**Problem Statement**

“The service we render to others is really the rent we pay for our room on this earth.” — Wilfred Grenfell

- Develop a mechanical device that produces flour from cassava root
- Targeted for use by small farmers in Kenya
- Will help to increase annual income
- Will provide a safe and reliable way to store harvested cassava root for future consumption
- Device will empower women in Kenya who are often the ones performing this labor intensive task
- The project is generously sponsored by a Kenyan NGO called the Macheo Children’s Centre

**Cassava**

- Also called tapioca, yuca, mogo, manioc, mandioca; it is a starchy tuber similar to the potato
- Very hardy, will grow where other crops can’t and still produce high yields making it a staple crop for the poor
- Contains potentially harmful levels of cyanide if not processed properly
- Once harvested and separated from the rest of the plant, the root will rot within two to three days, whereas flour lasts up to two years
- Root is eaten cooked in soups and stews or deep-fried, while flour is used to make bread, tapioca balls, and fufu, a starchy cooked dough made from boiling flour

**Nutrition Facts**

- Carbohydrates 10768 mg
- Fat 66 mg
- Saturated Fat 9 mg
- Protein 20 mg
- Sodium 0 mg
- Cholesterol 0 mg

**Design Specifications**

**Function** – Product must be a manual powered device that produces flour from the cassava root at a rate of ≥ 50 kg per hour

**Product Cost** – Product cost must be less than $35 to be affordable

**Manufacturability** – Must be readily manufacturable from local materials such as sheet metal, PVC, wood, and recycled parts

**Weight** – To ease transportation the device must weigh <15 kg, or be able to be disassembled into parts, each weighing no more than 15 kg

**Operating Instructions** – Device operation should be self-explanatory, requiring little to no instruction and operate via human power

**Health Issues** – Cassava flour produced using this system should contain ≤ 10 mg HCN equiv./kg and < 14% moisture content of dry weight.

**Energy Consumption** – Due to a lack of electric power and high fuel prices the device will be manually operated.

**First Prototype**

- Quick/simple way to test our final prototype idea
- Various hole sizes/shapes were explored
- Materials:
  - Plywood
  - 2 x 4 Lumber
  - PVC Pipe
  - Sheet Metal

**Testing**

**Procedure:**
- Peel cassava and cut into 1” by 2” pieces
- Place cassava in vertical dryer until dry
- Once dry, crank the handle clockwise for 10 minutes

**Data:**
- Took 3 days in 50-60 degrees Fahrenheit weather to dry the cassava
- Ground up the cassava into .1mm - 10 mm pieces
- Cassava was ground at a rate of approximately 18.14 kg/hour

**Moving Forward**

- Add weight on top of cassava to increase production speed
- Make device adaptable for any size cylindrical drum or barrel
- Add additional shields to protect the operator and aid in the collection of the flour
- Add an option to make the device bicycle driven

- Create pictorial assembly instructions to be sent to Macheo Children’s Centre
- Check in with our contact every two weeks for the first two months to assist with challenges that arise
- After the initial period we plan to be in contact every three months to receive updates on how our device is performing

**Final Design**

- Vertical dryer and a cheese grater style grinder
- Materials: laundry dryer drum, lumber, fence posts, fence post elbows, angle iron, galvanized hardware cloth, screws, nails, nuts, bolts, etc.
- Tools: hand drill, drill bits, screwdriver, hammer, circular saw, wrenches, staple gun, tin snips
- Created on a larger scale than the first prototype to produce a greater amount of flour for the amount of effort expelled by the operator
- Made with supplies that are readily available in Kenya
- Vertical dryer is based off of the design by Gonzalo Roa, a Ph.D. student at MSU in the late 70's who completed his dissertation on the natural drying of cassava

**Team Members**

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