www.wwf.org.pe/en/?uNewsID=328834)

**[3]** EWB design brief

# 11-Appendices

**Part 1 - INTERNAL TEAM ASSESSMENT DECLARATION & APPROVAL**

***Must be completed electronically using Microsoft Word Application & submitted by email to Reza Mohammadi –*** [***r.mohammadi@hw.ac.uk***](mailto:r.mohammadi@hw.ac.uk)

**Team Name \_\_\_\_Team 27\_\_\_\_\_\_\_\_ [B49CB]**

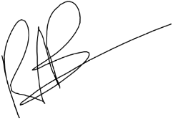
**Team Members: Andrew Leahy, Cameron Maxwell, Chi Hang Tse, Ross Brown, Callum Jardine, Zeon Ojuoko**

|  |  |  |
| --- | --- | --- |
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4) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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6) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |
| --- |
| **Team Procedures** |

1. Day, time, and place for regular **team meetings**:

Monday’s 1-2pm on Microsoft Teams

1. Preferred method of **communication** (e.g., e-mail, cell phone, wired phone, Blackboard Discussion Board, face-to-face, in a certain class) in order to inform each other of team meetings, announcement, updates, reminders, problems:

WhatsApp group chat

1. **Decision-making policy** (by consensus? by majority vote?):

By consensus

1. Method for setting and following meeting **agendas** (Who will set each agenda? When? How will team members be notified/reminded? Who will be responsible for the team following the agenda during a team meeting? What will be done to keep the team on track during a meeting?):

Weekly agenda set by – Cameron, all members notified via WhatsApp. Agenda will have allocated times for each activity, keeping members on track.

1. Method of **record keeping** (Who will be responsible for recording & disseminating minutes? How & when will the minutes be disseminated? Where will all agendas & minutes be kept?):

Callum and Ross will be recording minutes. All minutes and agendas will be shared and stored on Microsoft teams.

|  |
| --- |
| **Team Expectations** |

**Work Quality**

* 1. **Project standards** (What is a realistic level of quality for team presentations, collaborative writing, individual research, preparation of drafts, peer reviews, etc.?):

To create a project indistinguishable from work submitted within a professional setting, regardless of the task.

* 1. **Strategies** to fulfil these standards:

***Four-point plan***

1. Excellent time keeping, ensuring all aspect of project happen on time. Kept in place by both the agenda, and minutes.
2. A group responsibility to complete assigned tasks, enforced by the peer review system.
3. Drafted and completed work reviewed by all team members, keeping all parties on track, making sure work is up to the set standard, and establishing a full understanding of the project, group wide.
4. All individual research must come complete with references for all sources read and for all quoted material.

**Team Participation**

1. Strategies to ensure cooperation and equal distribution of tasks:

* Meeting agendas agreed upon by all team members
* Record kept of tasks assigned to members and record kept of when tasks are completed.
* Ensure all members agree on which tasks they will be required to complete and make sure everyone gets an equal opportunity to put themselves forward for each task.

1. Strategies for encouraging/including ideas from all team members (team maintenance)

* Keeping a non-toxic environment within the group, making sure everyone feels comfortable speaking and expressing ideas.
* Each member assigned a 3-minute slot at the beginning of each meeting to bring forward their own ideas without the fear of interruption, and/or total disagreement.

1. Strategies for keeping on task (task maintenance):

* Setting deadlines for each allocated task
* Prioritise more important and integral tasks
* Keep to the four-point plan as previously highlighted

1. Preferences for leadership (informal, formal, individual, shared):

Lead via a ‘loose leadership’ style. Though a leader is assigned, each member of the team has an equal amount of power. With the leader in place to keep goals aligned and tasks completed.

**Personal Accountability**

1. Expected individual attendance, punctuality, and participation at all team meetings:

All individuals have the responsibility of turning up on time for meetings and making sure the level of contribution is always something, be it, agreeing on ideas or suggesting them.

1. Expected level of responsibility for fulfilling team assignments, timelines, and deadlines:

Each member of the group should have full responsibility of keeping each allocated task within the deadline, all task will be done professionally and in a non-rushed manner.

1. Expected level of communication with other team members:

* Make sure that your team knows what you are doing
* Feel free to ask for support from any other team member, if needed
* Positive encouragement from one another
* Mutual agreement on decisions within the group

1. Expected level of commitment to team decisions and tasks.

The decisions and tasks will ultimately be democratic and agreed on by most members of the group. All team members are expected to follow team decisions and tasks, regardless if they agree or not. All comments and suggestions by any team member will be accounted for and taken into consideration when deciding tasks and making decisions.

|  |
| --- |
| **Consequences for Failing to Follow Procedures and Fulfil Expectations** |

1. Describe, as a group, how you would handle **infractions** of any of the obligations of this team contract:

Infractions will result in a discussion with the entire team in which we would discuss the type and severity of the infraction. A decision will be made by the group on how to resolve the issue in the best possible way for the individual and team at the same meeting.

1. Describe what your team will do **if the infractions continue**:

If infractions continue, the group will together agree on what internal measures we believe are necessary as well as reporting the issue to the university. We will then work with the lecturer to see if the issue can be resolved or if they have to, as a final measure, have to be removed from the group.

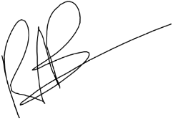
\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

1. *I participated in formulating the standards, roles, and procedures as stated in this contract.*
2. *I understand that I am obligated to abide by these terms and conditions.*
3. *I understand that if I do not abide by these terms and conditions, I will suffer the consequences as stated in this contract.*

1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_date 25/09/2020

2) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_date: 25/09/2020

3) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_date: 25/09/2020

4) date: 25/09/2020

5) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_date:25/09/2020



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