“Clean Technologies – Environmental technology, innovation and management systems as means for regional and local economic development”
Team

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- Mohammed Iqsour (Jordan)
The place is situated in Gral Artigas, Itapua, Paraguay, Geographical coordinates are 26 56' 0" South, 56 13' 0" West and its original name (with diacritics) is General Artigas.
Plastic is a relatively cheap, durable and versatile material. Plastic products have brought benefits to society in terms of economic activity, jobs and quality of life.

However, plastic waste also imposes negative environmental externalities. It is usually non-biodegradable and therefore can remain as waste in the environment for a very long time; it may pose risks to human health as well as the environment; and it can be difficult to reuse and/or recycle in practice.
Bioplastics fall into either or both of two broad categories:

- **Bio-based plastics** that are derived from renewable resources;
- **Biodegradable (compostable) plastics** that meet standards for biodegradability and compostability.

Bio-based plastics can be either biodegradable or non-biodegradable. Similarly, biodegradable polymers can be petroleum-based.
Major ways to synthesis bioplastics

- Use of natural polymer
- Use of Bacterial Polyester Fermentation
- Chemical polymerization

Biodegradable plastic - plastic material that can decompose into carbon dioxide, methane, water, inorganic compounds, or biomass via microbial assimilation (the enzymatic action of microorganisms).
Project Background
Currently, the production of raw materials in Paraguay for BPs is possible but the technology component is delayed due to technical issues.

The raw materials for BPs may come from crop biomass that can face competition pressures from agricultural and biofuels interests.

Also, the use of genetically modified bacteria and plants in the production of crops for BPs is controversial, as it is believed that they may lead to systematic degradation of biodiversity in ecosystems in the future.

In this context, our project considers the utilization of Mandioca (Cassava) root that is originally from Paraguay therefore GMO crops will not be used to obtain the biodegradable materials.
Vision

The vision of the Paraguayan Bioplastic Corp. is to introduce bioplastic products to the regional market, while considering the importance of environmental protection.

Mission

To develop an effective, efficient and economical production system and markets for post-consumer bio plastic materials. In doing so, help ensure that bioplastics fulfill their promise of being a fully renewable and truly sustainable material for retailers, waste management, recycling companies and consumers interested in bio- packaging materials that are better for our environment.
Objectives

- Aims for a favorable policy and economic framework to allow for the further technological advancement and full-scale market introduction of bioplastics;
- Promotes coherent standards, certifications and guidelines for transparent claims about bioplastics and their environmental benefits & impact;
- Advocates sustainable growing of biomass crops for the production of bio-based plastics;
- Supports the implementation of a better waste management infrastructure, including more efficient re-use, recycling, and recovery systems.
Strategies

❖ **Strategy One: Sufficient Supply of Biomass Feedstock**

This strategy targets at preparing sufficient quality and quantity of raw materials for the industry without having to interfere with the food supply. Also the acceleration of technology development to enhance the productivity of starch producing crops must be carried out to ensure that the bioplastics production can reach the break-even point and to prevent various problems on the crop cultivation including the destruction of an ecosystem balance.

❖ **Strategy Two: Accelerating Technology Development and Technology Cooperation**

This strategy focuses on the adoption of internationally recognizable technologies, and also aims to have local researchers and scientists to develop technological advances and innovation further from those adopted technologies. The goal to create the country’s own technologies is at the heart of this strategy.
Strategies

❖ **Strategy Three: Building Industry and Innovative Business**

Under this strategy, an investment in bioplastics industries and businesses must be encouraged from the upstream, midstream right to the downstream stages both at the international and local business levels.

❖ **Strategy Four: Establishment of supportive Infrastructure**

Many supportive infrastructures must be established to facilitate the development of bioplastics industry in Paraguay. These include establishment of industrial standards, setting up the laboratory for testing and certifying bioplastics products, raising public awareness for the use of bioplastics products for environmental protection concerns, implementation of pilot project for bioplastics utilization in small municipals or communities, and various activities related to public relations.
## Action Plan

<table>
<thead>
<tr>
<th>Targets</th>
<th>Key indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To obtain sufficient cassava as raw materials for production feedstock</td>
<td>- To have approximately 10,000 tons of cassava annually - To increase the cassava productivity to more than 8 ton per hectare</td>
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<table>
<thead>
<tr>
<th>Functions</th>
<th>Responsible</th>
<th>Source</th>
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<tbody>
<tr>
<td>2. Educate farmers to understand the use of agricultural products as feedstocks for bioplastic production - Select high-yield variety and distribute them to farmers together with the transfer of good cultivation techniques and other necessary knowledge to ensure high productivity</td>
<td>Advise and educate farmers on the importance of using cassava as feedstock for bioplastic production and its impact on the economics and environment</td>
<td>Ministry of Agriculture; Cooperatives; Municipality</td>
</tr>
</tbody>
</table>
### Action Plan

<table>
<thead>
<tr>
<th>3. Encourage improved management of cultivated areas</th>
<th>Map the cultivation areas and managing those areas for agricultural crops especially cassava</th>
<th>Ministry of Agriculture; Cooperatives; Municipality</th>
<th>Research and map a cultivation project covering the area of 2,000 hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Support the research and development, enhancement of crop variety, cultivation technology, and machinery to replace manual labor in cultivation and harvest process</td>
<td>- Prepare the direction for research on crop variety enhancement, and development of cultivation and harvesting technology - Allocate fund to support the research and development activities</td>
<td>Ministry of Agriculture; Municipality</td>
<td>Research fund for crop improvement and development of cultivation technique lasting for at least 5 years</td>
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</tbody>
</table>
Strategy 2: Accelerating Technology Development and Technology Cooperation

<table>
<thead>
<tr>
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<th>Responsible Agency</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assess and acquire suitable technologies to adopt or coinvest (including the execution of feasibility study)</td>
<td>Ministry of Industry; Municipality</td>
<td>Supporting representatives from private sector and member of academia to attend seminars and factory visits in countries of advanced bioplastics technology;</td>
</tr>
<tr>
<td>- Conduct all necessary activities to acquire suitable technologies from upstream to downstream industry</td>
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Strategy 3: Building industry and innovative businesses

<table>
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<tr>
<th>Targets</th>
<th>Key Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish a pilot industrial factory for monomer production (by 2017)</td>
<td>- To have a starch new factory to produce monomer (such as lactic acid, succinic acid, PDO-propane diol) from sugars, with capacity of at least 1,000 tons per year</td>
</tr>
</tbody>
</table>
### Strategy 4: Establishment of Supportive Infrastructure

<table>
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<tr>
<th>Targets</th>
<th>Key Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Set national biodegradability standards for bioplastics</td>
<td>- To set up certification standards for biodegradation for domestic products, including assurance logo for certification</td>
</tr>
<tr>
<td>2. Establish a Degradability Testing Center for bioplastics</td>
<td>- To establish at least 1 functioning center</td>
</tr>
</tbody>
</table>
The life cycle of Bioplastics

Raw Materials
The process typically starts with growing plants such as sugar cane, corn and potatoes that are high in starches, the raw materials that replace petroleum products in bioplastics.

Extraction
The plant materials are harvested and processed to extract their starches.

Refining
The starches are processed further in bio-refineries through the use of special enzymes or fermentation (much as biofuels are made) to produce the chemical compounds that react to make plastics. The compounds can be refined to fit the specifications manufacturers need for different products.

The Life Cycle of Bioplastics

Some bioplastics decompose in a fairly short period of time, and the full life cycle of such products is shown here. Other bioplastics aren’t biodegradable. But even in those cases, the use of plant-based raw materials means that pollution is being removed from the atmosphere while the plants grow, giving bioplastics a green appeal.

Disposal
When disposing of a bioplastic product that is fully biodegradable, consumers can place it in an organic-waste collection bin.

Compost and Renewal
The organic waste will compost and return to the earth as mulch to help new crops grow, completing the cycle.

Manufacturing
Bioplastics manufacturers use pellets or granules of the compounds to make utensils, plates, cup linings, carpeting and other products.
## Log Frame Matrix

<table>
<thead>
<tr>
<th>Narrative Summary</th>
<th>Verifiable indicator</th>
<th>Means of Verification</th>
<th>Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal:</strong> Encourage the sustainable development and use of bioplastic materials in Paraguay</td>
<td>X% of Bioplastic materials recycled or composted</td>
<td>Data research Scientific research paper / Statistical Data</td>
<td>Biodegradable products available on market</td>
</tr>
<tr>
<td><strong>Project purpose:</strong> Support the Production of the Biodegradable materials</td>
<td>X% of biodegradable materials produced</td>
<td>Lab test</td>
<td>Biodegradability Standard; Proper Policy</td>
</tr>
<tr>
<td><strong>Output:</strong> Number of plastic materials derived from petroleum reduced;</td>
<td>X% / or number of facilities specialized on biodegradable materials production and usage;</td>
<td>Survey</td>
<td>Willingness of Community to cultivate Cassava plants and starch for biodegradable plastic production industry</td>
</tr>
<tr>
<td><strong>Activities:</strong></td>
<td>• Machinery acquisition; • Variety identification; • Raw material Production</td>
<td>• Quote accepted • Lab test • Data collection</td>
<td>• existence of machineries on the market • technology available • Availability of professionals</td>
</tr>
</tbody>
</table>

- Machinery acquisition
- Variety identification
- Raw material Production
- Proposals consideration for 1 machine
- Quality test
- Survey
תודה על תשומת הלב

Thanks 😊