CASSAVA INNOVATION CHALLENGE

OVERVIEW OF CASSAVA VALUE CHAIN AND DRIVERS OF SPOILAGE

The ROCKEFELLER FOUNDATION

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CONTEXT

The Rockefeller Foundation Cassava Innovation Challenge aims to reduce spoilage in the cassava value chain in Nigeria by supporting solutions that enhance shelf life, here defined as the time it takes for cassava to become inedible following harvest due to physical deterioration.

The primary driver of cassava's short shelf life is the physiology of the root itself. If left unprocessed, cassava spoils in 24-72 hours after harvest due to a process referred to as post-harvest physiological deterioration (PPD)[1].

Other factors can also shorten shelf life. Because the cassava crop itself deteriorates so quickly, it is vulnerable to various inefficiencies and poor practices along the value chain – for example, poor handling that damages the root and leads to quicker PPD.

The shelf life issues in Nigeria stem from some of the following barriers along the value chain:

- **Limited access to existing cassava varieties.** Though varieties that extend shelf life do exist, farmers lack access to/knowledge about them
- **No or limited preservation between harvesting and processing.** Poor and inefficient handling, storage and transport either damages roots or leaves them exposed to the elements
- **Far-away processing.** Processors are far from cassava farms and use inefficient manual peeling, allowing more time for root to spoil

More information on the cassava value chain and the main drivers of spoilage can be found here.

HOW TO USE THIS DOCUMENT

This document provides an outline of the steps in the cassava value chain between harvest and processing—where most spoilage occurs—and identifies drivers of reduced shelf life at each of these steps (these are marked by exclamation marks). Examples of potential innovations are marked by tick marks.

Innovation challenge applicants are not expected to limit their innovation submissions to only those challenges listed below. They are merely a guide to provide a clearer picture of the specific barriers to shelf life which are present in the Nigerian cassava value chain. Applicants can therefore use the information to better understand and communicate where their innovation can add value. For example, for a storage innovation, knowing that farmers struggle to access financing may prompt an emphasis on cost effectiveness or partnerships with finance providers as part of the scale-up plan.

1 Reilly, K., R. Gomez-Vasquez, H. Buschman, J. Tohme, and J. R. Beeching (2003). Oxidative stress responses during cassava post-harvest physiological deterioration. Plant Molecular Biology 53: 669–685, 2003.

OVERVIEW OF CASSAVA VALUE CHAIN

1 **Limited access to existing cassava varieties.** Enhancing access to existing cassava varieties, e.g., providing a route to market, increasing knowledge of and access to varieties, may help reduce spoilage

In Nigeria, cassava farmers replant cassava stems from the previous harvest or receive new stems from stem sellers, institutions that distribute stems or processors;

There is no reliable commercial stem supply system in Nigeria that farmers can use to purchase stems. While there are some entrepreneurial stem sellers, the lack of a vibrant commercial market makes it difficult to disseminate new varieties – including those that increase the shelf life of cassava. Some existing varieties have the potential to reduce spoilage – for example, a variety that can increase shelf life by 20 hours (named TME 419) exists in Ogun State in Nigeria. However, access to these varieties is limited and so their potential is left largely unrealised.

Potential innovations might include: A mobile application that informs farmers of these varieties and posts locations of where and when farmers in a given location can purchase them; systems which bundle inputs with stems, thereby leveraging existing input (e.g. fertilizer) distribution networks to offer farmers new stem varieties etc.

2 **No or limited preservation of cassava between harvest and processing.** Reducing spoilage between harvesting and processing, e.g., better harvesting methods, storage solutions, waxing methods, to enable farmers to sell more quality cassava to the market

Farmers harvest cassava roots 10-12 months after planting or leave them underground until they can sell them (to avoid spoilage);

Manual harvesting damages roots, further reducing shelf life. Storage roots from current varieties of cassava are often irregularly shaped. This, coupled with farmers' use of imprecise manual tools, makes it difficult to harvest the cassava without damaging it (small cuts are ideal but difficult to administer quickly, given variation in shape and size). Damage during harvesting triggers the onset of PPD, as described above.

Cassava roots should be harvested at maturity for processors when they are at or close to peak starch accumulation. If kept in the ground for too long the storage roots become woody or lose starch, which is important to processors. The optimal age when starch and dry matter yields are highest is usually around 9-12 months (depending on variety, some mature in 12-18 months). Farmers may leave roots longer than the ideal time underground as a storage method.

Farmers lack access to storage materials that may preserve cassava once out of the ground. Where storage methods exist - e.g., sawdust, freezing equipment and vacuum polythene bags - such materials are not cost effective given the large volume of roots.

Potential innovations might include: Better, more robust containers that keep cassava from getting crushed when stacked.

Traders collect cassava roots from farmers to deliver them to primary processors, since farmers are fragmented and transport costs are high;

- **Farmers do not have access to equipment for processing to intermediate products to increase shelf life.** This leads to their reliance on traders to collect and transport goods to processors.

- **Producers and traders are not incentivised to care for the roots.** Processors pay farmers and traders for the weight of the product and are therefore less likely to care for the root or use processing equipment to convert cassava to a stable state where shelf life is extended.

- **Poor loading and unloading of roots during transport to the farm gate and onto trucks damages the crop.** Farmers often load and unload the roots roughly, which causes bruising and damage to the roots. Similarly, traders load and unload the roots onto trucks in a rough manner, causing damage. As with poor harvesting, damaged roots hasten PPD.

- **Poor packaging of cassava storage roots during transport hastens spoilage.** This is as a result of the stacking methods used (thin wood is often used to support the sides of vans so that more roots can be loaded), containers used to carry the cassava that lack the ability to absorb or limit the shocks from vibration during transport, poor road infrastructure and badly maintained trucks that lead to jostling of the cassava load, and heavy objects that are placed on the roots.

- **Traders experience multiple delays.** Poor coordination between farmers and traders makes it difficult to plan trips between farms efficiently. As a result, traders often wait for long periods for delivery of one farm's cassava after picking up another's. Further, poor road infrastructure leads to vehicle breakdowns. All of this leads to cassava being left out in the open for longer than necessary, which decreases shelf life.

Potential innovations might include: Farmer/trader coordination services such as SMS services notifying farmers of arrival times and expected volumes to be purchased.

3 **Far-away processing.** Enhancing availability and efficiency of processing, e.g., more efficient transportation, mobile processing units, to increase quality and quantity of cassava sold

Once primary processors receive fresh cassava roots they begin to process them. Women peel and wash the roots, which are then placed in a mechanical grating machine to make cassava mash.

Farms are typically far away from processors. Long distances, coupled with aforementioned transport inefficiencies and vehicle breakdowns, increase the time cassava is left out in the open and therefore the risk of PPD.

Manual peeling is slow. Depending on the end product, women are involved in peeling and washing the roots, which are then placed in a mechanical grating machine to make cassava mash. Manual peeling is labour intensive, costly and inefficient – especially given the inconsistent shapes and sizes of the cassava roots. This extends the time for the cassava to reach processing and, thus, the risk of PPD.

Potential innovations might include. Mobile processing units that allow for cheap and easy transformation to forms with greater shelf life; new peeling equipment that strips skin off cassava faster than manual processing.

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