Case Study: Cassava Lost During Post-harvest in Nigeria

Food Type: 

Food Production Stage: Post-harvest

What is cassava?

Cassava is a shrub that is grown throughout the tropical world including Central and South America, Southeast Asia, and sub-Saharan Africa (SSA). It's an edible starchy root like a sweet potato and a major source of nutrition to many people around the world.

Today we will focus on Nigerian cassava production because Nigeria is the world's largest producer at 54 million tons produced per year.[i]

The root can be eaten freshly prepared or after it is processed into secondary products such as chips, flour, and noodles. In the global north, cassava flour is typically called tapioca flour. While cassava is a major source of calories and nutrition for some of the world's most food-unstable populations, in the U.S. we encounter it mostly as a refined product, such as the basis for the pearls in Boba tea.

Cassava is the second most important source of calories in Nigeria. It is mainly grown by smallholder farmers on marginal land, meaning land that has poor quality soil and is difficult to grow crops in.[ii] Cassava is uniquely situated because "of its efficient production of food energy, year-round availability, tolerance to extreme stress conditions, and suitability to present farming and food systems in Africa."[iii] Specifically, cassava "has a number of attributes that have made it an attractive crop for smallholder farmers in Nigeria with limited resources…":

- It is one of the most efficient carbohydrate-producing crops. Its high carbohydrate content translates to more calories per root meaning each root can provide nutrition to more people than other crops;
- It is tolerant of low soil fertility and drought;
- It has the ability to recover from the damage caused by most pests and diseases;
- The roots can be left in the ground for long periods as a food reserve and, thus, provide a reliable food supply that serves as insurance against famine." [iv]

But cassava is quickly turning from a local product that subsistence farmers grow to feed their own family to a cash crop providing real incomes to smallholder farmers. Cassava is being sold by farmers to processing facilities that may be far from their farm in order to be turned to flour, chips, noodles, or other products. This is especially true in Nigeria.[v] However, access to processing facilities still remains a problem from some farmers.

Cassava's Achilles heel: While cassava has many attractive qualities as an agricultural crop and a source of calories, once harvested cassava root deteriorates within 24 to 72 hours.[vi]

Why this matters?

Because of its incredibly fast rate of deterioration, **up to 40% of cassava is lost post-harvest**.[vii]

This loss is not only a loss of edible food that could be used to feed a food insecure population but also the income that farmers are deprived of when their crop is lost.

As the Food and Agriculture Organization of the United Nations describes: "Cassava is one of the principal crops grown by small farmers in marginal areas of the developing world.... In many cases cassava is the only crop that can be grown in sufficient quantities to generate income."[viii] When that crop is lost, so is the income that small farmers rely on.

However, there are opportunities for incremental improvements and breakaway solutions to reduce that 40% of cassava that goes to waste.

How and where is cassava lost post-harvest?

This is the big question and there are many, many answers to it. Some-- but certainly not all-- of the reasons for how and where cassava is lost post-harvest are:

- Most cassava is harvested by poor, smallholder farmers in Nigeria and their harvesting tools are imprecise like you see in the photo on the side. When harvesting cassava by hand, it is difficult to pull it out of the ground. Damages to the tips of the cassava root trigger quick deterioration.
- Traditional intermediate processing methods (i.e. peeling, boiling) are sometimes carried out on smallholder farms to preserve cassava before it is processed into its final product. However, these methods are often not hygienic and produce a contaminated product. Contaminated products are either sold at a lower cost, reducing the income a farmer can generate, or they are thrown away because the contamination makes the food unsafe for human consumption.
- Cassava is manually harvested because of its irregular shapes. These irregular shapes make intermediate processing more time-consuming and loss-prone.[x]

- Farmers sometimes leave cassava roots underground to protect them from quick deterioration after harvest. However, cassava roots left underground too long can become susceptible to disease and pests. [xi]
- Cassava roots are often broken during the loading and off-loading of vehicles during transportation from the farm gate to processing facilities. After they break, they deteriorate quickly.
- With increased urbanization, processing facilities and markets are located further away from cassava farms. This results in more fresh products spoiling during transportation to processing facilities and markets. [xiii]
- Lack of access to properly maintained roads can cause delays during transportation to markets and processing facilities, resulting in more spoilage.[xiv] Even low quality roads can result in more bruising and damage to cassava in transportation, resulting in more spoilage.

In the context of post-harvest cassava loss in Nigeria, how might we reduce food loss before it reaches the consumer in order to increase the amount of available edible food and lessen the impact on climate?

Now it's time to brainstorm as many potential solutions that each respond to this case study. Within the example of cassava, there are many opportunities for improvement that will decrease food loss.

Start by brainstorming as many ideas as you and your team can come up with. Don't worry if you think they sound farfetched. After 15 minutes, talk to your team and identify the 2-3 most promising solutions that you came up with. To help you do this, use the **Business Canvas Solution** worksheet. After another 10-15 minutes, decide as a group on the single best idea and spend the rest of your time working on and refining that solution.

That last solution you work on is what you will turn into the Food Solutions Challenge! Solution submissions are 500 words or less. You can turn in your solutions to: http://bit.ly/2xNJloT

Remember: your idea doesn't need to fix every reason for post-harvest loss of cassava. You can take inspiration from information presented in the case study, the presentation you just heard, or credible online sources.

Examples of solutions may include any combination of the following:
Biological: coming up with a new cassava variety that is resistant to spoilage

Mechanical: creating improved harvest equipment to better harvest cassava

Business oriented: value chain coordination or other systems improvements

Product-based: an SMS service that helps farmers and processers coordinate about delivery and arrival times

Example solution:

Smallholder farmers in Nigeria spend an inordinate amount of time peeling cassava roots for intermediate processing before they are transported to a main processing facility where they are turned into their final product. This long process means that some cassava roots go bad before they can reach that final processing stage. The reason this peeling takes so long is because these farmers use knives and peel each root one-by-one. My solution is to create an automatic peeling machine that can be changed depending on the cassava roots size and shape. That way, the farmer can simply put their cassava root into the machine and it will mechanically peel the root for them. This machine will be based on a simple wood-lathe machine that was traditionally used to make baseball bats. This lathe can even be pedal-powered for times when there are electricity shortages. This automated process will allow for cassava roots to be peeled quickly and shipped to processing facilities thus decreasing the amount of cassava lost post-harvest.

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[i] Anderson, Leigh. "Cassava Bacterial Blight and Postharvest Physiological Deterioration Production Losses and Control Strategies." University of Washington, EPAR Brief No. 298. 2015

[ii] D. Naziri et al. / J. Agr. Rural Develop. Trop. Subtrop. 115 - 2 (2014) 111–123

[iii] Hahn, S.K. "Cassava as livestock feed in Africa" An overview of traditional processing and utilization of cassava in Africa,

FAO, 1992, http://www.fao.org/wairdocs/ilri/x5458e/x5458e00.htm#Contents.
[iv] Wenham, J.E. “Post-Harvest Deterioration of Cassava: A Biotechnology Perspective.” Introduction, FAO, 1995, www.fao.org/docrep/v4510e/V4510E09.htm.
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[vi] Wenham, J.E. “Post-Harvest Deterioration of Cassava: A Biotechnology Perspective.” Chapter 6 General Conclusions, FAO, 2015, www.fao.org/docrep/v4510e/V4510E09.htm.
[vii] The Rockefeller Foundation. (2017). The Rockefeller Foundation Announces Results of the Cassava Innovation Challenge [Press release]. Retrieved from https://www.rockefellerfoundation.org/about-us/news-media/rockefeller-foundation-announces-results-cassava-innovation-challenge/
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[xii] D. Naziri et al. / J. Agr. Rural Develop. Trop. Subtrop. 115 - 2 (2014) 111–123
[xiii] Anderson, Leigh. “Cassava Bacterial Blight and Postharvest Physiological Deterioration Production Losses and Control Strategies.” University of Washington, EPAR Brief No. 298. 2015
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