

THE CONTRIBUTION OF SIMPLE AGRO-PROCESSING INDUSTRIES

Sheila N. Yakwezi*

INTRODUCTION

The development of agro-processing industries in developing countries has been in many cases been associated with the production of export commodities. Modern processing facilities have been established as a consequence of this. Traditional methods may not be able to compete with the modern technologies that are replacing them. The topic of local and indigenous knowledge may play a particularly important role in the food sector of developing agro-industries.

Various economic conditions, such as fast urbanization as well as change in consumer habits, have to be met by agro-industrial development in developing countries. Processing technologies to be considered may include harvest, storage, and conservation, transport, processing of primary products, as well as recycling technologies. However, specific environmental conditions in developing countries may present particular challenges to the development and application of these technologies.

The progress will depend on the development of innovative products for the local markets, such as processing technologies for micro, small and medium sized enterprises (SMEs) in DCs, which may give them an opportunity to achieve the accepted standards. This paper outlines how simple processing activities could achieve this by studying the examples of value-added meat, together with cassava. In addition, how the economic landscape of a rural village could be improved by such a venture.

BACKGROUND

Uganda is a country in East Africa lying astride the equator. The Sudan to the north, Kenya to the east borders it, Tanzania and Rwanda border the country to the south and the Democratic Republic of Congo to the west. Uganda consists mainly of a high plateau, rising to mountains, as well as a considerable portion of area covered by lakes and rivers.

Uganda covers an area of 236,860 km², with a land area of 19,965,000 ha, of which 34.1% (68000,000ha) is arable and under permanent crops, while 9% (1,800,000 ha) is under permanent pasture (FAO, 1995).

Uganda is an agricultural country, with a human population of 21,300,000 having a fertility-rate of 3%, this rapidly growing population imposes a number of challenges in the provision of food. About 85% of this population are rural and engaged in agriculture. A problem associated with this kind of population is the limited nature of economic activities in the rural areas. Agricultural practices are mixed, with the majority at subsistence level.

MEAT AND MEAT-PROCESSING

Meat Production in Uganda

In Uganda, Livestock production consists of keeping of cattle, goats, sheep, pigs and poultry. The animal management system practiced is largely based on a communal grazing and tethering of indigenous livestock. Zero grazing of exotic breeds of cattle and their crosses is also practised.

Livestock contributes about 15% of agriculture production. Following the decline in cattle-production in Uganda from almost 8 million in 1970 to about 3.9 million in the 1980s, there has been a steady recovery of the national herd. Between 1988-1998, the annual average meat production was (106.8 thousand tons), of which 64.8% was beef, 21% goat and mutton, pork 6 % and chicken was 8.2%. In 1984, total meat consumption was 800 thousand tons, while in 1992-1993, per capita consumption of meat was only 5.6 kg.

* Researcher, Uganda Industrial Research Institute, Kampala, Uganda.

Animal-Rearing Methods in Uganda

The cattle are mainly reared on rangelands which occupy about 84,000 km² extending from Moroto and Kotido in the north east, through central Uganda, to south west of Mubende, Masaka, Rakai and Mbarara.

The main livestock production systems include:

- a. *Extensive Traditional*: The indigenous breeds are mainly kept under extensive traditional production systems. These include the East African shorthorn and the zebu. The indigenous breeds have been imported from Kenya and Sudan. Indigenous animals are hardy and adapted to the local environment.
- b. *Intensive Commercial Systems* such as beef ranching on private and government farms, and zero grazing, but this constitutes less than 5% of the total production.

The exotic breeds of cattle include the Aberdeen Angus for beef shorthorn. The dual-purpose breeds are mainly Friesian and Red Poll.

Constraints to Meat Production

A number of problems are usually faced by the livestock farmer and some of these include:

- **Poor Access to Markets**: this may be due to expensive, poor, or even lack of, transport mainly due to the poor road-systems in the villages. The market may usually be a long way from the farm and, therefore, this may increase the transport costs.
- **Low Purchasing Power of the Consumer**: the consumers are not willing to pay the required price, either because they cannot afford, or they are willing to bargain elsewhere for lower price-ranges. This may create a problem for the farmer as he/she may have to sell at a very low and unprofitable price, especially if it is a distress sale. This is especially true during dry seasons, when the holding capacity of the farms is low.
- **Disease**: farmers at the grass-root level may not have enough money to buy the chemicals needed to treat disease causing organisms, such as ticks. Usually farmers may look at disease-reducing mechanisms as an unnecessary expenditure. This has an adverse effect on the quality of meat and its by-products.

Possible solutions to overcome these constraints and increase productivity

- **Proper Infrastructure**: this may include construction of proper roads within the village area. If there is improvement, then there will be better access to the market by the livestock-farmers. This problem can assume great urgency if livestock processing is carried out in the rural areas.
- **Establish a Grading System**: this will partly solve the problem of the purchasing power. The price to be paid should depend on a number of factors, such as the size, age, breed, weight of the animal.

Livestock Products Marketed

The livestock are marketed for slaughter or breeding. The conventional animal-products often marketed include meat, milk, hides and skins, bones, horns, as well as blood. However, it is important to note that, due to the relatively crude methods of handling and slaughtering, only the income from meat constitutes any significant income to the farmers.

In Uganda, most of the meat is consumed fresh. Slaughtering may usually take place in abattoirs or on the farm. From there, the meat may be sold directly to the consumer or may be sold to the butcher, who will finally sell it to the consumer. Many livestock farmers are unable to produce and process products from their animals. This is due to a number of constraints, such as the lack of transport to and from the market, as well as lack of technology in terms of equipment as well as infrastructure; electricity and water.

Types of Livestock Markets

There are three types of livestock markets in Uganda, and these include:

- Primary (village) Markets: these are usually located in surplus producing areas and operate once or twice a month. They are mainly the points of assembly to supply secondary markets. However, farmers at the primary markets are facing infrastructure problems, such as poor forms of transport. The movement of livestock to the livestock-market is usually on foot. This causes stress and consequent loss in quality. The prices at this market are also settled by private treaty, leading to low prices in cases of distress sales during drought.
- Secondary Livestock Markets: these exist in or around large urban centres, such as district headquarters. If the livestock are going to a secondary market within the district, they are normally transported on foot. The trader will usually hire a special herder to do this. The herd will be transported on lorries, only if there is demand from bigger cities. These large markets act as outlets for all types of sellers.
- Tertiary livestock markets: these livestock-markets are represented by the slaughterhouses and abattoirs, in the main urban city-centres, and slaughter-slums in sub counties within cities. There are also small functioning abattoirs at the district headquarters.

There are two main abattoirs in Uganda, both of them situated in the capital city.

In the traditional way of meat-processing and trade, there are a number of shortcomings e.g.:

- The meat, as sold, contains a lot of inedible tissue, such as tendons and bones, which creates a disposal-problem for the final consumer, who is normally located in the urban areas.
- The value of the meat produced is relatively low, since no prior processing is carried out.

PROCESSING

Meat, in general, has been part of the diet for most populations around the world ever since man began to hunt and fish. However, meat is a perishable good that will have to be treated in different ways, in order to keep well. The history of meat-processing started when man began to dry, smoke and cure meat. Since the early days, meat-processing has developed into almost an artistic skill, with a specific background. Products and techniques have been developed in order to satisfy customers and meet economic demands. Many of these processes can be adapted to rural situations.

Simple Meat-Processing Methods

Collection of meat: The quality of meat should be taken into consideration when selecting. The quality should be good, with less bone. For small-scale processing, there is recommendation for meat from the hind legs, as it has more meat than bone.

Deboning of meat: The meat is separated from the bones and other tissues. The meat for processing is cut into small pieces, which can pass through the mincer with ease.

Mincing: the mixture is then passed through the mincer for grinding into small pieces. In rural areas, where there is no power, a manual mincer is used. The only limitation here is that the quantity produced is small and there is demand for a lot of human labor.

Once the minced meat has been produced, a number of processed meat-products can be made. Processed meat-products are those which are made first by deboning, then the meat may be mixed with other non-meat materials, especially at village level. Materials, such as cassava, sweet potatoes, green pepper, onions, salt, curry powder, may all be mixed with the meat before it is ground. Then the meat mixture can be shaped differently to form a number of products, such as sausages, meatballs, burgers,

samosas, beef chaps. These can then be fried or roasted and sold fresh.

Therefore, there are meat products, which are simple to make and do not constitute a quantum-leap in the equipment and processes that can be made in rural areas.

How Meat-Processing can Improve a Rural Community

Processing creates employment-opportunities for people at the village-level, e.g. a group of widows can form a group that will grow cassava and onions, to be used as part of the ingredients.

This increases profit, as most of the products have a longer shelf-life in comparison to the raw material. Quality products are made, as there is less bone in the product.

Nutritive value is increased when a number of other ingredients are added to the mixture of the meat.

The potential in meat/beef-processing is largely unexploited at the village-level. Opportunity therefore does exist in further processing of animal flesh into a variety of products.

CASSAVA PROCESSING AT VILLAGE-LEVEL

Because of Uganda's geographical position, it has good tropical soils and good climate. Uganda also has a lot of agricultural raw material (e.g. cassava, fruits, etc), most of which is organically produced. For this reason, Uganda has a good potential to process good-quality products to market, both domestically and regionally.

85% of the Ugandan population lives in rural areas and depend on agriculture for their livelihood (MAAIF, 1999). Food processing (value addition), thus, is needed to greatly improve livelihood of the farmer.

Cassava

Cassava is a major food crop in the region. In Uganda, cassava is the second most important root-crop, which rates second to banana as a food crop. The crop is grown throughout Uganda. The crop has an outstanding ability to withstand drought and remain in the soil after maturity, without any serious deterioration. Apart from being a staple food, it can be used for starch production. The world cassava-production is mainly for production of food, with the following distributions: 58% is eaten by humans, 28% fed to animals, 3% is processed into industrial products and 11% is wasted. In Uganda, most of the cassava is produced for human consumption. Eaten alone, cassava does not provide a lot of nutrients and is therefore considered a low-value food.

Varieties

In Uganda, there are two varieties of cassavas: the bitter variety, due to the high levels of gluco-cyanides, and the sweet varieties, which have lower levels of the gluco-cyanides. The bitter varieties contain a large amount of cyanides, these substances can cause various health problems and therefore the cassava must be processed before consumption. There are three efficient techniques, mainly used for processing bitter-cassava varieties, such as:

- Traditional dry fermentation
- Traditional wet fermentation
- Rapid fermentation (Gari).

Major Production Areas

Cassava-production areas are usually in the east (Soroti and Kumi) and north (Lira, Gulu). Others, parts of Masindi, Arua and regions in the West, also grow cassava. The cassava-growing areas overlap with livestock-raising areas, thus, making cassava a good vegetable candidate, as an additive for value-added

meat products.

Agronomic Practices

There are two planting seasons, which coincide with the onset of the rains; these seasons are: March to June, and August to October.

Cassava requires between 6 months to 3 years: depending on variety and meteorological conditions.

Roots are usually harvested manually, by the farmer, and transported or carried on the head, care being taken during harvesting to avoid damage to the roots.

After harvesting, the family consumes the produce, either as:

- boiled cassava
- dried cassava
- mashed cassava

Causes of Post-Harvest Losses

- Lack of transport
- Rapid fresh-root perishability
- Over production
- Poor storage facilities
- Pest and diseases
- Damage during harvesting
- Poor marketability of produce

Transport, Storage and Marketing

Transport: Poor state of roads into local and regional markets is the main problem. 25% of the feeder roads are impassable during the rainy season, 45% still require rehabilitation and 20% need culverts and drainage repairs.

Storage: The storage facilities in Uganda at all levels i.e., farm, village and regional, are poor and inadequate. Mbarara, one of the major cassava-supply areas in the country experiences a shortage of 15,000 Tons during the off peak season. This is compounded by the lack of processing-facilities near the areas of production. An improved granary can be used, in order to achieve better storage results, such as a guard against pests.

However, mere storage is not the solution because very few crops maintain their quality during storage. The solution lies in long-term storage of crops in a processed form e.g. cassava flour, cassava starch, or dried cassava chips. However, value could be added by processing the cassava into other more nutritious products.

Marketing: There are two main reasons why produce does not usually find market; these include poor quality of the products and over production. Significant production depresses the market, so that loss in value can sometimes be as much as 90%.

Strategies to Reduce Post-Harvest Losses

- Avail of better transport system
- Leave the crop to stand in the garden and only harvest it when needed. The problem with this method is that the roots become fibrous and the quality is adversely affected. Land remains occupied for a long time, so that it cannot be put to other uses, which is uneconomic for the peasant farmer

- Burying the harvested cassava in wet grounds, after covering with saw-dust; this can only be a short-term measure.
- Processing of cassava is the best strategy

PROCESSING AT VILLAGE-LEVEL

Processing increases the availability of quality food, along with opportunities for the producers to generate more income, since processing by its very nature is value- addition.

1. Current Situation

Presently, Uganda processes only one percent of its agricultural produce and the value of cassava processed is much lower. This indicates that there is a vast potential for agro-based industries.

In order to penetrate new markets, and sustain old ones, it is necessary to develop quality-products that appeal and satisfy the buyers' needs. This can be done by simple appropriate technology equipment. At present,

- Not much value-addition is done to cassava i.e. it is not processed and is consumed virtually in its primary condition
- Perishable farm produce are wasted or sold at give away price due to inadequate post-harvest facilities and lack of effective processing or preservation techniques.

Processing includes primary processing (peeling) and secondary processing (product development and value addition).

2. Peeling and Fermentation

The tubers are peeled almost immediately. This removes half of the gluco-cyanide.

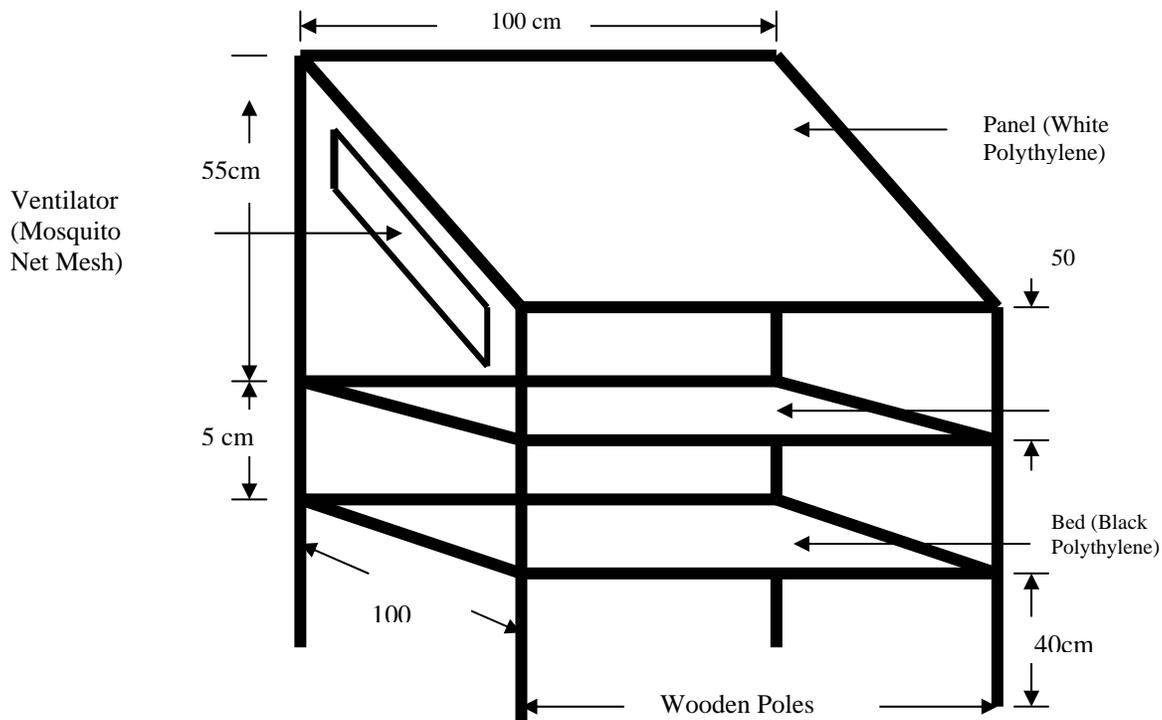
Fermentation has played a role for many years. It is the process used for marketed products, such as "gari" and "fufu". Usually, cassava may be fermented by immersing it in water. This process plays an important role in nutrient enrichment, because the non-protein nitrogen may be converted into protein.

3. Drying

Cassava roots contain 61% of water, coupled with cyanide. During the drying process, there will be breakdown of cyanide. Drying can be carried out by traditional means, such as direct sun-drying or improved means, such as use of a solar dryer.

- Traditional drying:* Peeled cassava is put on the ground to dry under the sun; this leads to inclusion of many non-palatable materials like stones. A product dried in this way is not suitable for further processing, due to variation in quality.
- Improved methods e.g. using a solar dryer:* An improvement in drying can be attained by using a simple solar dryer shown below. A cabinet is used for drying the cassava. The drier is simple in design and does not require electricity. It can be fabricated from very simple materials, such as wood and polyethelene sheeting.
- Functions of Parts of the Solar Dries*

Panel: Constructed using polythylene (white). Must be inclined at a small angle and should face the east for better results.



Note: All the vertical surfaces are constructed using white polythene

Figure - 1: Diagram of Solar Dryer (in cm not to scale)

- Ventilator: Constructed, using the mosquito net mesh. It allows moisture to escape.
- Drying Chamber: Consists of a tray constructed of the mosquito-net mesh. Note that the tray is portable, hence the material can be easily put into or removed from the chamber.
- Bed: Constructed using polythene (black). It absorbs radiant energy from the sun and radiates the energy to effect the drying.
- Wooden Poles: Provides the framework.

Table - 2: Benefits of Using Improved Drying-Techniques, as Compared to the Traditional Drying Method

Traditional Drying Method	Improved Drying, Using the Solar Dryer
Cassava may get mouldy, thus affecting its quality	Quality of the product does not deteriorate, lose colour or texture
Loss through birds and animals	Loss does not usually occur, because the cassava is protected
Nutritive loss is higher e.g. Vitamin C	Nutritive loss is reduced
No uniform drying	Uniform
Cumbersome and time consuming	Less time consuming, less cumbersome
High possibility of foreign matter contamination	Reduced contamination

4. Milling or Grinding

Dried cassava is ground to make cassava flour. A number of products can then be made from this flour, such as:

- Pasta
- Cassava-flour rock buns

- Sponge cake
- Short-bread biscuits
- Cassava bread
- Meat balls
- Meat chops
- Samosas

However, there are constraints such as:

- Processing is expensive in terms of both labour and running costs, as even the equipment recommended in this paper would require some form of investment from the farmer.

So, farmers should form unions associations so as to pool their resources to:

- Provide better transport and
- Buy better farming equipment;
- Eventually, build their own processing facilities.

In this way, they will improve their economic status because of better farming and value added to their products.

CONCLUSIONS

Major Advantages of Processing Technologies

- Minimise post-harvest losses
- Extend the shelf-life of food-produce, thus increasing food security
- Stabilise prices of raw materials during peak season
- Good returns to farmers
- Provide employment-opportunities
- Promote economic growth of the community
- Provides food of uniform quality, on a large scale
- To meet the food requirements, particularly in inaccessible areas
- To create new products of increased appeal and added value
- To provide nutritive value
- To promote the establishment and expansion of appropriate industries.

Food processing is quite restricted in most developing countries due to lack of knowledge and skills in modern and affordable processing methods. Other hindering factors are the difficulty to access funds, selection of suitable equipment and tools and technical support services. In most cases, the rural population has access to plenty of carbohydrates but is lacking animal protein in the diet.

Meat in many areas is considered a very expensive commodity in rural areas, not only in Uganda but in many developing countries, and annual per-capita consumption is below 4 kg. By mixing meat with other non-meat ingredients such as cassava, sweet potatoes, onions and other high-value but all the same lower costs, processed products can be obtained.

The products targeted are mainly fresh processed meat products, which can be processed at village-level, using simple equipment, most of it manually operated. This makes the production largely independent from expensive electrical power, thus cutting down on costs.

The processed products should be affordable by rural population. This can be achieved by incorporating non-meat ingredients, available in the locality, like cassava. This would contribute to marketability of local agricultural produce.

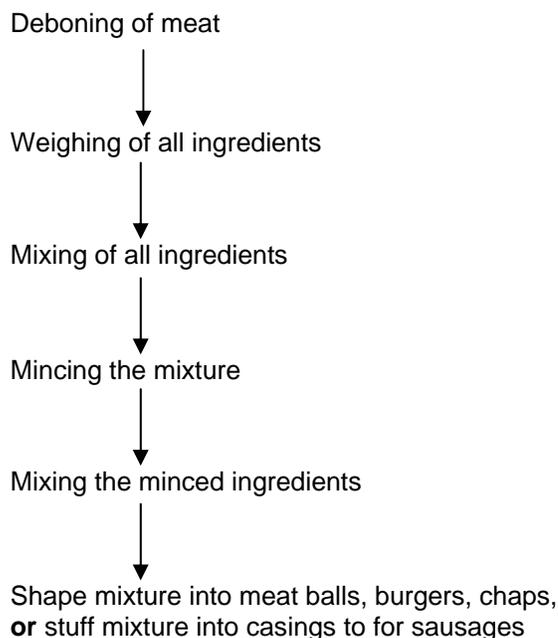
The generation of natural packing material, such as casings (for sausages) from intestines of slaughtered

animals and the use of common spices, which can actually be grown in home gardens, avoids such expensive importation, thus cutting down on costs.

The Most Common Ingredients for such a Product are:

- Type of meat (beef, goats, sheep, pork, chicken, fish)
- Cassava (fresh and peeled or as flour or rush)
- Sweet potatoes (fresh and peeled or as starch)
- Onions (fresh and peeled or cooked)
- Green pepper
- Curry powder
- Common salt

The Process of Manufacturing Involves:



Potential therefore exists in the processing of cassava at grass-roots into value-added products by addition to high-value products like meat and fish. However, the following issues must be addressed. These include:

- Improved post-harvest handling techniques e.g. solar drying
- Improved storage facilities
- Better transport
- Making good-quality products that appeal to consumers
- Farmers could form strong farmer-associations, which will assist the farmers to keep the business at the “ roots”
- By products of the cassava, processing can be used as organic manure.

BIBLIOGRAPHY

- European Commission, Research Directorate Confirming *the International Role of Community Research*
- National Environment Management Authority, *State of the Environment*