

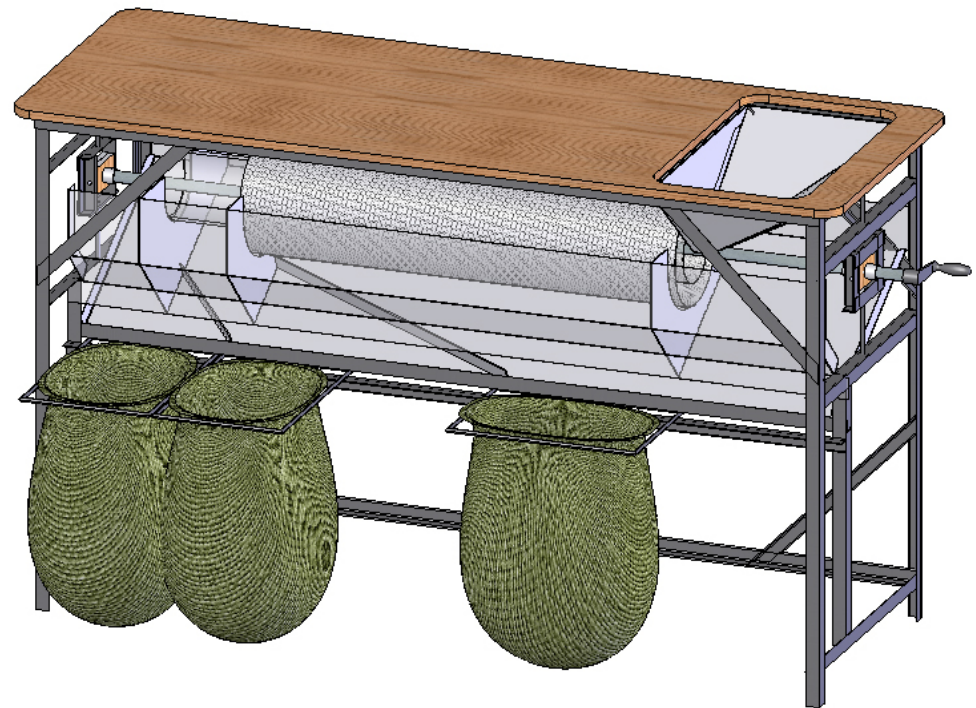
# Coffee Bean Sorter

Orange Team



# Outline

2. Customer
3. Product
4. Distribution



# Motivation

- Gourmet size requirement
- Limited processing technology



$\sim 17/64''$

# Customer



## **As Green as it Gets**

Works with a farming cooperative in Guatemala



## **Maya Pedal**

Builds human-powered agricultural tools



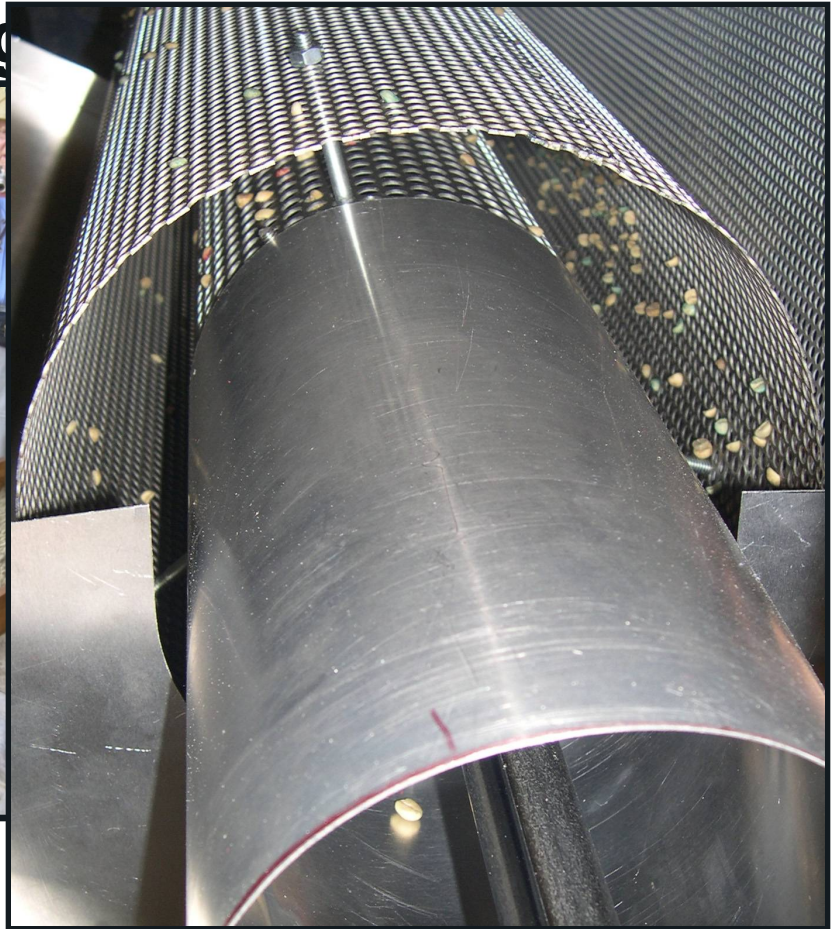
## A vertical strip of coffee beans, likely Arabica, showing a rich brown color and characteristic creases. The beans are arranged in a dense, slightly overlapping manner. A jagged, torn paper edge runs vertically through the middle of the strip, separating the beans into two sections. The background is a plain, light color.



# Sorting Methods

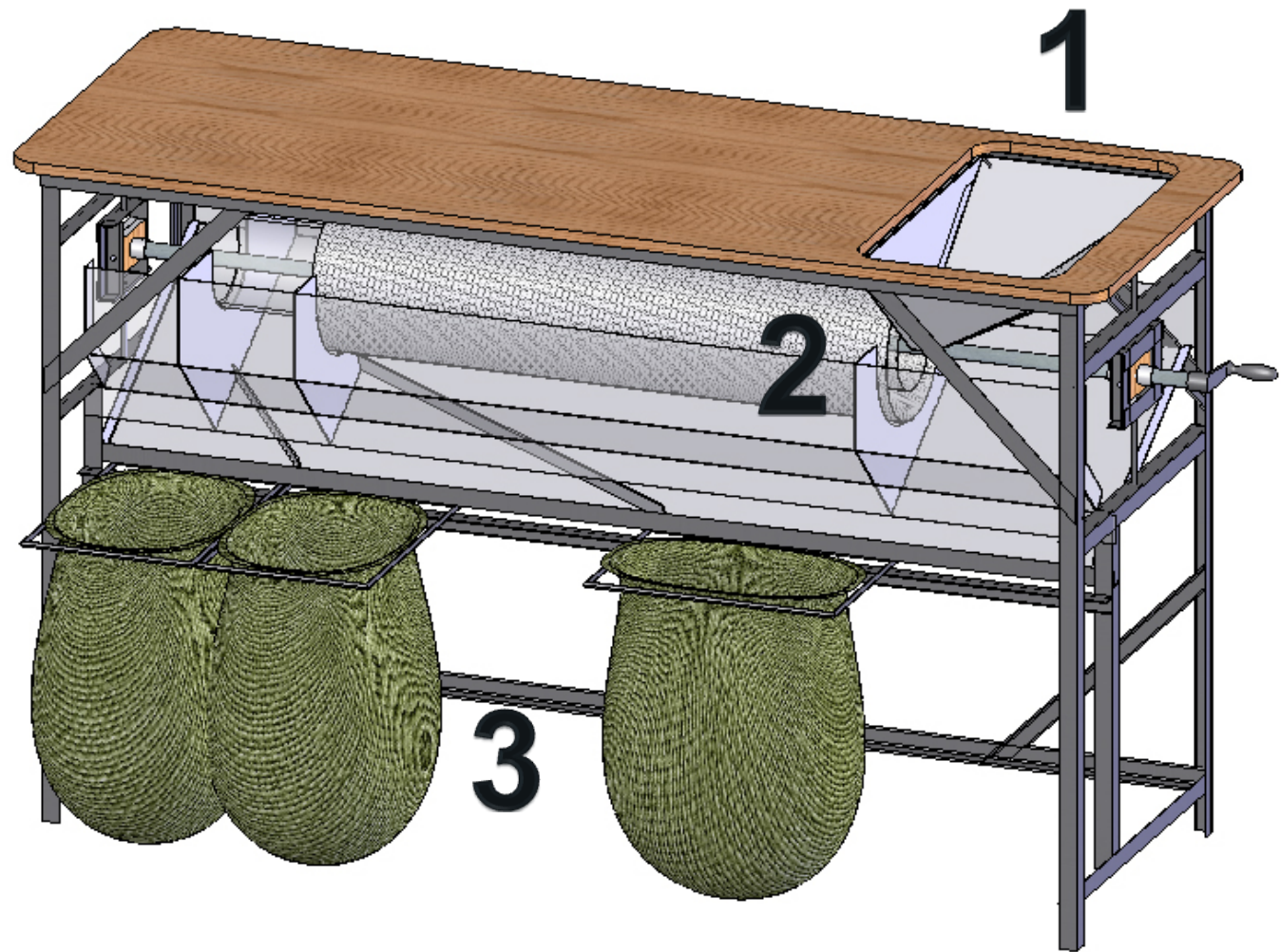
## Drum Sorting

## Screen Sorting





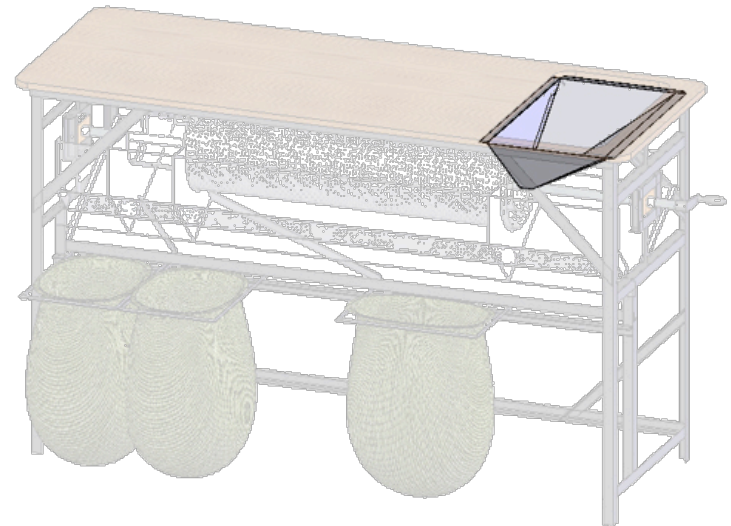
# Our Solution



# Hopper Design

## Challenge:

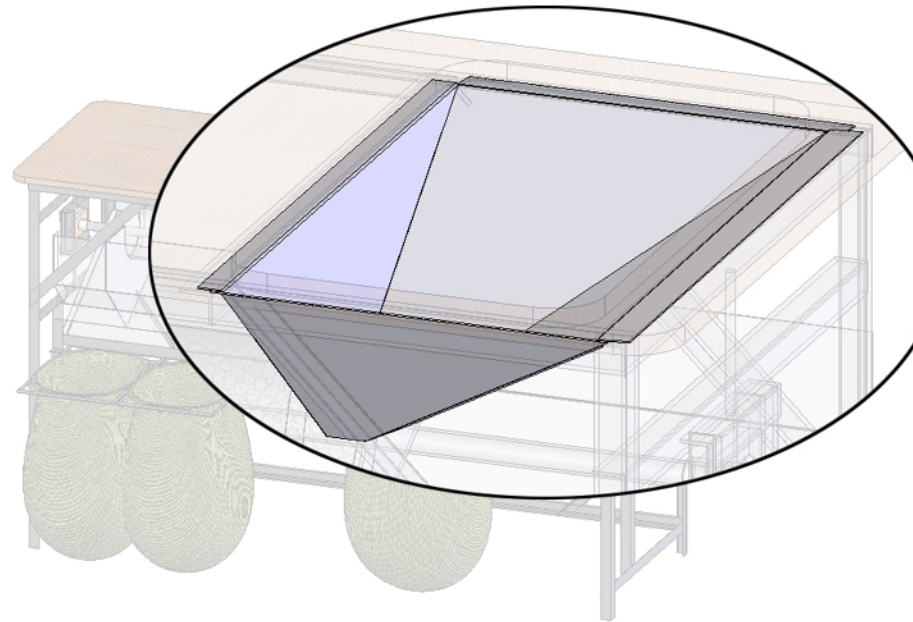
- Accommodate the average farmer
- Small or large batch loading



# Hopper Design

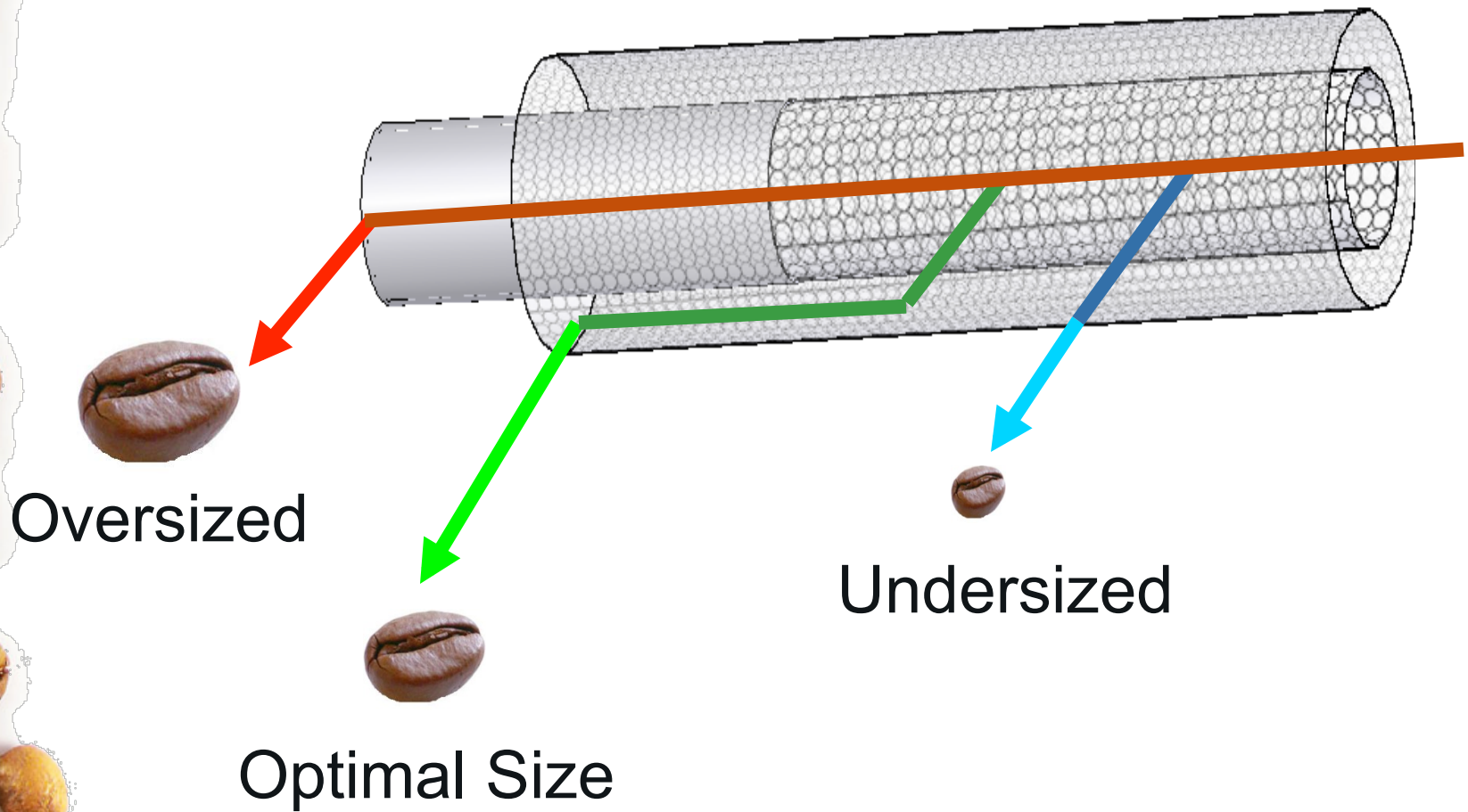
## Challenge:

- Accommodate the average farmer
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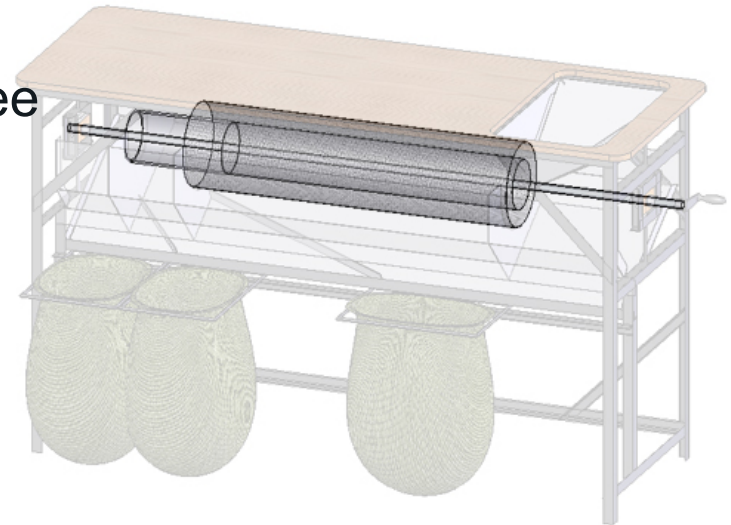
# Bean Paths in Drum



# Drums

## Challenge: Accuracy

- 15 undersized beans per pound
- Dependent on:
  - Feed rate: 230 lb/hour
  - Turning rate :  $\frac{1}{4}$  turn per sec
  - Drum Length: 48 in
  - Drum angle: 1 degree



# Collection Bags

## Challenge:

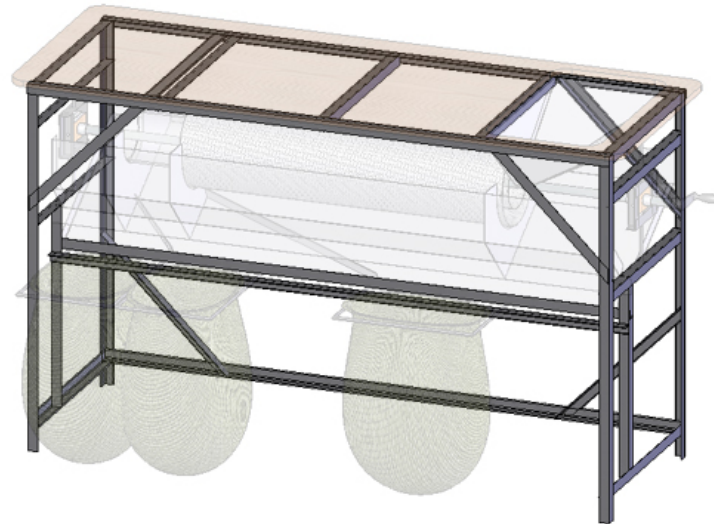
- Quick loading and unloading
- Visible throughput



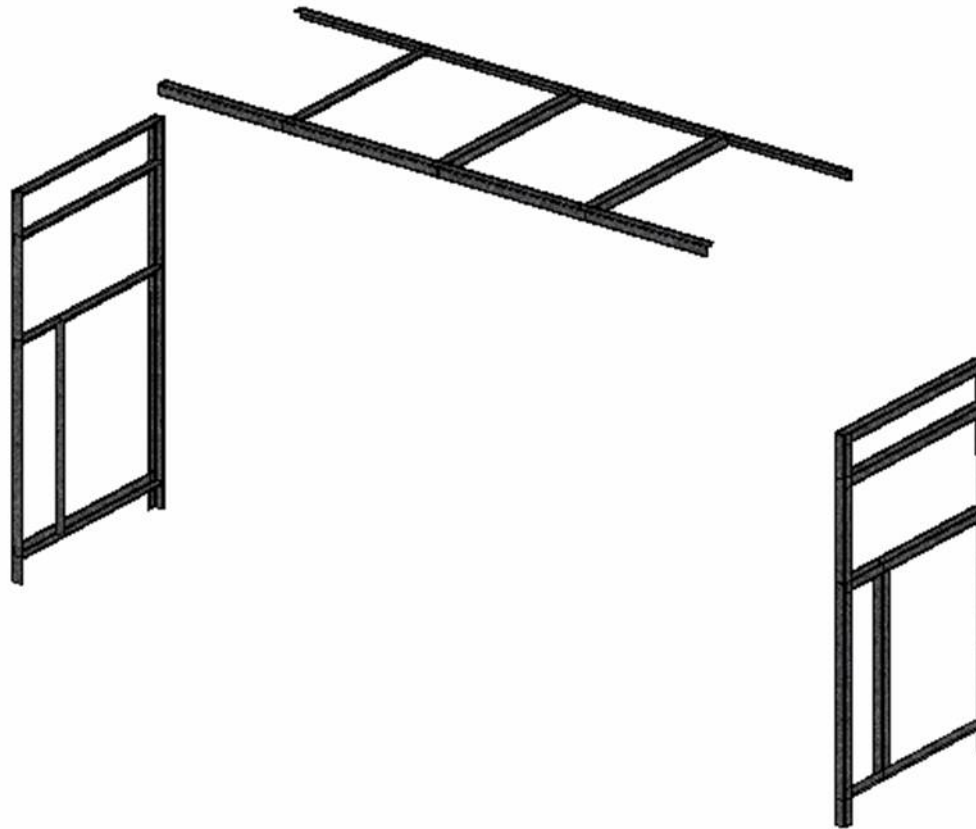
# Frame

## Challenge:

- Easily manufactured
- No sharp corners



# Frame





# Benefit Analysis

- 10 times faster
- Annual revenue increase of 10%
- Net Present Value of \$800



# Cost Analysis

- \$205 material costs
- Fabrication costs
  - Estimated 20 hours of labor
  - \$36 in labor
- Payoff in 2 months of use



# Distribution Scheme

- Building plans
- Field test prototype
- Worldwide dissemination



# Questions?



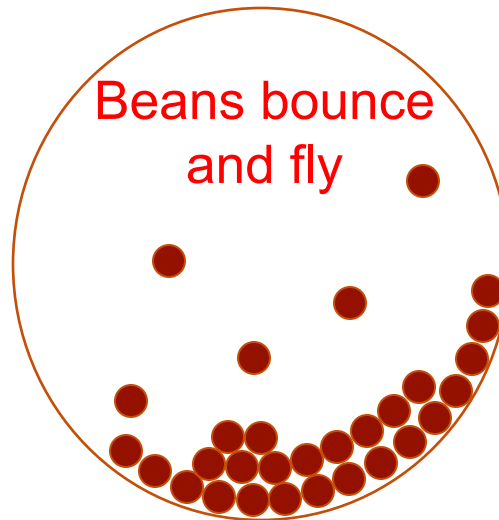
# Bean Dynamics and Diameter

Better for sorting



Tumbling helps beans mix between layers

Worse for sorting



But with too much tumbling, the beans do not contact the drum surface enough to sort



# Results of Testing

## Design parameter

Improving Accuracy

Improving Rate

Drum diameter



Drum angle



Drum length



Rotation rate



Hopper feed rate





# Optimization of Drum Dimensions and Rotation Rate

| Drum angle | Rotation rate<br>rot/sec | Diameter | Length | Total rate<br>lbs/hr | Defect occurrence<br>rate beans/lb |
|------------|--------------------------|----------|--------|----------------------|------------------------------------|
| 2          | 0.5                      | big      | short  | 225                  | 327                                |
| 2          | 0.33                     | big      | short  | 260                  | 130                                |
| 2          | 0.33                     | big      | short  | 235                  | 96                                 |
| 2          | 0.25                     | big      | short  | 230                  | 66                                 |
| 2          | 0.25                     | small    | short  | 240                  | 47                                 |
| 2          | 0.25                     | small    | long   | 230                  | 20                                 |

# Sorting Each Bean Type

Black



Eye

Pergamino



Size

Rocks or Twigs



Size

Cherry



Size

Genetically Deformed



Eye





# Cost Analysis

| Material                        | Cost         |
|---------------------------------|--------------|
| 25 meters Angle Iron            | \$25         |
| (2) 4' x 8' Sheet Metal         | \$70         |
| (1) 4' x 8' Screens             | \$35         |
| 18 tabular feet of 3/4" plywood | \$45         |
| Fasteners                       | \$30         |
| <b>Total</b>                    | <b>\$205</b> |

# Customer

## As Green As It Gets

- Works with a farming cooperative in Guatemala



## MayaPedal

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# Hopper Design

- Challenge:
  - Accommodate the average farmer
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