## COLLABORATION ANALYSIS

**PHASE I**

Local water filtration and resource management.

**PHASE II**

Waste management within the coffee production process on small scale farms.

**PHASE III**

Farming cooperative that would manage waste and increase revenue streams.

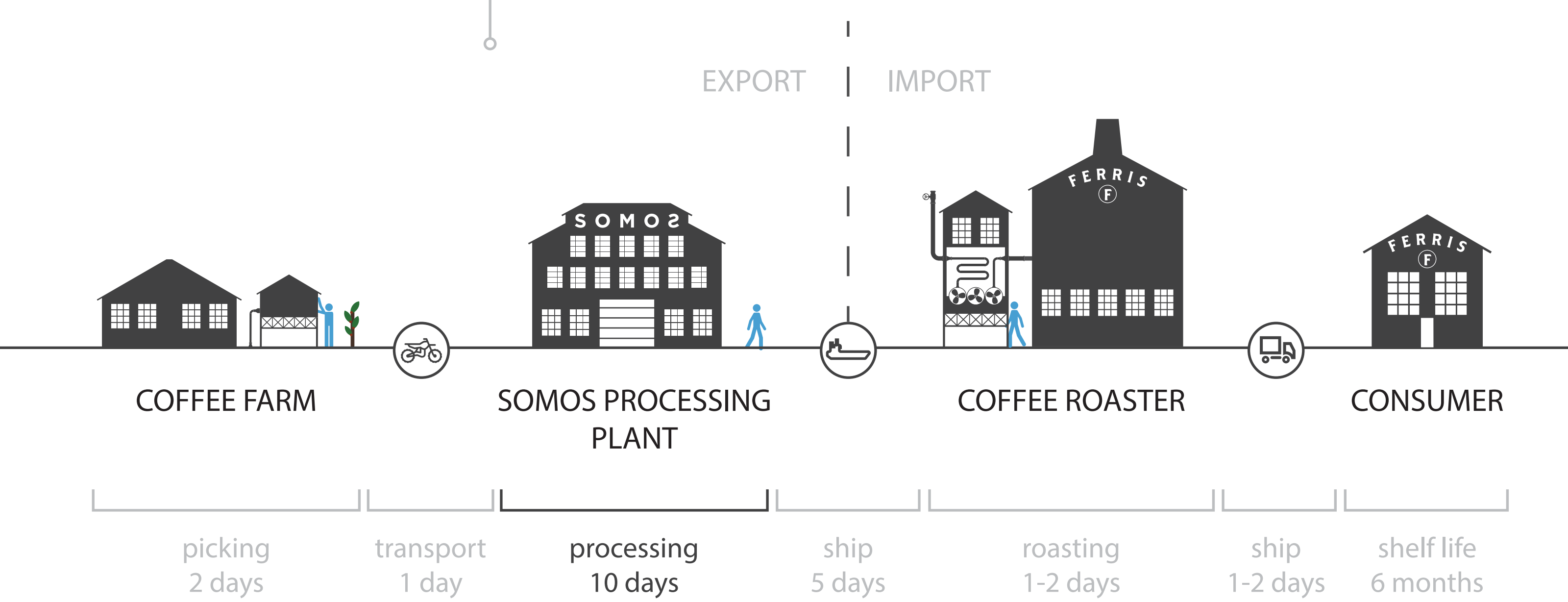
**PHASE IV**

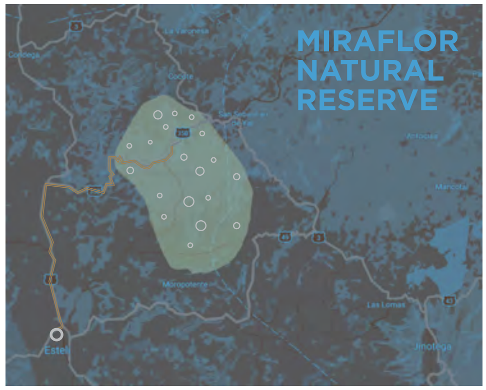
Scaled back the Co-op and addressed it's financial reality.

## SOLUTION SUMMARY

Miraflor is located in a unique biosphere in northern Nicaragua that contains opportune growing conditions for organic shade-grown coffee. Although this method is a more sustainable approach than many other coffee production processes, large amounts of water still only have one lifecycle before being contaminated, mismanaged, and eventually running off into nearby communtiy water reserves. (1).

We plan to redesign the coffee production process so as to eliminate waste, reusing the resources or turning them into revenue streams where possible. Somos proposes a cooperative that connects small coffee farmers of Miraflor to green coffee importers and ultimately the consumer. We would process the whole coffee cherries at a central location to avoid contaminating the water resources on the farm. By focusing the raw materials to one location, Somos can take advantage of the waste byproducts from coffee production to produce other raw materials that can be exported for additional revenue.




**The scope of our wicked problem addresses the ineffective waste management within small scale coffee production in Miraflor, Nicaragua; ultimately resulting in contamination of nearby water resources during a heightened drought season.**

The farmers are able to collect water naturally from the nearby springs.

Unfortunately, once contaminated, it reaches water supplies further down the mountain.

During the washing process - a step which uses 11 liters of water for each pound of coffee - the coffee beans shed a layer of mucilage which contaminates the water. This water - referred to after contamination as *aguas mieles (honey water)* - becomes highly acidic during the process, so much so that it cannot provide a viable second life within agricultural use or human consumption. At this point it is comparable to vinegar pH levels. (3). After it has been used, the *aguas mieles* finds its way back into the soil, eventually polluting the natural water reserves on which nearby communities rely.

There is a multi-faceted sense of urgency behind this issue because it is dealing with various important yet fragile ecosystems: water is undeniably the most valuable resource for human life, coffee is one of the most important agricultural exports for the country of Nicaragua, and this method of production is the primary source of work for the small farmers of Miraflor. (2). There are certainly efforts to re-purpose plant waste and filter the acidic water to be used again - which is necessary - but the plant waste from production processes only decreases in value overtime or remains of the same value, where it could actually be upcycled and sold as a new product.

CURRENT CONTAMINATION PROCESS

BARRIER



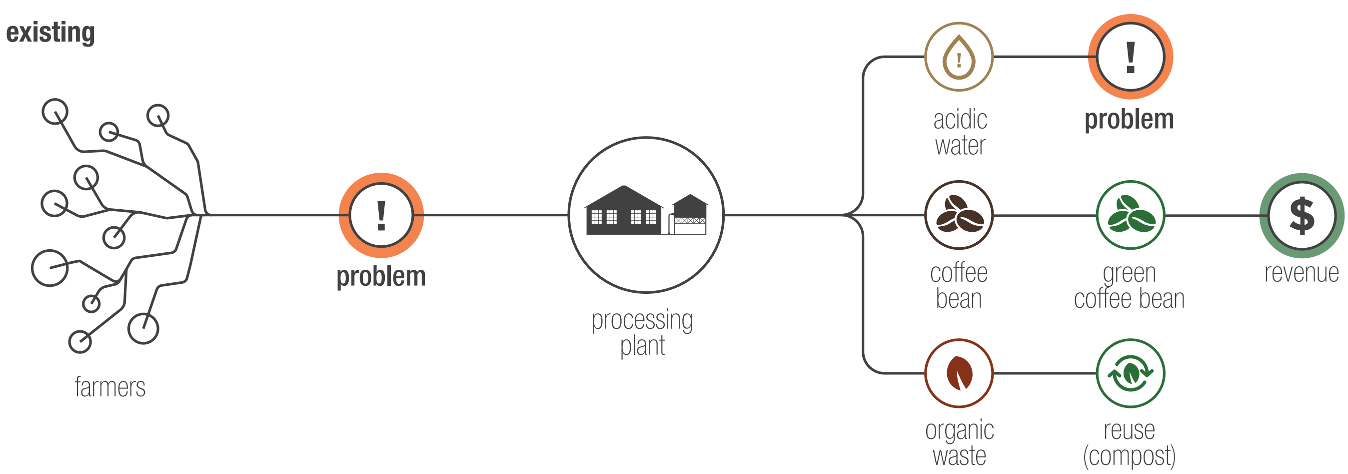

PICK ① — **DEPULP** ② — FERMENT ③ — **WASH** ④ — DRY ⑤ — SELECT ⑥ — **SHIP** ⑦

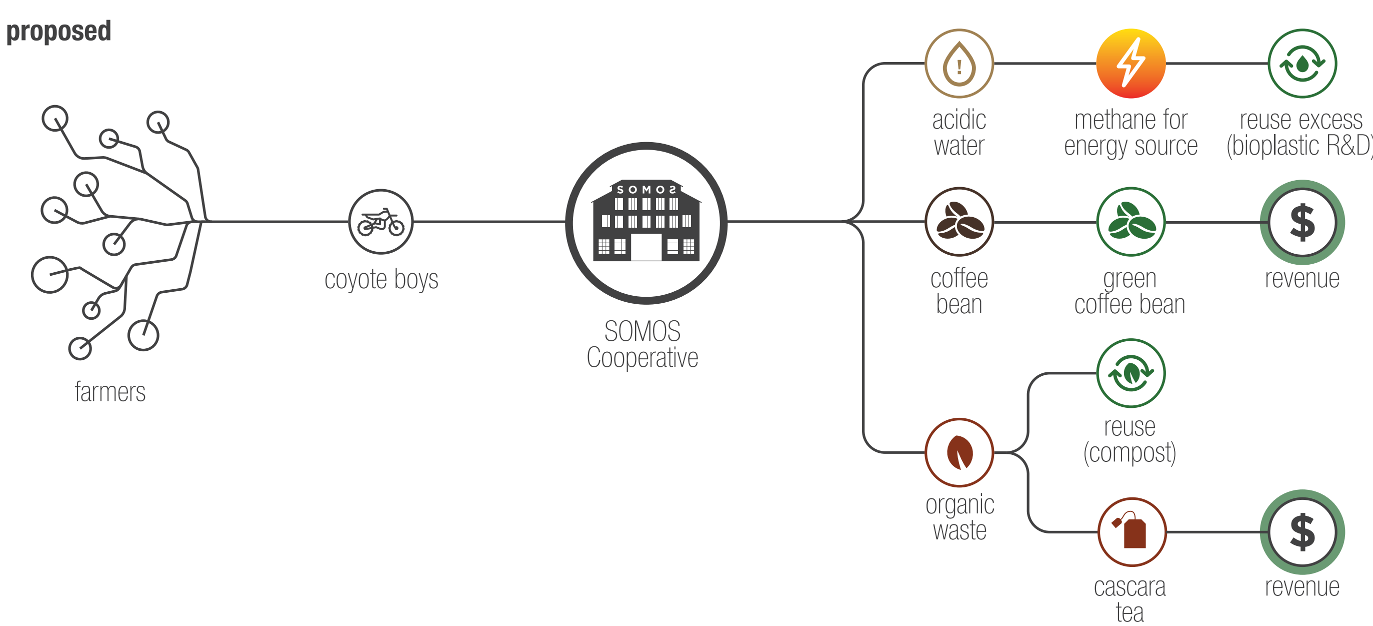
## CONNECTING THE DOTS

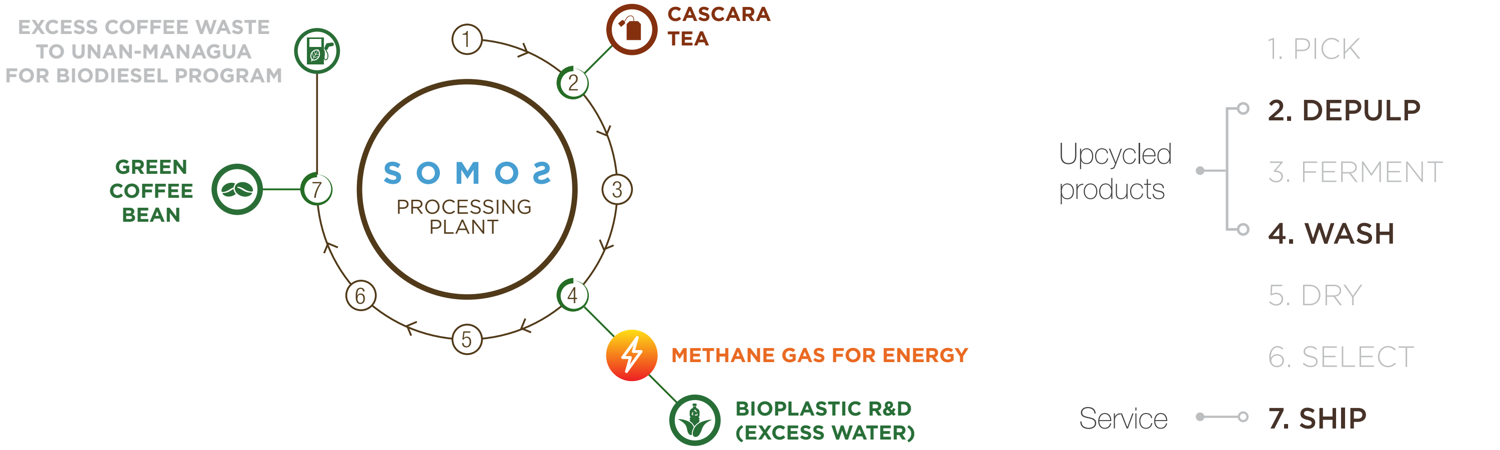
**Given the rough terrain, the farmers indicate their biggest challenge is transporting green coffee beans to the market place. By focusing on transporting the entire coffee cherry to Somos processing plant, the effort can simultaneously help farmers sell their product and manage their waste, while all resources for additional revenue streams will be generated in one location.**

Some transportation is already provided by a locally organized group of dirt bikers, referred to as “the coyote boys.” This local group transports various goods to and from the community, and would operate as a grassroots delivery service. Somos will incentivize farmers to sell the whole coffee cherry: we can then process the coffee beans and the pulp for cascara tea, the acidic water will be used to produce methane and starch plastic packaging, and the excess natural byproducts will be returned to the farmers as compost.

The acidic water can be combined starch, glycerin, and vinegar in order to make bioplastic materials for packaging products. (6, 7, 8). We have found excess glycerin from a biodiesel project at UNAN-Managua, and a starch processing plant in Managua (ALCASA). This would help close the loop of their processes, provide a needed resource for ours, and strengthen the partnership between Somos, UNAN, and other local businesses and industries.






The three main opportunities for Somos are centered around economic efficiency, environmental effectiveness, and social equity: our process will provide additional sources of income for the community and greater resource security for farmers, all the while keeping acidic water out of the nearby drinking supply.

Our service fills a need for effective agricultural waste management in Nicaragua, especially in the time of severe drought. However, this is not where we see the innovation: by connecting resources from the countries biggest industries, we can turn waste into food for new products to emerge that embrace circular economic principles. When the acidic water is put into an anaerobic digester system and combined with natural bacteria, the reaction produces methane.

The methane can be utilized as a source of energy to power machinery and technological equipment within the facility. Fortunately, we observed first hand anaerobic digester systems in existence on small farms in the area.

In addition to making the coffee process more effective, the starch plastic can help provide packaging for a new product (the cascara tea). The tangible solutions this initiative could provide hold a very unique value: by turning what is perceived as waste into a revenue stream, not only are we eliminating “waste” but also selling it as a valuable resource. This will provide revenue for the initiative to sustain, and most urgently keeps the nearby water supply free of contamination.

## REVENUE STREAM(S)

### COFFEE

| Processor | | Wholesale | | Retailer | | Consumer |
|---|---|---|---|---|---|---|
| Green Coffee (60 kg) $86.00 | KEYSTONE MARKUP | Green Coffee (60 kg bag) $172.00 | KEYSTONE MARKUP | Green Coffee (60 kg bag) $344.00 | | Roasted Coffee (12 oz) $11.75 |

### CASCARA

| Processor | | Wholesale | | Retailer | | Consumer |
|---|---|---|---|---|---|---|
| Dried Cascara (60 kg) $163.20 | KEYSTONE MARKUP | Dried Cascara (60 kg) $327.00 | KEYSTONE MARKUP | Dried Cascara (60 kg) $660.00 | | Dried Cascara (4 oz) $6.05 |

## CAPITAL

As much as possible, our materials will be sourced from Nicaragua. Due to the rudimentary process involved in producing coffee, no advanced technology is required for our process. This is key to the continued success and stability of Somos: technology foreign to the community can rarely be maintained with the resources available.

The highest value and utility of these materials will be used at all times as the process has multiple parts, involving each piece of equipment and material during the process. Field research was conducted by teammates in Phase II that discovered all materials can be sourced from local economies. For example, glycerin byproducts for the starch plastic production would be sourced through the waste stream of a biodiesel project at UNAN-Managua.

FUNDS

- Microlending for startup costs
- Coffee and cascara
- UNAN allocating resources for additional economic support
- Social & entrepreneurial ecotourism

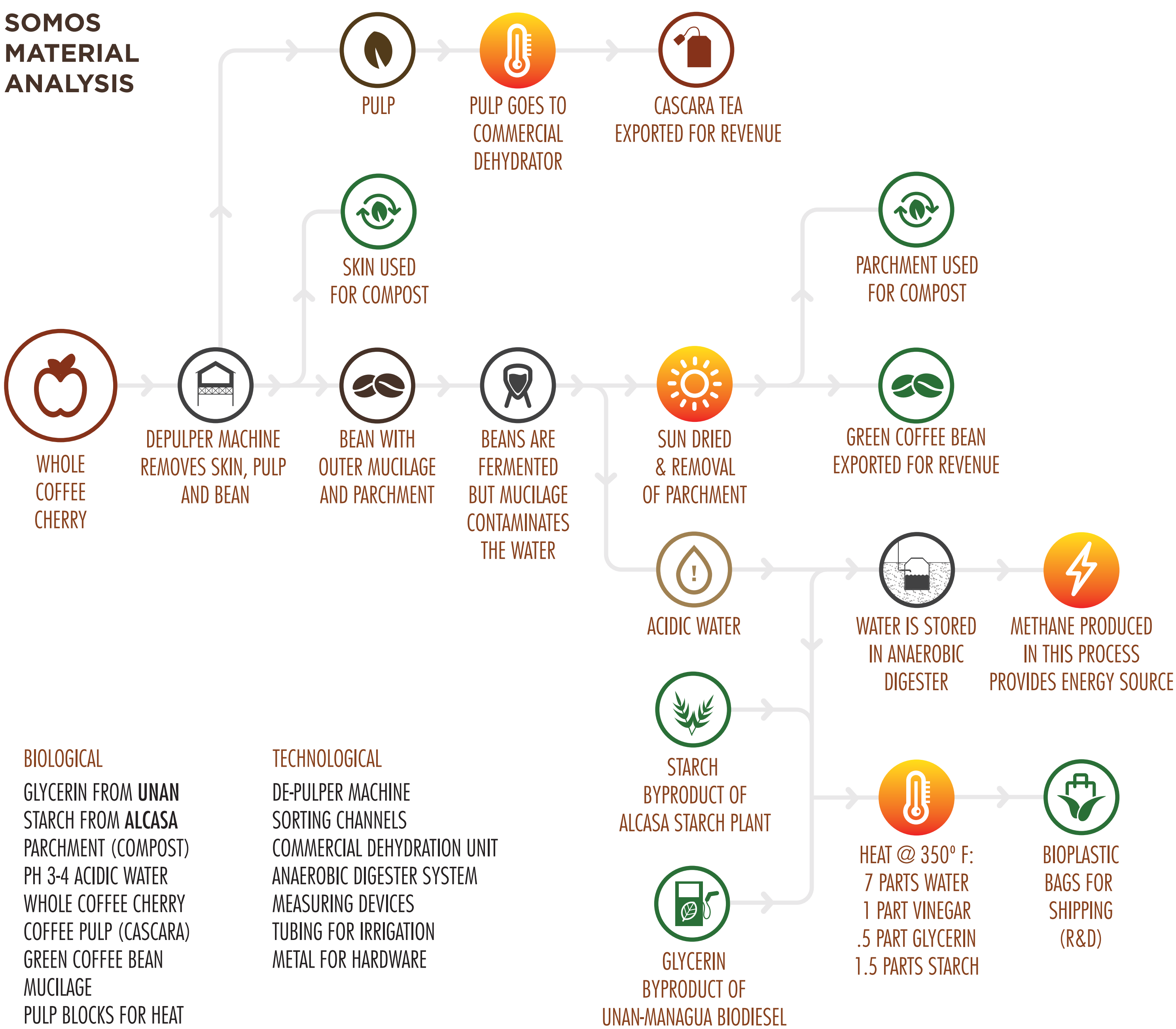
ASSETS

- Dehydrator (cascara)
- Anaerobic digester (acidic water)
- Transportation between UNAN, ALCASA, and Somos Cooperative

FACILITIES

- Existing processing plants, facilities and land utilized by strategic partners

## SOMOS MATERIAL ANALYSIS




BIOLOGICAL

GLYCERIN FROM **UNAN**
STARCH FROM **ALCASA**
PARCHMENT (COMPOST)
PH 3-4 ACIDIC WATER
WHOLE COFFEE CHERRY
COFFEE PULP (CASCARA)
GREEN COFFEE BEAN
MUCILAGE
PULP BLOCKS FOR HEAT

TECHNOLOGICAL

DE-PULPER MACHINE
SORTING CHANNELS
COMMERCIAL DEHYDRATION UNIT
ANAEROBIC DIGESTER SYSTEM
MEASURING DEVICES
TUBING FOR IRRIGATION
METAL FOR HARDWARE

## KEY PARTNERS

1. Coffee farmers
2. UNAN-Managua
3. Ferris Coffee
4. ALCASA Starch Plant

## KEY ACTIVITIES

-Starch in powder form (1)
-Certified Circular Production Process (1 & 3)
-Equipment for water purification (2)

## KEY RESOURCES

-Starch (1)
-Glycerin
-Packaging
-Installation of processing plant equipment

## VALUE PROPOSITION

**EVERY BYPRODUCT OF THE COFFEE PRODUCTION PROCESS IS EITHER SAFELY RE-USABLE OR SOLD, CREATING AN ADDITIONAL REVENUE STREAM.**

## CUSTOMER RELATIONSHIPS

-USDA organic certification
-Empowers local economies (old and new)
-Established connection with Ferris for export
-Circular business = new opportunities
-Ferris will have source for ogranic coffee & tea
-Powerful story of origin

## CHANNELS

Ferris channels for import and individual customers. Our segments are reached through marketing to inform the consumer about the circular coffee and cascara process.

## CUSTOMER SEGMENTS

1. Coffee roasters
2. Coffee/tea exporters
3. Coffee/tea importers
4. Conscious consumers

## COST STRUCTURE

-Pay coffee farmers
-Pay for starch and glycerin (both from Managua)
-Transportation
-Equipment/facilities (large startup cost)
-Export fees
-Production team

## REVENUE STREAMS

NEW
-Cascara tea

EXISTING
-Green coffee bean

Our customers are willing to pay for the current prices of coffee and tea. Wholesale starch plastic is used for packaging. Ferris buys wholesale, sells retail to individual consumers. New revenues contribute tenfold to the overall profit after initial startup costs for this production process.

## STRENGTHS (S)

**SOMOS**

Income security

Geographic Location

Strategic partnerships

Technical expertise at UNAN-Managua

**CUSTOMER**

Premium organic arabica coffee bean

Ferris Coffee's brand language

Competitive tea prices

Happy B2C customers

## WEAKNESSES (W)

**SOMOS**

Implementation costs

Relies on strong crop yields during drought

Starch plastic R&D may not sustain

**CUSTOMER**

Unfamiliarity with Cascara tea

May not see benefit of Cascara over traditional teas

## THREATS (T)

**LOCAL**

Marketplace of Nicaragua might reject this new business model

Adoption in developing nation may be challenging

**GLOBAL**

Climate change affecting crop yields

Market volatility of coffee prices as seen in the last decade

## OPPORTUNITIES (O)

**LOCAL**

Implementation of this process for small processing plants

Possible use of ecotourism as a revenue stream

Diversification of salable products

**GLOBAL**

Circular Coffee production being a new global market

Process implemented on a larger scale

Potential adoption of single use starch plastics

## RISK ANALYSIS

Risks inherent in our business model include market volatility and fluctuation of coffee pricing, and high implementation costs that will make it challenging to get off the ground.

# CASCARA ANALYSIS & BALANCE SHEET

1 UNIT = 60 KG BAG

| | |
|---|---|
| **SALES** | |
| SALES PRICE PER UNIT | $163 |
| **VARIABLE COSTS** | |
| MANUFACTURING COST PER UNIT | $20 |
| REP COMMISSION COST PER UNIT (20%) | $8 |
| VARIABLE COSTS PER UNIT | $28 |
| UNIT CONTRIBUTION MARGIN | $135 |

| | |
|---|---|
| ***STARTUP COMPANY COST*** | |
| COST | $40,000 |
| TOTAL FIXED COSTS | $60,000 |

| | Year 1 | | Year 2 | | Year 3 | | Year 4 | |
|---|---|---|---|---|---|---|---|---|
| SALES VOLUME PER YEAR (UNITS) | 800 | | 900 | | 950 | | 1,000 | |
| SALES PRICE PER UNIT | 163.2 | | 163.2 | | 163.2 | | 163.2 | |
| PRODUCT SALES | 130,560 | 100.0% | 146,880 | 100.0% | 155,040 | 100.0% | 163,200 | 100.0% |
| TOTAL REVENUE | 130,560 | 100.0% | 146,880 | 100.0% | 155,040 | 100.0% | 163,200 | 100.0% |
| VARIABLE COSTS | 22,528 | 17.3% | 25,344 | 17.3% | 26,752 | 17.3% | 28,160 | 17.3% |
| FIXED COSTS (rent, people) | 60,000 | 46.0% | 66,000 | 44.9% | 72,600 | 46.8% | 79,860 | 48.9% |
| SUPPORT COSTS ( sales, marketing, social) | 1,000 | 0.8% | 1,100 | 0.7% | 1,210 | 0.8% | 1,331 | 0.8% |
| PROFIT (LOSS) | 47,032 | 36.0% | 54,436 | 37.1% | 54,478 | 35.1% | 53,849 | 33.0% |
| ADJUSTED PROFIT (LOSS) after Royalty | 47,032 | 36.0% | 54,436 | 37.1% | 54,478 | 35.1% | 53,849 | 33.0% |

*Field research trip over spring break to better understand project constraints*

*Initial experimentation was done to test the process of making starch plastic*

**Based on previously proposed solutions from other countries, we have noticed a trend: if the solution does not come from within the community, it rarely succeeds. The technology that has shown up in similar local efforts before is often from outsiders with little perspective or understanding of the resources available to maintain foreign systems. There is an innate need for new solutions to be developed with local agency and assets in order to sustain, while also providing a strong sense of ownership and job creation.**

## MOVING FORWARD

While this is an ideal scenario, we see major barriers in the ability to implement systems that are effective for the intended solution, yet are made by those living there, easily maintainable, and source local materials. This is ultimately our biggest design challenge: connecting existing processes and resources with additional methods for this new type of processing plant.

Implementation of this process and necessary equipment will be another barrier. Although we are working with organic farms - which is necessary for cascara production - it is nonetheless a new process and will require additional resources. Initial implementation will focus on cascara production in order to increase profit, while storing the acidic water safely for early experimentation. However, this leap in innovation will bring barriers in the materials needed, equipment costs, and human capital.

## Resources

**(1)** Claim based on field research and our case study.

**(2)** http://www.fews.net/sites/default/files/documents/reports/CENTRAL%20AMERICA%20-%20Special%20Report%20-%20Coffee%20Sector%20-%202016.pdf

**(3)** http://www.ticotimes.net/2014/11/26/nicaraguan-coffee-farmers-seek-creative-solutions-to-drought-climate-change

(6) https://www.scientificamerican.com/article/bring-science-home-milk-plastic/

(7) http://bioplasticsinfo.com/starch-based-plastic/properties-of-starch-based-plastic/

(8) http://green-plastics.net/posts/39/how-to-make-algae-bioplastic/

http://www.ncausa.org/About-Coffee/10-Steps-from-Seed-to-Cup

http://www.fews.net/sites/default/files/documents/reports/CENTRAL%20AMERICA%20-%20Special%20Report%20-%20Coffee%20Sector%20-%202016.pdf

http://www.sustainableamerica.org/blog/6-ways-the-coffee-industry-is-turning-waste-into-a-resource/

http://equalexchange.coop/history-of-coffee-in-nicaragua

http://se.asee.org/proceedings/ASEE2014/Papers2014/4/112.pdf

http://www.renewableenergyfocus.com/view/40192/innovation-biofuel-derived-from-coffee-processing-wastewater/

https://www.worldfoodprize.org/documents/filelibrary/images/youth_programs/research_papers/2007_papers/Oskaloosa_Anderson_6DAA47E3C79BB.pdf

https://knoema.com/COMTRADE0124DEC2011/un-comtrade-merchandise-trade-by-commodity-goups-01-24-of-hs-2011?tsId=33042540

http://alcasa.online/

## Scholarly Articles

http://go.galegroup.com/ps/i.do?id=GALE%7CA413743754&v=2.1&u=lom_ferrissu&it=r&p=ITOF&sw=w&asid=cbae18b60998cb092bb62529c23a8e9a

http://go.galegroup.com/ps/i.do?id=GALE%7CA452943230&v=2.1&u=lom_ferrissu&it=r&p=ITOF&sw=w&asid=16f603a10f686b14bfda550d5eadc14e

http://go.galegroup.com/ps/i.do?id=GALE%7CA336969074&v=2.1&u=lom_ferrissu&it=r&p=ITOF&sw=w&asid=354d7e2ce9d160103c91d1d1992964fb

http://go.galegroup.com/ps/i.do?id=GALE%7CA452881999&v=2.1&u=lom_ferrissu&it=r&p=ITOF&sw=w&asid=9a990b26dacc112c509710ad9e211035

## Coffee COOPs in Nicaragua:

http://www.pacha.coop/about

http://justcoffee.coop/Grower%20Cooperatives/la-fem/ (how coffee can encourage other activist's movements. Equality and equal opportunity for women.

http://coopcoffees.coop/category/producers/latin-america/nicaragua/