

4/6/2021

# RE-LOOP



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## 1. Purpose

When people think of Lebanon, they think of a touristic country with lots of wonderful landscapes. While it is true that some of these natural landscapes are still present, it must be noted that most of them have been ruined by men. At every corner of every street, you are presented with piles of garbage.

As a group of Lebanese students, we have witnessed firsthand the lack of management in the waste sector in our country, and we think it is about time something is done about it! The last study, dating from 2014, shows that the municipal solid waste (MSW) is composed mainly of metal, plastic, glass, paper and organic waste. They are dealt with by mainly 3 methods, landfills (or open dumps), composting and recycling. The distribution is showed in the following figure.

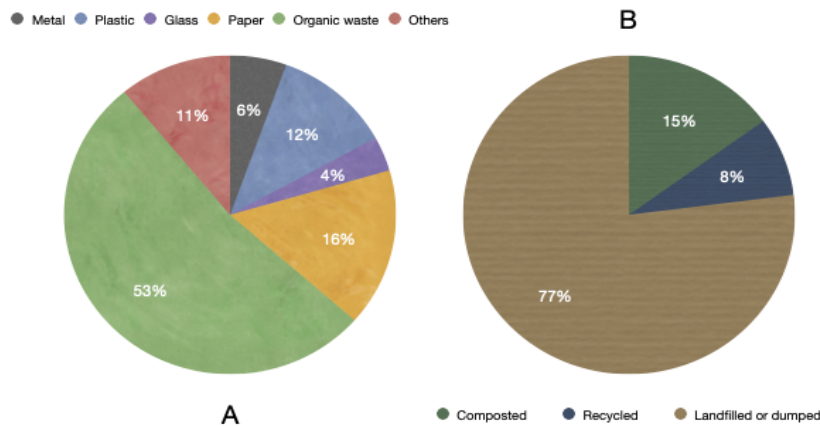


Figure 1: Distribution of waste in Lebanon  
A) Waste types B) Treatment.

The numbers show that an astonishing amount of 38% of organic material is untreated. Organic material is mostly food leftovers. These materials can be processed in three different ways:

1. Whey, starch and waste oil will be used as nutrients for bacteria to produce the polyhydroxyalkanoates (PHA) by the process of fermentation.
2. Bones, large wooden pieces and diseased plants can be turned into biochar.
3. All other organic material can be used for composting.

PHA's are a class of natural (not synthetic) polyesters that are derived from bacterial fermentation. Microorganisms synthesize polyesters in nutrient-deficient conditions, and these PHAs can then be harvested. PHAs are both bio-based and biodegradable.

Another portion of organic material (bones, large wood chunks, diseased plants), that can neither be composted nor fed to bacteria, can be pyrolyzed, and turned into biochar. Biochar is the product of thermal decomposition of organic material. It is a stable, carbon based, soil amendment that increases water retention and nutrient absorption in soil. Pyrolysis also produces heat, an energy source with diverse applications. With minimal technology we can harvest the thermal energy and use to accelerate the process of composting. If we invest in a more performant technology, it is possible to generate the necessary electricity to power all operations for our project – making it “self-sustainable”.

In order for the start up to be successful we plan on working closely together with people from different backgrounds:

- Drivers to collect the required waste and distribute the products.
- Operators to handle all the steps of the production.
- Engineers to supervise production.
- Scientists to monitor bacterial activities, supervise quality and R&D new technologies
- Social media specialists to help promote awareness and sales of product.
- Customer service representatives to accountants allowing for covering all background activities.

Besides creating vast job opportunities, our company will also focus on teaching the younger generation about the importance of sustainable practices, including composting and waste management. This would ensure that our work will have a positive impact in the long term. Furthermore, opening our doors to college students, through internship opportunities, will allow the notions of circular economy and sustainability to spread through the Lebanese community.

In summary, our purpose is to turn unwanted food waste into an invaluable resource for agriculture, all while creating job opportunities and promoting the circular economy principles to empower future generations.

## 2. Goal

Based upon our mission explained above we have set ourselves a number of goals:

- **Reduce food waste**, a big problem in Lebanon causing different type of pollution.
- **Produce Lebanese compost**, an unavailable resource, to help our farmers grow more organic fruits and vegetables.
- **Produce biodegradable plastic raw material**, a new concept in the Lebanese market that will help fight plastic waste accumulation.
- **Produce biochar**, another tool that improves the quality of soil.
- **Raise awareness** for the importance of:
  - Using biodegradable plastic.
  - Composting.
  - Managing waste.
- **Create various job opportunities.**
- **Increase soil fertilization** with natural products.

Setting these goals serves to draw the lines in our companies' activities, while allowing us to focus on building upon our key competencies.

### 3. Circular economy and sustainability

The circular economy is a relatively new approach for managing both resource consumption and waste production. By turning specific food waste into biodegradable plastic raw material, we can reduce both the accumulation of unconsumed food and the usage of the plastic resources. Moreover, our plastic product is biodegradable and will not impact the environment anywhere close to the levels of regular plastics.

However, since not all food waste is suitable for this production, it is necessary to have a composting operation. This complementary operation will also be beneficial as it converts food waste to nutrients for crops, allowing reintegration of food leftovers into the production process instead of simply sending it to landfill sites.

Both these productions are not optimal for treating wooden waste, bones from butcher shops and diseased plants. These three categories will be the fuel for the production of biochar, another resource for the agricultural sector. This production will also be a source of energy for our operation.

The sustainability of this project comes from a simple principle: “As long as human beings exist; food waste will be produced”. This means that we will always be able to collect the main raw material necessary for all our operations.

### 4. Youth empowerment

Even though the bulk of our activities will be focused on production, a part of our resources will be dedicated to teaching the younger generation how to manage waste in a sustainable manner. As mentioned previously we believe this is vital for our startups long term success. The message that we will preach is that waste management is not only an interesting career path, but also a great way for them to participate in the sustainable development of their country, thus leaving a footprint for generations to come. This will be achieved by organizing workshops adapted for all age groups.

Furthermore, since we will be creating many job opportunities in various domains, our company will be able to welcome **interns** from different backgrounds:

- All kinds of engineering students (mechanical, production food engineers).
- Lab technicians and microbiologists.
- Different domains responsible of all background activities (Human resources, marketing, accounting and management)

### 5. Implementation requirements and methods

#### a) Identifying the main aspects

The business model canvas was the main tool we used to pinpoint the different aspects of our startup. Several reiterations were necessary in order to obtain a version that would be in line with our goals and beliefs. Once the canvas was ready, we were able to structure the complicated ideas and develop them, simultaneously making adjustments along the way. With your positive

feedback and green light to proceed into the next stages of the project we would begin the “concept development phase”. This would include the working on the following points:

#### Key partners

- Reaching out to potential key partners to promote our idea as a better solution for their problem and promote our services / products.
- Seek advice from experts in the fields ranging from supply chain to fermentation.
- Explore collaboration opportunities with other companies in the field, including - “compost baladi”, a young startup focusing on compost. If this succeeds, we can invest more resources in the plastic production, knowing that they will focus on the composting part.

#### Key activities

- Collect and sort organic waste. All these materials can be processed, mainly by composting, but first we will pick all the nutrient source for specific bacteria strains. These strains ferment some types of organic waste, like starches and whey, to create their own reserves and these reserves are small grains of PHA. The remaining material like wooden chunks and bones can be pyrolyzed and turned into biochar.
- Transform the fermentation concept that produces plastic into a production line and optimize it.
- Create an operation plan that allows us to apply our idea.

#### Key resources

- Study the procurement process for the raw materials needed to transform waste into the different products.
- Find an adequate location for the operation set up
- Analyze the operation plan to hire based on the job positions listed above.

#### Value propositions

- Offer fertilizer and plastic raw material, two scarce resources in Lebanon, made out of waste, a major problem in the country. This will promote local agriculture in a time where importing is hard due to the economic crisis.
- Spread waste management and circular economy cultures, to ensure that future generations will be more conscient about the environment.
- Create jobs in the waste management field.

#### Channels

- Optimize storage to avoid pest infection and spread of bad smells.
- Up / down stream transportation means – including the most adequate vehicles for the operations

## Cost structure

Based on preliminary research we believe the cost of the three production lines is 300 000 \$ divided between fixed costs and variable costs for the whole project. Since our idea is innovative, we expect that we will come out even in 4 years approximately.

## Revenue streams

Main revenue sources will be the sales of the products. However, since our products will be an interesting resource for big agriculture and plastic companies in Lebanon, it will be possible to establish long terms contracts and offer discounts in exchange for exclusivity.

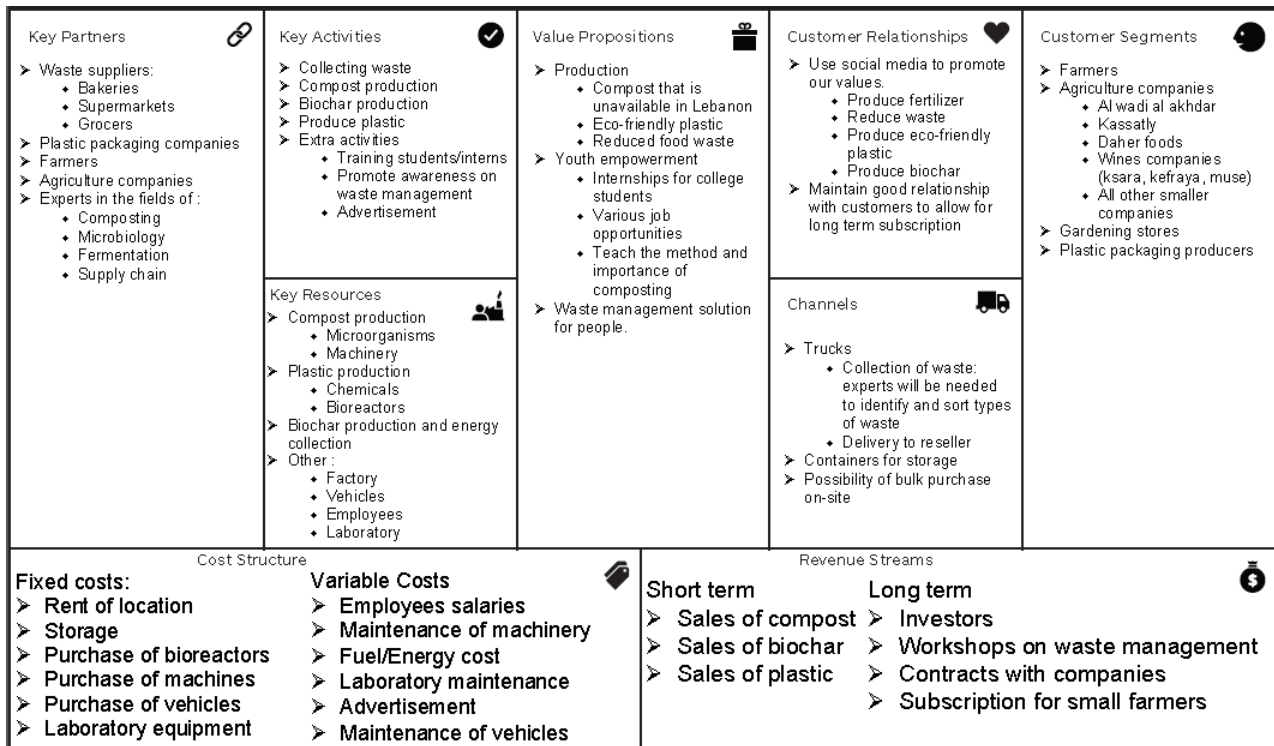


Figure 2: Business model canvas

## b) Work breakdown structure (WBS) and schedule

We managed to establish a first version of a WBS. This document is in no case a final version, because we know that there is always room for improvement when it comes to implementation.

The WBS and the according schedule have been sent in a separate excel sheet. The template used was found on the "Vertex 42" website. It allowed us to create a Gantt chart to visualize our tasks and schedule them with ease.