# SCALING HQCP MASH PRODUCTION IN NIGERIA AND TANZANIA: CREATING NEW ENTERPRISES – engaging processors

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Nigeria, the world's largest producer of cassava, harvests 50 million metric tonnes (Mt) of cassava tubers annually. More than 95% of its uses require peeling which generates up to 14 million Mt of waste – potentially 4 million Mt of livestock feed ingredients – annually; mostly wasted due especially to challenges related to drying. Sun drying is practically impossible during the wet season and takes 2-3 days in the dry season to reduce moisture content of fresh peels from about 60% to 20% or less - a marketable state.

An innovative process has been developed at ILRI, Nigeria in collaboration with the CGIAR Research Programs on Roots, Tubers and Bananas, Humidtropics and Livestock and Fish to add value to the cassava peels as livestock feed. The process drastically reduces drying time to 6-8hrs sunshine hours (see process in this link: http://youtu.be/JwfgyHKnkLE). The main products are fine and coarse fractions of High Quality Cassava Peel (HQCP) mashes for monogastrics and ruminants. Some of the major feed industry players have independently tested the HQCP mashes in their laboratories and conducted animal trial evaluations. So far, they are fully convinced of its utility as an energy supplement (10-11MJ/kg DM), sometimes replacing up to 30 per cent of the maize in poultry feeds without affecting performance. The industry, on the one hand, is looking forward to using this product in feed formulations and they are looking for a steady supply of HQCP of reliable quality (aflatoxin free) in commercial quantities. Most garri processors – except those that were are currently working with – are familiar only with the sun drying of peels and know that it has some economic value as feed. They are not aware of the potential of processing cassava peel to produce HQCP mashes and the consequent economic benefits that it can bring in. Processing steps involved in production of HQCP mashes from cassava peels include grating, dewatering through hydraulic press, sieving and sun drying/roasting which are same as the process involved in garri production. This makes the uptake of innovation by the processors easy as the skill sets and the necessary equipment's are already available with the processors. Garri processors, some SMEs and a few public and private sector operators who have come to know about the HQCP mash production process are keen to engage in production if they have an assured market and an attractive price. It would appear then that cost of production and the quality of the processed HQCP mash *vis a vis* the price offered by the feed industry would be major criteria for translating this innovation into profitable business models for the various segments of processors interested in engaging.

This processing method that shortens the drying period from 3 days to 6-8 hours can benefit the garri processors and other enterprising individuals who produce and sale HQCP mashes utilizing the large amounts of peels routinely allowed to rot or deliberately burnt due to constraints faced in the drying peels in the traditional manner. Economic incentives – in the form of a good price that the feed industry is willing to pay for the HQCP, strong demand, familiarity with processing steps and having the necessary infrastructure at hand are some of the major positive factors that would motivate

processors to take up cassava peel processing. A key point in beginning to engage potential processors in producing HQCP mashes is hands on experience in handling peels i.e. following hygienic methods to produce safe and quality mashes that are continuously acceptable to the feed industry. Feed industry would stand to benefit from the steady supply of locally produced quality byproduct that is priced economically.

To bring the demand and supply of HQCP mashes together and develop a viable business partnership, two broad models are proposed namely: i. decentralized processing model (low product volumes produced in many locations using only existing processing methods and involving large numbers of processors) and centralized processing model (high product volumes using industrial machineries including flash driers).

## A decentralized model

A decentralized processing model involves participation by large number of processors producing low volumes. All the processes of production– grating, dewatering, sieving and drying/roasting will be carried out by the processors using their own set up. As the production is in low volumes, the finished product has to be pooled to reasonable quantities acceptable to the industry. Advantage of this system is that the additional investment to start the process is low and large number of processors can be involved in this process. However the limitation is that the processors have to be trained in large numbers and monitored to ensure that quality and hygiene are maintained throughout the production cycle.

The processors have to fully accept that set quality standards will be strictly enforced as acceptance by the industry would be based on the quality of HQCP mash and any compromise would not only lead to rejection but may jeopardize the business relationship. Establishing and strengthening would involve training of the processors in handling peels and the precautions/hygiene measures that need to be observed to ensure quality. This requires that the necessary inputs/infrastructure to maintain good production practices e.g. water and concrete slabs are in place. Apart from training the personnel and strengthening their infrastructure, working closely with them and monitoring their production cycles for a period of 2-3 months is imperative. This would give them the necessary confidence in handling the operations and will also ensure quality compliance from industry perspective.

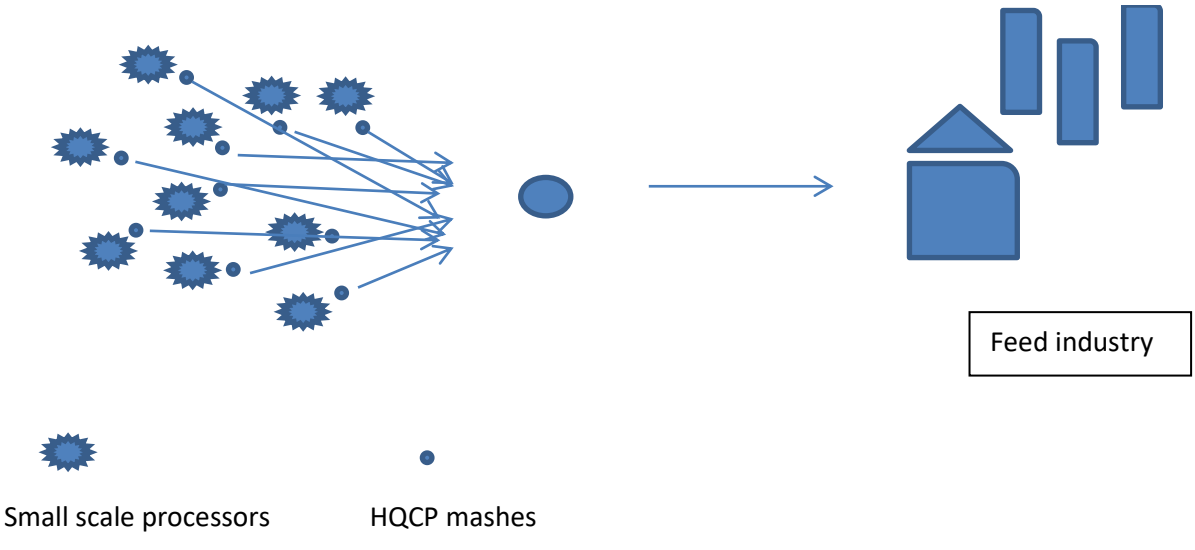


Figure 1. An illustration of a decentralized model of HQCP mash production

## Setting up a decentralized model

To set up the decentralized model of production, it is planned to strengthen the capacity of the processors by providing with technical support for skills development bearing in mind the issues of product quality and safety. This is proposed to be carried out in two phases, i) beginning with the training of the "fryers" i.e. the women already involved in toasting garri – in doing a similar thing with the fine fraction of the wet cake; and ii)training of the people who grate at ILRI pilot processing plant. For training fryers, the production of fine fraction of wet cake will be carried out at the ILRI HQCP facility. Processed fine fraction of wet cake will be introduced to the garri processors and they will be engaged in the frying of the wet cake to produce fine HQCP mash for sale to the feed industry. This would ensure exposure to frying of peels and would also give a better idea on the time, labor and inputs in form of fuel required to produce the fine mash. This provides improved estimates on cost of production.

As the fryers become engaged, training in grating, pressing and sieving of the cassava peels will be taken up by engaging the processing community and identifying the potential candidates who would be taking up the production of HQCP on commercial basis. Traditionally, grating and dewatering by hydraulic pressing is always carried out by men while sieving is usually done by women. In the improved process, however, sieving is mostly mechanized.. Training will be at the ILRI cassava processing facility for duration of 4-5 days and they will be trained in the multiple batches in the various activities. Broadly the activities include – sorting of peels to eliminate stumps that damage the grater, grating of peels to achieve desired particle size (usually done thrice), packing of grated material into water-porous bags, optimizing the pressing operation to ensure maximum water loss, pulverizing cakes and sieving to produce fine/ coarse fractions. Training importantly includes activities in cleaning of all equipment and the working environment using pressurized water hosing, precautions for

hygienic processing, maintaining machines in good working condition, common problems encountered during various operations and the trouble shooting of different operations. Once the training on grating peels and toasting are done, the trainees would be certified to produce and market the products from start to finish. ILRI will provide advice on economic units e.g. number and capacity of equipment and labour requirements for production and each processing group would determine what they can afford to establish and maintain with ILRI's initial technical support.

## Centralized models

A centralized model involves more investment than the decentralized model and aims at handling large volumes in a situation where an interested entrepreneur sets up a flash drying unit located centrally to many cassava processing centers. Small scale processors would be engaged in the production of pressed cake on regular basis. The entrepreneur would be responsible for pooling and transporting pressed cake to the flash drying equipment where they pulverize, sieve and dry to reach the final products. Small scale processors will be paid for the cake they produce based on the moisture content (@ 40 per cent as standard) and quality of the cake (freshness of peels used) that they produce. The advantage of this system is that large volumes can be handled ensuring quality to satisfy the demand of the feed industry and also ensure the participation of small scale processors in larger numbers. Centralized system of HQCP production would mainly depend on the volume of the peels processed in a locality in addition to the cost of production. Investment by the entrepreneur should be justified by sale of larger volumes.

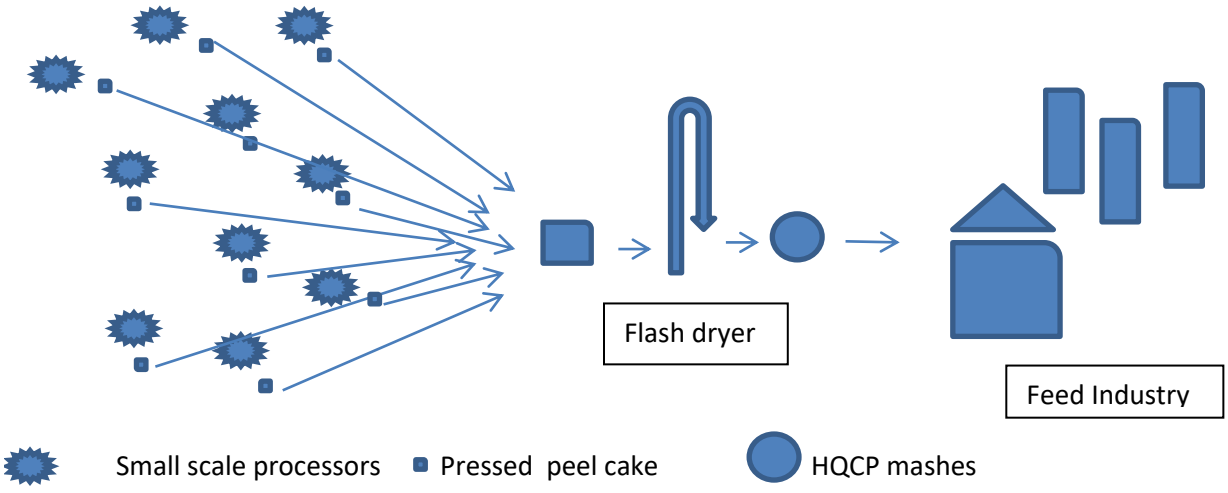


Figure 2. An illustration of a centralized model for HQCP mash production

## Setting up centralized models

Centralized models are best suited for producing high volumes and require higher levels of investment in terms of setting up of flash driers to handle large volumes. Identifying clusters of cassava processing centers for steady supply of large volumes of processed cake and the transporting charges/ logistics are key components of centralized models. Additional costs incurred in collation, transporting and processing need to be balanced with the profit margins and volumes handled as the cost of mash production would be highly affected by costs of collation and transportation. Assured market in terms of the volumes and profit margins should be attractive enough for the entrepreneur to set up the flash drying system. There are two options for operating a centralized model. The first one is where the entrepreneur collects dewatered cake from garri processor and processes it further by pulverizing, sieving and flash drying the fine fraction. In this system, the entrepreneur enters into an agreement with garri processors to ensure supply of required quantities and quality of pressed cake – in terms of moisture and the quality of peels used in producing the cake – and pays according to the mutually agreed terms and conditions. Proper training of the garri processors to produce the pressed cake in hygienic way is crucial to ensure quality control as the quality of the peels selected and the hygiene of the machines involved in processing are very important.

The second option for operating a centralized model is where the processing of peels to flash drying of HQCP is all centralized and this involves greater automation where the processing is carried out in higher volumes using automated and efficient graters and pressing machines. Peel suppliers get paid for the peels and garri processors supplying peels stand to benefit from the additional revenue in addition to operating in processing centers that are clean – free from rotting peels. In addition to fine HQCP mash, entrepreneurs get revenue from the coarse fraction of the cassava peels that is good for ruminants.

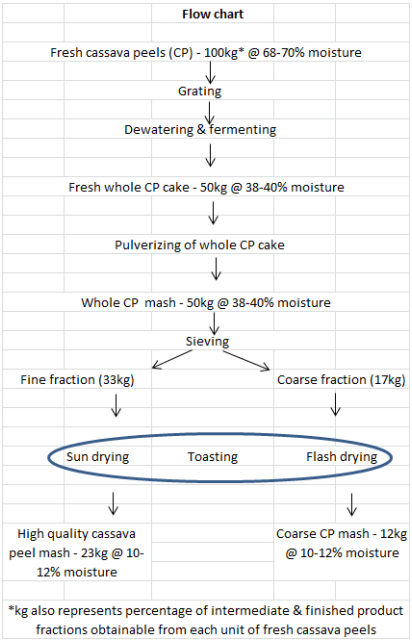


Figure 3. Flow chart for various product lines generated during cassava peel processing

Cassava peels is currently dried by conventional ways using sun drying and dried cassava peels is the only product that is being used as livestock feed apart from negligible quantities of garri sieving waste used in fish feeds. Drying is the major challenge leading to dumping and wasting of potential cassava waste (peels, undersized & damaged tubers and other wastes) estimated to be around 14-15 million tons generated annually by small scale stakeholders that account for close to 90% of the cassava processing in Nigeria. Cassava waste can be suitably processed to generate a range of products that could be effectively used as livestock feed, generating additional revenue for the cassava processors, strengthening cassava value chain apart from contributing to improved feeding of livestock, and leading overall to improved productivity of livestock Enabling factors in terms of the continued availability of cassava waste in substantial quantities round the year on supply side and demand as feed ingredient from the livestock sector are key in facilitating large scale adoption of cassava peel processing. Cassava is a major food crop in many African countries and is a high priority area in many of the countries' national agriculture agenda as they seek to promote food security. This implies support to increase cassava production and thus the availability of cassava waste on a continuous basis from supply side. Rapid urbanization and growing incomes leading to greater demand for animal source foods in developing countries are some of the major factors creating strong demand for feed ingredients. Apart from the supply of raw material and demand scenario for livestock feeds additional factors like employment opportunities for women (who constitute 80-85% of work force in small scale sector cassava processing) and rural youth, income generation, environmental benefits in terms of reduced pollution due to effective disposal of cassava wastes around processing centers etc., are some of the major considerations that warrants large scale adoption of the cassava waste.

ILRI scientists working with CGIAR Research Programs on Roots, Tubers and Bananas (RTB), Humidtropics and Livestock & Fish have developed improved methods for processing cassava peels. The methods enable processors to adopt a range of options to generate different end products that cater for different categories and species of livestock. The major processes involved and the end products with their yield percentage are summarized in the flow chart. Characteristics of different end products in terms of the processes involved, shelf life and suitability for different species is summarized in Table 1.

Table1. Summary of characteristics of end products of cassava peel processing

| | Wet peel cake | Whole peel mash | Coarse fraction of peel cake wet | Fine cassava peel fraction mash- HQCP | Coarse fraction peel fraction mash |
|---|---|---|---|---|---|
| Processing steps | Grating and dewatering | Grating, dewatering and drying | Grating, dewatering and sieving | Grating, dewatering, sieving and drying | Grating, dewatering, sieving and drying |
| Machinery | Grater, hydraulic press, metal frame and wooden planks, water pressure pump cleaner | Grater, hydraulic press, metal frame and wooden planks, solar drying /frying pans-firewood/flash dryer, water pressure pump | Grater, hydraulic press, metal frame and wooden planks, sieve, water pressure pump cleaner | Grater, hydraulic press, metal frame and wooden planks, sieve, solar drying/frying pans-firewood/flash dryer, water | Grater, hydraulic press, metal frame and wooden planks, sieve, solar/frying pans-firewood/flash dryer, water |

| | | | | | |
|---|---|---|---|---|---|
| | | cleaner | | pressure pump cleaner | pressure pump cleaner |
| Hygiene | ++ | ++ | ++ | +++ | ++ |
| Moisture % | 38-42% | 10-14% | 38-42% | 10-12% | 10-14% |
| Fiber level | ++ | ++ | +++ | + | +++ |
| Shelf life | Less than a week | 3-4 months | 2-3 days | 3-4 months | 3-4 months |
| Suitability - species of livestock | Cattle, sheep and pigs | Cattle, sheep and pigs | Cattle, sheep and pigs | Poultry, fishes, pigs, cattle and sheep | Cattle, sheep and pigs |