UPCYCLED GREENHOUSES NEPAL

Figure 1: PSD Plastics (UIAA, 2019)

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EXECUTIVE SUMMARY

“In a world where we produce enough food to feed everyone, 821 million people – one in nine – still go to bed on an empty stomach each night. Even more – one in three – suffer from some form of malnutrition”. (FAO, 2020) For a lot of developing countries growing produce to suit the climate proves to be an impossible task as they do not have the technology or means to grow off season vegetables and fruit. This not only affects the food that people in developing countries can eat but also means that there is often a drastic shortage of jobs in the agricultural industry. “At 39.4 million, East Asia accounts for one in every four jobless people throughout the developing world.” (The Globalist, 2014) Therefore, it makes sense in order to try and counter poverty and hunger by creating a product that allows for off season growing and creates jobs.

The proposal for our business, Upcycled Greenhouses Nepal, is to build greenhouses out of recycled plastic bottles and locally sourced raw materials in order to combat plastic waste, aid in the harvesting of offseason produce and reduce unemployment.

BUSINESS OVERVIEW

IDENTIFIED AREA AND ISSUE

Our chosen country is Nepal, with our initial target area being Jhapa. The Government’s waste management technique used for the 700+ small industries within Jhapa is very simple and takes place only in market areas and main cities. Since plastic makes up 12% of household waste and 22% of industrial waste in Nepal, Jhapas waste management issues along with their abundant source of bamboo makes them the ideal initial area. (Asian Development Bank, 2013)

Nepal, as is the case with many undeveloped countries, has vast issues with poverty, hunger, unemployment, waste and changing climate. We believe that our Upcycled Plastic Greenhouses will create jobs (Naseem, 2019), address the plastic waste issues at a low cost to allow for off-season growing in the ever changing climate of Nepal.

UNITED NATION SUSTAINABLE DEVELOPMENT GOALS: OUR OBJECTIVES

Upcycled Greenhouses have been designed to incorporate many of the United Nations Sustainable Development Goals. The 6 main goals chosen to be incorporated into our business are, 1. No Poverty, 2. Zero Hunger, 8. Decent work and Economic Growth, 12. Responsible consumption and production, 13. Climate action and 15. Life on land. (United Nations, 2020) Through the implementation of these goals we aim to help reduce poverty in Nepal where in 2019 8% of Nepalese lived below the national Poverty line of USD$1.90 pd. (The World Bank, 2020) This will be done through the implementation of new jobs as well as bringing new income into communities through sourcing of materials locally, therefore contributing to the economy of the individual villages as well as the ability to sell excess offseason produce. Our goal is to decrease Nepal’s current global hunger index from level: serious through the implementation of our affordable greenhouses in many small nepalese villages to help individual families have access to affordable produce. (Global Hunger Index, 2020) We aim to build greenhouses in many villages creating new jobs for the local unemployed. We intend to create cost effective yet well built greenhouses out of locally sourced materials made to last. We have created a product that will keep giving for many years and is inexpensive to fix. with 90% of our materials sourced from local waste through the implementation of paying individuals to collect plastic bottles that currently are discarded throughout Nepal and are unable to be recycled or composted of. (Himalayan Climate, 2014)
PRODUCT OVERVIEW

PRODUCT DESCRIPTION

Our upcycled plastic greenhouses are mostly made of recycled plastic bottles. These bottles have the bottom section cut off and are then stacked on top of each other to form the foundation of the greenhouse wall/roof. As shown below in Figure 1. These bottles will be attached to the bamboo using wire which is looped and tied off. Wire will also be looped horizontally around each stacked section in order for added stability and strength.

TECHNICAL DESIGN

Each Greenhouse is made of approximately 2185 upcycled plastic bottles. These bottles are attached to a Bamboo structure (60m) that is held together by wire (140m). The Greenhouses are 3.5M wide by 4M long. With a slanted roof to allow for rain to run off the roof. The heights at either end are 1.25M and 1.75M. These heights were chosen to maximise types of produce that can be grown within the greenhouses. As outlined in Figure 2 below.

PRODUCT CREATION

We will have four Nepalis workers employed to assemble the upcycled greenhouses. These workers will assemble the stacks of bottles at our headquarters. The bamboo will be cut to size at headquarters in order to fit the plan of the frame. They will then transport the bottle stacks, bamboo and wire to the site where they will first assemble the greenhouse frame using the cut bamboo and wire. The next step is tying the bottle stacks to the bamboo frame, ensuring that it is structurally sound (enough vertical tension between bottles, wire and bamboo in order to make it strong). The stacks/vertical bamboo struts will need to be slightly dug into the ground on the bottom row in order to achieve a fixed greenhouse that is resistant to wind.

Figure 2: Functional Design

Figure 3: Upcycled Greenhouse Design to scale
Nagar Mitra-Friends of the City is an organisation that employs workers in Nepal to collect plastic waste. These workers are usually of marginalized ethnicities and are in dire need of as much support as they can get in terms of poverty and lack of education. (Himalayan Climate, 2016) The Nagar Mitra are currently selling their collected plastic bottles to organisations such as the Himalayan Climate Initiative for 40 Nepalese Rupees per kg of plastic bottles ($0.33 USD). (Himalayan Climate, 2014). Purchasing bottles directly from the Nagar Mitra will be our source as it not only allows us to collect plastic for our greenhouses, but also financially supports these workers. Trashpakers is a movement of travellers and locals from all over the world to spread awareness of the global pollution problem and arrange cleaning events to reduce trash waste from the environment (Trashpackers, 2020). In collaboration with Trashpackers, we would like to arrange two events every month in different areas in Nepal to collect trash. Our monthly aim is to collect around 3000 trash bags. In this way, we will participate in reducing environmental pollution and use that plastic waste to increase our inventory.

**BAMBOO**

Small producers and gatherers can be considered important players in the bamboo based activity. In an average farm in East Nepal, an average farmer has one or two bamboo clumps (R. K. Jha, 2015). However, they are scattered and they are not able to supply in bulk. Their uses are subsistence; they only sell in order to meet emergency cash needs and bamboo cultivation is not done at the cost of food production (R. K. Jha, 2015). However, they are scattered and they are not able to supply in bulk. Their uses are subsistence; they only sell in order to meet emergency cash needs and bamboo cultivation is not done at the cost of food production (R. K. Jha, 2015). The farm gate price is around Rs 10-15 per bamboo culm. The traders are found to be selling at around Rs 80 per 12m stick (R. K. Jha, 2015).
Market Analysis

Market Objectives:

Target Markets:

<table>
<thead>
<tr>
<th>Primary Target Market:</th>
<th>Secondary Target Market:</th>
<th>Indirect Target Market/Partnerships:</th>
</tr>
</thead>
<tbody>
<tr>
<td>-Large Scale commercial Farmers within the villages of Jhapa</td>
<td>-Small scale farmers and households in Jhapa</td>
<td>-Municipalities within the area (Government Agency) who are assigned with the responsibility of collection of waste. Concept of farm school can be launched where school as well as specific agriculture school students can enter the farm where the tunnel farming is done.</td>
</tr>
</tbody>
</table>

Marketing Strategy and Objectives:

<table>
<thead>
<tr>
<th>Objective</th>
<th>Consumer/Primary Target Market</th>
<th>Secondary Target Market</th>
<th>Government Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieve 5% of our target market within the first year of operations.</td>
<td>To sell our product to small scale farms and households and achieve status within the industry in Jhapa</td>
<td>To promote the importance of sustainability within communities of Nepal</td>
<td></td>
</tr>
</tbody>
</table>

Promotion:

- Our sales rep will visit larger local farmers who set the industry standard for farming procedures in villages. Short Documentary Campaign. Outlining our progress and reasons for operating.
- Large scale farmers who use our product will become public advocates for our business. This is the most effective way to reach our secondary target market who may not have access to internet or television.

To promote the importance of sustainability within communities of Nepal:

- a. Have our board/original team members create a promotion programme for schools in Nepal which will educate students on the importance of being sustainable.
- b. Collaboration with the local municipality in Jhapa as well as nearby districts such as Itahari, Ilam and Biratnagar which collects such plastic pet bottles everyday (once in the morning and once at night to be precise). If during collection of pet bottles, rotten vegetables and other organic wastes are collected then this can be used as manure for the production of tomatoes and other vegetables.

Competitor Analysis:

Currently in Nepal there are no competitors who produce small scale recycled plastic greenhouses. Many company’s construct greenhouse structures out of very expensive materials such as stone, wood and plastic sheeting with costs starting from Npr 30,000 to over Npr 80,000. For example, a Humla Greenhouse (pictured to the right) costs approximately Npr 87289 to build of which Npr 24000 of the cost were from stone. (Seona Candy, 2020) The use of stone walls in these designs are not only expensive but limit the amount of light that can enter the greenhouses, decreasing the key effect of the structure. Therefore, we will be using not only cost effective materials such as locally sourced bamboo but also environmentally sustainable materials such as the use of upcycled plastic bottles which will allow for optimal light penetration.

Figure 6: Humla Greenhouse (Seona Candy, 2020)

Figure 7: Humla Greenhouse (Seona Candy, 2020)
FINANCIAL ANALYSIS

INITIAL INVESTMENT COSTS

The initial investment for this project is estimated to be $5,000 (USD) for the first two months. This will cover Production Costs and Salaries Expenditure, Warehouse Expenditure and Transportations. After these two months, the business is expected to generate income to cover all costs. We are expecting to generate net income from the business in the second year. In case of any unexpected additional expenditures, we require an extra $1,000 (USD) for the capital of the venture.

FORECAST REVENUE AND EXPENSES

After calculations based off (Denholm,1992), we are willing to sell our product for 110$ (Npr 13348.98), per unit. That will generate 1% of net profit per product. However, when the ‘Unit Sold’ will increase every year by an estimation of 25%, the Cost of Goods Sold will decrease per unit, which will eventually increase our net profit.

Our expenses are high in the first year due to the estimated units sold, but by increasing the units sold in the second year, taking into account the expected expenditure of the venture, will lead to more revenue to cover all costs and generate a net profit.

Our staff (local workers) will be employed on an hourly wage. Our staff will consist of one Bamboo consultant/sourcer, one plastic collection coordinator, and four builders. This number of staff is estimated to increase within 5 years to 10 workers, which will increase the salary expenses, as well as the revenue.

FORECAST SALES AND COSTS GRAPH

<table>
<thead>
<tr>
<th>Year</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selling Price</td>
<td>$110.00</td>
<td>$110.00</td>
<td>$110.00</td>
<td>$110.00</td>
<td>$110.00</td>
</tr>
<tr>
<td>Unit sold</td>
<td>240.00</td>
<td>300.00</td>
<td>375.00</td>
<td>468.00</td>
<td>580.00</td>
</tr>
<tr>
<td>Revenue</td>
<td>$26,400.00</td>
<td>$33,000.00</td>
<td>$41,250.00</td>
<td>$51,480.00</td>
<td>$63,800.00</td>
</tr>
<tr>
<td>Operating Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fixed costs</td>
<td>$8,326.08</td>
<td>$8,326.08</td>
<td>$11,101.44</td>
<td>$11,101.44</td>
<td>$13,876.80</td>
</tr>
<tr>
<td>Warehouse</td>
<td>$1,285.44</td>
<td>$1,285.44</td>
<td>$1,285.44</td>
<td>$1,285.44</td>
<td>$1,285.44</td>
</tr>
<tr>
<td>Total Fixed costs</td>
<td>$9,611.52</td>
<td>$9,611.52</td>
<td>$12,386.88</td>
<td>$12,386.88</td>
<td>$15,162.24</td>
</tr>
<tr>
<td>Variable Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plastic bottles</td>
<td>$3,757.20</td>
<td>$4,696.50</td>
<td>$5,870.63</td>
<td>$7,326.54</td>
<td>$9,079.90</td>
</tr>
<tr>
<td>Bamboo</td>
<td>$792.00</td>
<td>$990.00</td>
<td>$1,237.50</td>
<td>$1,544.40</td>
<td>$1,914.00</td>
</tr>
<tr>
<td>Wires</td>
<td>$2,491.20</td>
<td>$3,114.00</td>
<td>$3,892.50</td>
<td>$4,857.84</td>
<td>$6,020.40</td>
</tr>
<tr>
<td>Transportation</td>
<td>$85.00</td>
<td>$100.00</td>
<td>$125.00</td>
<td>$150.00</td>
<td>$175.00</td>
</tr>
<tr>
<td>Tools and other costs</td>
<td>$30.00</td>
<td>$40.00</td>
<td>$50.00</td>
<td>$60.00</td>
<td>$70.00</td>
</tr>
<tr>
<td>Total Variable Costs</td>
<td>$7,155.40</td>
<td>$8,940.50</td>
<td>$11,175.63</td>
<td>$13,938.78</td>
<td>$17,259.30</td>
</tr>
<tr>
<td>Total Operating Costs</td>
<td>$26,378.44</td>
<td>$28,163.54</td>
<td>$35,949.39</td>
<td>$38,712.54</td>
<td>$47,583.78</td>
</tr>
<tr>
<td>Net income before tax</td>
<td>$21.56</td>
<td>$4,836.46</td>
<td>$5,300.62</td>
<td>$12,767.46</td>
<td>$16,216.22</td>
</tr>
<tr>
<td>Tax</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Net income</td>
<td>$16.17</td>
<td>$3627.35</td>
<td>$3975.46</td>
<td>$9575.59</td>
<td>$12162.17</td>
</tr>
</tbody>
</table>
We have chosen to initially implement our upcycled greenhouses in Jhapa, Nepal. After our first year of operations we aim to have expanded our product into 2 other areas of Province 1 in Nepal, employing locals and utilising local resources from those areas. Both reducing our transport cost in terms of supplying from Jhapa to other areas and giving back to local industry through economic support. Within the next 5 years we are aiming to have a significant presence in all of Nepal and begin to break into other areas of SouthEast Asia.

**MATERIAL COSTS PER UNIT**

<table>
<thead>
<tr>
<th></th>
<th>Cost/ unit Npr</th>
<th>Required Amount</th>
<th>Total Cost Npr</th>
<th>Total Cost USD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bottles</strong> (1kg = 23 x 2L bottles)</td>
<td>Npr 40/kg</td>
<td>2185 bottles = 95kg</td>
<td>Npr 3800</td>
<td>USD $31.31</td>
</tr>
<tr>
<td><strong>Bamboo</strong> (1 stick = 12m)</td>
<td>Npr 80/stick</td>
<td>60m = 5 sticks</td>
<td>Npr 400</td>
<td>USD $3.30</td>
</tr>
<tr>
<td><strong>Steel wire</strong> (1kg = 10m wire)</td>
<td>Npr 90/kg</td>
<td>140m = 14kg</td>
<td>Npr 1260</td>
<td>USD $10.38</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td>N/A</td>
<td>N/A</td>
<td>Npr 5460</td>
<td>USD $44.99</td>
</tr>
</tbody>
</table>

**PRODUCE**

**PRODUCE IN NEPAL**

In Nepal, most commercial farmers use greenhouses (often termed plastic tunnels) to produce fresh vegetables such as tomatoes, radish, beans, cucumber, capsicum, pepper, and eggplant all year round. (Tiwari, 2017)

For an example of how excess produce can generate income, tomatoes which in season sell for $0.58 per kg (Current retail price) but increase to $0.91 per kg (maximum price) when sold out of season. (READ Nepal, 2015), (Peck, 2009)

![Figure 8: Produce Nepal. (Demuth’s Blog, 2014)](image)

**CLIMATE / GROWING CONDITIONS**

Nepal basically has a sub-tropical, monsoon type climate. However, in Nepal there are three different areas with contradicting weather. In northern Nepal, the summers are cool whereas winters are severe, while in the south the summers are very hot while winters are mild to cold. Whereas, in between, such as in areas like in Kathmandu Valley in the hills it has a pleasant climate with average summer temperature of 20°C – 35°C and 2°C – 12°C in winter. (Weather Online, 2020) Making Nepal the ideal climate to maximise the use of our upcycled greenhouses to grow off season produce. (Tiwari, 2017)

![Figure 9: Best time to visit Nepal. (Kim Kim, 2020)](image)

**FUTURE OUTLOOK**

We have chosen to initially implement our upcycled greenhouses in Jhapa, Nepal. After our first year of operations we aim to have expanded our product into 2 other areas of Province 1 in Nepal, employing locals and utilising local resources from those areas. Both reducing our transport cost in terms of supplying from Jhapa to other areas and giving back to local industry through economic support. Within the next 5 years we are aiming to have a significant presence in all of Nepal and begin to break into other areas of SouthEast Asia.


Himalayan Climate. (2014). PET Bottle Recollection Center has started buying PET waste from the Nagar Mitra (Waste Workers). Himalayan Climate Initiative For Sustainable Solutions. Retrieved from http://himalayanclimate.org/GETRecollection/GET_Updates/2014_08_19/GET_Bottle_Recollection_Center_has_started_buying_PET_waste_from_the_Nagar_Mitra_Waste_Workers_


