

South Africa's trade balance: The potential for food and feed extrusion

By Prof LJ Grobler and Dr Christo Joubert

An opportunity ideally suited to Africa may emerge through the agro-processing technique of extrusion, to help alleviate increasing poverty and support food security.

South Africa is a net importer of products such as wheat and rice, although the country's trade balance for primary agricultural products is still positive. However, it has a negative trade balance for several processed products such as soya bean oilcake, soya bean oil, palm oil, processed cereal products, and others. If some of these products could be manufactured in South Africa, it would substitute imports, meaning better economic growth and lower unemployment.

Several of these processed products can be manufactured with a technique called extrusion, which is a technology with huge

potential, especially since the demand for extruded ready-to-eat products is growing in Africa, and therefore also the potential for exports of the equipment and manufactured products.

Agro-processing technique

Extrusion is a continuous agro-processing technique used to produce pre-cooked or ready-to-eat products made from mainly agricultural grains and pulses. The process adds value to cereal, oilseeds and legumes.

The technology forms the heart of the integrated value chain, from the production of agricultural products by farmers through agro-processing with extrusion to finished beneficiated pre-cooked or ready-to-eat products for the consumer market. The technology therefore creates jobs, in contrast to most other technologies that replace jobs.

The process entails the flow of ingredients under pressure, with food or feed ingredients the final product. This is done with a combination of moisture, pressure, temperature and

mechanical shearing. Extrusion changes the characteristics of the underlying products through texture alteration, thermal treatment, partial dehydration, homogenisation, protein denaturing, gelatinisation, grinding, hydration, expansion, shearing, mixing, destruction of micro-organisation, destruction of some toxic compounds and shaping.

Built in Africa for Africa

The North West University in Potchefstroom started an extrusion development research project in 1998. The aim of the project was to develop and manufacture local twin-screw extruders for the food, feed, plastics and polymer processing industries.

The extruders were developed and commercialised successfully, which resulted in the establishment of CFAM Technologies (Pty) Ltd, a North West University spin-off company, in 2007. Today CFAM's extruders and other processing technologies have earned a reputation as 'built in Africa for Africa'.

Development and marketing

There are opportunities in the market for the development and marketing of extruded food products. The potential of using extrusion to add value to agricultural raw materials is largely untapped in Africa, but the demand for ready-to-eat, stable and nutritious food exists and is growing. This is mainly due to the short preparation time, ease of consumption, new tastes and nutritious content of these types of food.

This demand can be met by producing extruded food – using extrusion processing technology to add value to local raw ingredients while providing for the growth of food security in South Africa.

Useful in several areas

- The flexibility and wide range of applications of extrusion in food



A typical extrusion plant.

production make extrusion technology ideal for producers who want to add value to raw materials or otherwise wasted materials.

- Extrusion technology that is used as a 'ready-to-eat' cooking process is particularly suitable for Africa, as it is relatively inexpensive, energy-efficient and produces long-lasting food.
- It is also environmentally friendly as it produces minimal waste products.
- Extrusion technology can be applied in different environments and can process a variety of unique products using one machine. Generally underutilised ingredients can therefore be used before they go to waste.

The size and layout of extrusion plants depends on the required production rates and type of products to be produced. The capacities can vary from 100kg to ten tons per hour.

A unique opportunity

The need exists for the medium-scale manufacturing and distribution of affordable, protein-enriched, long-lasting maize, soya, legume, pulse and grain food products for local and regional markets, using locally designed and manufactured twin-screw extrusion equipment.

Faced with increasing poverty and the need for food security in South Africa and Southern Africa, affordable, highly nutritious and long-lasting food sources serve to tackle this challenge.



Extruded wholegrain white maize.

The National Development Plan recognises food security as a high priority. This strategy was implemented through financial backing given to the North West

University to develop food extrusion technologies.

The developed twin-screw extrusion technology enables the following:

- Processing of protein-enriched maize and/or soya snacks.
- Fully balanced porridges made with maize, soya, grains, legumes and pulses.
- Wheat-free breakfast cereals.
- Lower-cost equipment.
- Smaller and more compact plants.
- Flexible product mix, while still economical.
- South African developed and supported equipment and recipes.

An established integrated extrusion value chain will provide the following social, health, environmental and economic benefits:

- High and balanced protein content product for everyone, including the poor.
- The potential to create job opportunities in the formal and informal sectors and BEE businesses.
- Low effluent and waste, and non-hazardous waste.
- The use of semi-skilled operators and labourers.
- Ease of operation with fail-safe procedures for less qualified operators.
- Low-cost, yet high-precision equipment and engineering.
- Quick changeover time between various products.
- Easy to clean.
- Low maintenance requirements and fast repair times when necessary.
- Low operating costs.
- Small space requirements.

Twin-screw food extruders

The processing of maize, soya, grains, legumes and pulses into pre-cooked or ready-to-eat finished products is mostly done on imported single-screw and twin-screw extruders. However, protein ingredients are viscous and extremely difficult to process in single-screw machines.

CFAM Technologies (Pty) Ltd has developed and built a series of twin-screw extruders, which can easily process these hard-to-handle ingredients. This makes the processing of protein-enriched, pre-cooked or ready-to-eat maize, soya, legume, pulse and grain food products possible, while still affordable.

The locally developed extruders and plants enable smaller-scale manufacturing, which enables profitability on a regional scale by using existing distribution channels or even new BBBEE channels.

Value proposition

Extrusion processing of cereals is a well-known application; most breakfast cereals are products of extrusion. Several varieties are possible, namely:

- Variation of shapes.
- Variety of colours in the mix.
- Processing of various grains and legumes such as maize, sorghum or millet (*mahangu*), etc.
- Processing of oats and soya beans.
- Producing snacks.
- Recreating traditional meals such as porridge, a staple of the South African diet, or other traditional meals such as *oshifima* (porridge made from *mahangu*).

Extended shelf life

The demand for nutritious food with shelf stability that requires no specialised storage is well established in Africa. Two main extruded product types are doing well in the current consumer market: snacks and instant porridge products. The latter is made from various staple ingredients such as maize, oats, soya and wheat.

Considering the popularity of soya and maize, the following extruded products were identified as some of the potential products for production in various regions of South Africa:

- Maize snacks.
- Soya-maize snacks (protein enriched).
- Maize porridge.
- Soya-maize porridge (protein enriched).

Other products

There is a long list of other products that can be manufactured from extrusion, including infant food, pasta, croutons, couscous, pre-cooked reformed rice, viscosity control flour, textured protein (meat analogues/meat alternatives and meat extenders), and fish and pet food. 🌱

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