

Full Length Research Paper

The status of the agro-processing industry in Zimbabwe with particular reference to small- and medium-scale enterprises

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Accepted 13 July, 2011

The review examined what small and medium agro-processing systems require to effectively manufacture and market processed products; and analysed agro-processing service provision, and research and extension linkages in Zimbabwe. The number of agro-processors has increased, creating employment opportunities, but the prevailing economic environment tend to favour growth of medium-scale enterprises by down-sizing of large-scale processing systems and upgrading of small-scale processing enterprises. There are well-established skills training programmes in manufacturing, targeted at rural artisans. However, the agro-processing sector currently faces many challenges including access to finances, limited research, technical advice, market information, lack of reliable markets and general institutional decline. Equipment ownership mechanisms have been left to evolve without adequate technical advice and support. Equipment costs are unaffordable to individuals, technology access rather than ownership is more favourable. Many large-scale processors are subcontracting medium-scale processors who meet the required standards, to supply them with processed products for packing, labelling and marketing. There is hidden agro-processing information and expertise among technocrats, deliberately kept unpublished for commercial purposes. A review of this type requires good connectivity to be able to access relevant and up-to-date information.

Key words: Agro-processing industry, equipment, small and medium enterprises, Zimbabwe, service-milling.

INTRODUCTION

The national land redistribution under the resettlement models A1[‡] and A2[§] is expected to increase levels of agricultural production. Though the newly resettled farmers are currently battling to raise production amid lack of funding, agricultural inputs and commercial farming skills; given enough time there should be an

increase in productivity. Research has established that productivity increases exponentially with decrease in farm size in all natural regions of Zimbabwe (Elich, 2005).

With anticipated increase in agricultural production, there is need to have proportionate improvement in the agro-processing industry. Agro-processing industries refer to those activities that transform agricultural commodities into different forms that improve handling, increase shelf-life and add value to the product. Agro-processing industries, especially food manufacturing, tobacco and textile processing dominate the commercial industrial sector of Zimbabwe. These are mainly owned by multinational conglomerate companies with interest in farm produce supplied by large-scale commercial farmers. For example, Cairns Foods Company Ltd. is the

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[‡] The A1 model has plots with 5-6 ha arable and in excess of 6 ha for grazing.

[§] The A2 model has farms ranging from 15 to 50 hectares in the peri-urban areas, 15 to 250 ha in Agro-ecological region 1 and 350 to 2000 ha in agro-ecological region V.

largest food processing company in Zimbabwe. The company requires a minimum of 100 tonnes of groundnuts per year for peanut butter processing and a small proportion of that is produced by small-scale farmers, and the company's demand for potatoes and fruits is largely met by large-scale commercial growers (Acquah, 1997). At present, the small-scale farmers are not organised or prepared to produce for such large-scale processing companies. However, they are for other commodities such as cotton through the Cotton Company of Zimbabwe (CottCo).

Small-scale farming in Zimbabwe rarely provides sufficient means of survival in many rural areas. It is therefore imperative to explore alternative income generating opportunities to support poor families who cannot fend for themselves from the land-based activities alone. Research demonstrates that rural households depend on a diverse portfolio of activities and income sources (Shackleton et al., 2000). Agro-processing activities can contribute to sustainable livelihoods through improved incomes, employment, food availability, nutrition and social and cultural well-being from a limited area of land (Simalenga, 1996; Proctor et al., 2000; Azama-Ali, undated).

Small-scale food processing activities represent a potential source of livelihood for many poor people in sub-Saharan Africa.

The overall potential of agro-processing is huge as it can:

1. Increase the value of crops of poor farmers and thus yielding higher returns;
2. Expand marketing opportunities;
3. Improve livelihoods of people;
4. Extend shelf-life of commodities;
5. Improve palatability of commodities;
6. Increase diversity of products;
7. Enhance food security by reducing food losses, increasing availability and improving access to food;
8. Overcome seasonality and perishability constraints; and
9. Empower women who are often more involved in agro-processing than men.

In sub-Saharan Africa, it is estimated that 60% of the labour force find part of its work in small-scale food processing enterprises and the majority of these, are women (ITDG, 2005). The greatest potential growth in small-scale agro-industries is in fruit and vegetable processing as many horticultural producers experience problems in marketing of fresh produce. The major limitations faced by fruit and vegetable farmers include lack of: readily available marketing information; market integration; data on supply and demand trends; and data on price trends, reliance on spot or road-side markets, transport constraints and spoilage (Boyd et al., 1997; Mhazo et al., 2003). Adoption of improved and validated food processing technologies, enforcement of good standards of quality and hygiene and regulatory instruments

may assist local small- and medium-scale agro-industries to compete favourably in the market place. Small to medium-scale enterprises are those organisations with a total fixed capital base, excluding land that does not exceed US\$66, 667 and employ not more than 75 permanent employees (Small Enterprise Development Corporation, Zimbabwe; personal communication). However, research has shown that a number of factors may constrain the ability of small- and medium-scale agro-based enterprises to effectively manufacture and market processed food products.

1. On a macro level, many policies implemented by governments have served to hinder the development of small-scale industries (Dawson, 1994; Simalenga, 1996).
2. At the firm level, limited access to credit; limited access to foreign currency (Nazare, 2005); lack of appropriate technologies (McPherson, 1991; Mugova, 1996); lack of technological capability; the unreliable supply of raw materials (Mosha, 1983); lack of management skills (Odufa, 1995); poor product quality control (Jaffee, 1993); and poor markets, amongst other things, have constrained the development of small-scale industries.

These problems apply to many sub-Saharan countries and particularly Zimbabwe. The purpose of the current review was to develop and present a detailed and clear picture of what the present agro-processing systems in Zimbabwe require to effectively manufacture and market processed food products; with particular reference to small- and medium-scale enterprises. The main focal areas included service provision, linkages with research and extension, demand-led services, agro-processing technologies, farmer empowerment, policy implementation, gender issues and government vision. Figure 1 indicates locations of the major agro-processing activities discussed in the study.

Agro-processing definitions

Agro-processing could be defined as a set of techno-economic activities carried out on an agricultural commodity for the purposes of making it usable as food, feed, fibre, fuel or industrial raw material. The agro-processing value chain encompasses all subsequent operations after the stage of harvest till the produce reaches the final consumer in the desired form, packaging, quantity, quality and price. Such activities comprise two major categories; primary and secondary processing operations.

Primary processing operations

This involves activities such as crop drying, shelling/threshing, cleaning, grading, and packaging. These activities are mainly carried out at the farm and only

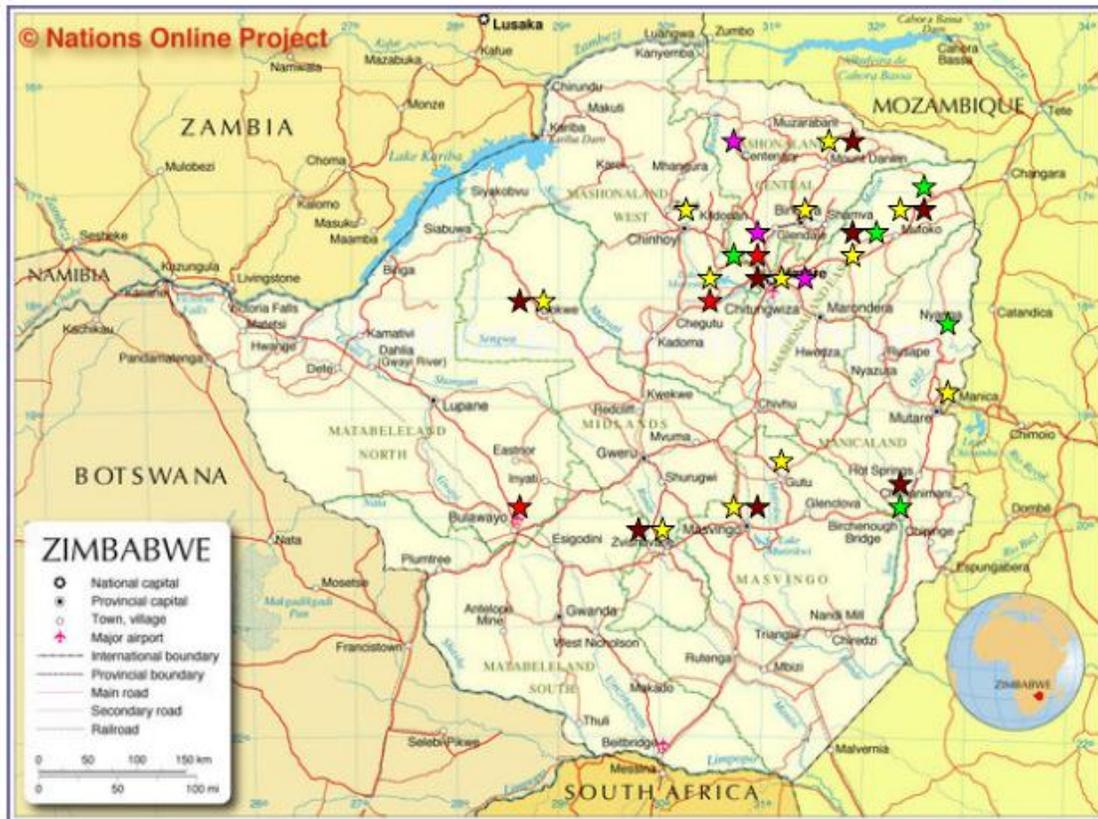


Figure 1. A road map of Zimbabwe showing the network of agro-processors and agro-processing equipment manufacturers, ★ agro-processing equipment manufacturers ★ sunflower oil processors ★ peanut butter processors ★ fruit juice processors ★ dried fruits and vegetables processors.

transform the commodity into a slightly different form prior to storage, marketing or further processing.

Secondary processing operations

This entail increasing nutritional or market value of the commodity and the physical form or appearance of the commodity is often totally changed from the original. Some examples of secondary processing are milling grain into flour, grinding groundnuts into peanut butter, pressing oil out of vegetable seeds, pressing juice out of fruit, and making cheese out of milk. Depending on type of commodity, equipment needed for primary processing is completely different from that used in secondary processing or major adjustments/modifications need to be done to suit either.

Agro-processing equipment supply chain

Historically, formal manufacturing, distribution and sales of agro-processing equipment have been a preserve of conglomerate companies. Processing systems were split

into manual tools and machines for small-scale users (mainly for smallholder farmers) and motorised equipment for medium- to large-scale processors. Since the mid 1990s, many new small- to medium-scale formal and informal manufacturers entered the market resulting in a dramatic increase in medium-scale motorised systems for processing food crops. It is now possible at medium-scale level to process cereals into various flours and stock feeds, groundnuts into peanut butter, sunflower, cotton and soybeans into edible oil and fruits and vegetables into jams, pulps, juices, pastes, sauces, pickles, and confectionery products.

The major manufacturers of primary processing equipment in Zimbabwe are presented in Table 1. The range of processing equipment is limited to manual and motorised shellers/threshers for cereals and pulses. The major consumers of primary processing equipment are individual farmers or farmer groups and private contractors. Most of the manufacturing activities are located in Harare, Norton and Bulawayo, with distribution networks in the major cities, towns and growth points or Rural Service Centres (RSCs). The local industries have the capacity to manufacture complete shellers/threshers. However, for motorised equipment, the sources of power (electric motors

Table 1. The major formal manufacturers and distributors of primary and secondary processing equipment in Zimbabwe.

Company	Location	Retail outlets	Product range and power source	Product sourcing
Appropriate Technology Africa	Harare	Harare, Mutare	Vegetable oil mills, cereal grinding mills, dehullers, manual and motorised peanut butter mills, motorised juice extractor.	In-house manufacturing and importation
G. North and Son	Harare	Harare	Manual and motorised shellers, threshers; winnowers.	In-house manufacturing
Hastt Zimbabwe	Norton	Harare, Norton	Tractor PTO-driven crop shellers and threshers.	In-house manufacturing
Institute of Agricultural Engineering	Harare	Harare	Multi-crop threshers, Manual groundnut shellers, cereal grinding mills, dehullers, motorised peanut butter mills,	In-house manufacturing
Practical Action*	Harare	Harare, Bulawayo, Mutare	Manual and motorised shellers, threshers, vegetable oil mills, cereal grinding mills, manual and motorised peanut butter mills.	In-house manufacturing
Precision Grinders	Harare	Harare	Motorised/PTO-driven multi-crop threshers, manual shellers, cereal grinding mills, dehullers, manual and motorised peanut butter mills, mixers.	In-house manufacturing and importation
Renox	Harare	Harare	Vegetable oil mills, cereal grinding mills, dehullers, peanut butter mills.	In-house manufacturing
Stainless Steel Products	Harare	Harare, Bulawayo	Industrial pots, steam pots, pasteurizers, meat mincers, sausage makers, blenders, bakery ovens, potato chippers and peelers, mixers.	In-house manufacturing and importation
Tanroy Engineering	Harare	Harare, Mutare, Bulawayo	Manual groundnut shellers with winnower; motorised multi-crop shellers and threshers, vegetable oil mills, cereal grinding mills, dehullers, groundnut roasters, manual and motorised peanut butter mills, cassava and sweet potato chippers.	In-house manufacturing
Zimbabwe Oil Press Project (ZOPP)	Harare	Harare, Rusape, Mutare	Manual groundnut shellers, Vegetable oil mills, groundnut roasters, Manual and motorised peanut butter mills.	Subcontracting the informal manufacturers
Zimplot Ltd.	Bulawayo	Harare, Bulawayo	Manual groundnut shellers.	In-house manufacturing

*formerly Intermediate Technology Development Group (ITDG).

and engines) have to be imported from South Africa and/or Asia. This obviously has a negative bearing on the availability and final cost of motorised equipment. Thus, it becomes more economic for the processors who cannot afford the full equipment cost to access the technology through service provision rather than ownership of the hardware.

The growth of secondary agro-processing in Zimbabwe

is quite evident in the rapid rise in numbers of equipment manufacturing companies (Table 1), dramatic increase in processing enterprises and the widespread availability of various processed foods on both the formal and informal market. Growth has been greater in the small- and medium-scale enterprises than the large-scale sector. There is clear evidence of widespread activities in manufacturing of cereal flour, peanut butter, soyabean

products and animal feeds as indicated by the increased number of manufacturers of related equipment. This development should in theory lead to a wider choice of equipment and a level of competition that would benefit the consumers (Nazare, 2005). However, while there are many players in the manufacturing sector, there are challenges hindering growth; limitations in research and development, reluctance of local engineers to share information and expertise leading to limited variety of equipment designs on the market. Most of the manufacturing companies rely heavily on procuring equipment and/or components of equipment from South Africa or Asia as well as the local formal and informal importers. This approach may result in poor equipment quality control and limited consumer choice. Ultimately, there are also costs associated with fixing poor quality machines when they break down. Nonetheless, the positive side of it is that it reduces the cost of tooling for individual manufacturers, may guarantee interchangeability of spares among equipment from different manufacturers and creates employment for the locals.

Research and development

Development of agro-processing equipment has not received the level of research support it deserves. There are limited and isolated research efforts in the private sector. In the public sector, budgets for research and development have been cut down drastically and furthermore there is a critical shortage of qualified research staff to carry out the work due to the "brain drain" experienced in the last eight years. However, considerable research in the development of crop shellers, threshers, vegetable oil mills, peanut butter mills and crop dryers has been conducted by the Ministry of Agriculture, Mechanisation and Irrigation Development (MAMID) through the Institute of Agricultural Engineering, the University of Zimbabwe (UZ) and ENDA Zimbabwe, a local non-governmental organisation, since 1990. Useful research results have been generated but extension of the results to the private sector (manufacturers) and farmers has generally been poor. Researchers and technocrats tend to hide information and expertise among themselves and deliberately keep research findings unpublished for their own commercial purposes. Extension of mechanisation information or technical advice has generally been lagging behind as there are very few grass root level-based staff as in the case with veterinary and agricultural extension. This further compromises access to agro-processing technologies.

UZ usually works in partnership with the private sector in equipment manufacturing. Transfer of technologies to end-users is facilitated by the linkages that exist between the university, the public sector and NGOs. Involvement of university students in various research activities also helps in the dissemination of research results. The development and extension of the peanut butter

technology has been a major success story for the Development Technology Centre (DTC), a research and extension unit at the UZ. Technology manufacturing and marketing is now fully market-driven. However, issues surrounding intellectual property rights and patenting have not yet been addressed. Many a time, technology generated by academic or public sector research organisations ends up being used for commercial purposes without due recognition of the people involved in knowledge development.

There is no evidence of real budgets for research and development in the private sector save for Precision Grinders, Hastt Zimbabwe and Practical Action that have established in-house research and development divisions. Others depend on technology importation (plus adaptations) of research results from local work.

Extension and training

Training in agro-processing is at three levels; manufacturers, distributors and end-users who are either farmers or entrepreneurs. Training in manufacturing techniques is not a limitation in Zimbabwe. Training of artisans (tool makers, welders, fitter and turners, sheet metal workers etc) is well established and of high standard. Training Institutions such as Silveira House, Glen Forest Training Centre, Hlekweni Friends, the Institute of Agricultural Engineering of MAMID offer training in blacksmithing targeted at rural artisans. Rural blacksmiths carry out minor repairs on equipment at local level. However, most of these institutions are operating below normal capacity due to financial constraints and/or high staff turn-over.

There is very limited training offered to distributors as basic knowledge about the operations of equipment is frequently missing at points of sale. This is often exacerbated by lack of operator's manuals on some products. Where attempts are made to provide manuals, they sometimes lack necessary assembling and troubleshooting details.

Very few small- and medium-scale agro-processors have received formal training in food processing techniques. Most of the formal training support for small-scale food processors has been provided by Ranche House College with funds provided under a Dutch-funded programme called "Food Processing as a Small Business" (Mhazo et al., 2003). The training included solar drying of fruits and vegetables, technical and business skills, and entrepreneurship and financial access and management.

MAMID has a mandate to disseminate research outputs to farmers and other clients via the Department of Mechanisation which is represented at provincial level and more recently, in some districts. However, coverage at ground level is not as good as the Department of Agricultural, Technical and Extension Services (AGRITEX)

which is responsible for the conventional agricultural extension. Most Department of Mechanisation Staff have generally failed to keep abreast of current technology development trends in agro-processing and their capacity to provide technical, training and advisory services is limited.

Private sector manufacturers have their own marketing and extension strategies driven mainly by their own staff particularly at fora such as agricultural shows (at various levels) and the Zimbabwe International Trade Fairs. Training for end-users is provided in a number of ways comprising short duration demonstrations offered by sales personnel, formal and informal skills training and technical training offered during installation and commissioning of equipment.

Constraints in the agro-processing industry

Growth of the agro-processing industry in Zimbabwe is hampered by various constraints that range from equipment supply to problems faced by consumers of the technologies.

In the manufacturing sector, progress is limited by:

1. Difficulties in accessing foreign currency to import machinery;
2. Reduced demand for equipment as most clients fail to mobilize resources to acquire equipment;
3. Limited transfer of technology from research to manufacturing;
4. Limited access to working capital;
5. High duty, tax on imported raw material and spares: In some cases the government policies on duty and taxes charged on imported equipment discourage local manufacturing. For example industrialists are charged value added tax (VAT) on imported materials used in the manufacturing process yet the finished piece of equipment is sold without VAT making it impossible to recover costs. The manufacturers get frustrated when they pay high duty and taxes on raw materials while the competing finished products are imported at low duty; and
6. The manufacturing sector has also been characterised by poor quality products, especially from the informal sector, as the enforcement of standards has not been effective. The prevalence of substandard equipment on the market at times forces the government to create conditions for importation of high quality products to protect the consumers.

Agro-processors face numerous constraints including:

1. Poor equipment back-up service rendered by dealers;
2. Shortages and high cost of equipment and spares;
3. Limited access to information from extension services;
4. Limited access to appropriate packaging material for processed products;
5. Lack of marketing skills;

6. Inadequate support services from training institutions, private sector consultants, small enterprise advisors, research institutions and engineering workshops;
7. Erratic supply of power due to frequent electricity cuts;
8. Unreliable supply of raw materials, reduced demand for processed food products;
9. Poor cash flow emanating from low volumes of raw materials hence low income is realised from processing;
10. Failure to meet food processing regulations pertaining to food safety and hygiene practices which need to be adhered to in the industry. Attention to hygiene and basic food safety procedures is limited among informal enterprises. Knowledge of specific regulations and legislation governing food safety and hygiene issues is only evident among those processors who market their product through formal outlets. The required costs of meeting the Standard Association of Zimbabwe regulations are viewed by the more informal processors as prohibitive (Mhazo et al., 2003);
11. High cost of processing equipment;
12. Lack of warehousing space
13. Limited capacity to mobilise capital for equipment purchase and working capital.

Constraints faced by farmers (producers of raw material) include:

1. Frequent droughts resulting in crop failure;
2. High costs of production inputs (seed, fertilizer, chemicals etc.) resulting in a decline in the levels of production hence shortages of raw material. This factor together with the preceding one could have a compound effect;
3. Lack of funding and unfavourable borrowing conditions;
4. Lack of commercial farming skills; and
5. Lack of marketing skills and market information.

Opportunities in the agro-processing industry

Agro-processing opportunities in Zimbabwe currently tend to favour growth and development of medium-scale processing industries that match the current production levels and the distortions in marketing of produce. The prevailing economic environment favour more down-sizing of large-scale processing systems and upgrading small-scale processing industries. This is mainly due to the fact that the demand for raw materials by large-scale manufacturers is currently not being met due to low national production levels hence the enterprises are operating below capacity. This has resulted in scaling down of business, massive staff retrenchments and/or closure of factories. For example, one company in Harare sold their peanut butter business (equipment and franchise) to a medium-scale processor. Some large-scale operators contemplate sub-contracting small and

medium processors who can meet their set standards. The contractor would provide packaging materials and take responsibilities for packaging, transporting and marketing the product. This arrangement shifts raw material sourcing and processing risks away from the large-scale processor. This also reduces the contractor's overheads.

Small-scale enterprises, which are characterised by use of manual equipment, are losing business to the medium-scale as the latter use motorised equipment which have advantages of both higher capacity and efficiency. Manual equipment is either abandoned or upgraded to match the demand. Examples are: (i) the rapid obsolescence of manual sunflower oil presses in the 1990s following the importation of motorised multi-crop oil expellers from Asia and (ii) the current requests by peanut butter processors to upgrade manual mills by installing motors. Small-scale processors who cannot afford to improve their processing systems are likely to be pushed out of business.

The merits and demerits of the development and expansion of medium-scale enterprises are summarised in Table 2. Generally, it appears that currently, there are more merits than demerits in going for the medium-scale enterprises. There is great potential in the development of medium-scale grain milling, bread-making enterprises, livestock feed manufacturing, peanut butter and vegetable oil processing as opportunities for market entry by medium-scale entrepreneurs increase. Fruit and vegetable processing and preservation offer a new viable opportunity though more effort needs to be put into product promotion and marketing. For example Lamin and Son in Nyanga district started processing a wide range of fruits as a pastime but later expanded into a medium-scale factory capable of producing half a tonne of dried products per day for both domestic and export markets (Acquah, 1997). There are widespread shortages of fruits and vegetables in the drier parts of the country yet during peak production periods there is a glut and large amounts of fresh produce are wasted in the wetter parts of the country. Fruits can be processed into pulps/juices, wine, jams, jelly, marmalade, pickles, dried products and confectionery items. Small- and medium-scale agro-processing industries at Rural Service Centres (RSCs) are strategically located to take advantage of both raw material and local markets. The dominant activities in RSCs are cereal milling, peanut butter milling, and vegetable oil processing. Some typical specifications for rural oil seed processing plants are given in Table 3. Locating the oilseed plants within the same vicinity as a cereal grinding mill allows a wider variety of processed products to be produced such as livestock feed.

Table 4 provides an indication of viability levels for the various oilseed processing enterprises at a typical RSC in Zimbabwe.

Service oil processing is the simplest operational system offering the following benefits:

1. The enterprise does not have to mobilise capital for procurement of raw materials,
2. There is no need for raw materials and processed products storage space,
3. Storage management skills are not required,
4. There is no requirement to procure packaging materials with the corresponding capital needs,
5. The entrepreneur does not have to market the processed products,
- 6 Working capital requirements are limited to repairs and maintenance, power and communications costs, salaries and rentals/rates.

The option of sunflower seed procurement, processing and product packaging is marginally viable under the prevailing economic environment. The soya bean processing option will realise higher margins than sunflower seed processing mainly because of the higher value of soya meal.

There are also opportunities for fruit and vegetable drying, canning, bottling, juicing and freezing in the RSCs (Price Water House, 1994). Equipment required for small-scale fruit processing is based on the usual home kitchen gadgets including stoves, pots, knives and spoons which are widely available in hardware shops around the country. For medium-scale enterprises, more specialised equipment such as stainless steel industrial boilers, pulpers, pasteurizers and canning machines become necessary. These are available in Zimbabwe from Stainless Steel Industries and Ag-Venture respectively. The Development Technology Centre of the University of Zimbabwe reported limited awareness of the Zimbabwean market to dried fruit products as a constraint to the uptake of solar dryers (Nazare, 2005).

One less developed area that is not normally addressed in post-harvest discussions is that of processing of meat, mopani worms, fish and non-food products such as hides and skins for preservation and value addition. As costs of commercial meat products increase, consumers turn to informal sources of beef, chicken, pork and fish. Small to medium-scale handling, processing and packaging of meat into value added products such as sausages and dried meat deserve greater attention. Meat mincers and sausage makers are available in the country. Slaughtering of the animals is predominantly manual using axes and knives. Mechanized plucking machines for removing chicken feathers are known to exist but are rarely used at small- and medium-scale. Mopani worms (*Imbrassia belina*) are a seasonal delicacy in Zimbabwean diets and Gondo et al. (2010) provided evidence of commercialisation potential based on export opportunities worth millions of United States dollars to South Africa, Botswana, Zambia and the Democratic Republic of the Congo. However, extended utilisation of this resource is inhibited by lack of appropriate processing technologies for harvesting, de-gutting, drying, seasoning, packaging and storage leading to failure to expand marketing opportunities as product quality rapidly deteriorates and shelf-

Table 2. Summary of merits and demerits of the medium-scale agro-processing enterprises.

Merit	Demerit
Empowerment of women's clubs through increased throughput, as women tend to work in groups.	Disempowerment of individual women who were into manual processing, through loss of small business opportunities.
Decentralisation of industries resulting in employment creation	-
Improved adherence to manufacturing regulations and standardisation of equipment.	-
Provision of service processing facilities and relieving small-scale processors of the burden of equipment operation and maintenance	Rapid obsolescence of manual equipment leading to loss of capital investment.
Improved chances of standardisation of equipment.	-
Improved planning and time management by clients who would otherwise budget time for processing activities if they were to use manual methods.	Loss of business by large-scale processors, scaling down of operations, massive retrenchments, closure of factories.
The poor may be able to access custom processing as even small quantities can still be service-processed for household consumption without investing into the processing equipment.	Loss of business by small-scale processors.
Creation of local markets for producers of raw material which could stimulate local production.	-
Higher chances of formalisation of businesses and competition among processors which could lead to improved revenue to central government and reduced prices for consumers respectively.	-

- = none.

Table 3. Oil seed equipment, power and performance specifications.

Oilseed	Processed products and byproducts	Processing capacity* (kg/h)	Power specification	Equipment model
Sunflower seed	Sunflower Oil, sunflower cake, sludge	200	380 V (three phase)	Screw press 100YCL,
Soya beans	Soya oil, soya meal	200	380 V (three phase)	Screw press 100YCL
Soya beans groundnuts	Roasted soya beans or Roasted nuts	40	Manual	Wood fired roaster
Groundnuts	Peanut butter	20	220 V (single phase)	Bucket mill (2-2.5 kW)

life is reduced (Gondo et al., 2010).

Small- to medium-scale leather tanning technologies are available and their economic viability has been demonstrated by DTC. Development of the hides and skins sector has been hampered by low quantities collected and low quality of hides, skins and leather. In Zimbabwe, Practical Action have refurbished slaughtering shades and pitched hoist frames coupled with training to show that flaying animals in an upright position ensures proper bleeding of the animal

which minimises clotting of blood in the veins of the hide. Blood clotting in the veins should be avoided as the patterns of veins remain visible after tanning resulting in low quality finished leather (Anonymous, 2007). There is dire need to explore possibilities of up-scaling small leather industries in light of the radical changes that have taken place in the footwear and general leather goods sector where there is a critical shortage of leather. There is also need to expand the scope of small- to medium-scale agro-processing to include

timber products and medicinal plants though it may be argued that these should be regarded as more inclined towards the area of natural resources.

Common utilities such as roads/rail, power, water and communication are vital to the development of industries in both rural and urban areas. Most of these are well-developed in Zimbabwe. However, electricity which is an important utility in agro-processing and rural engineering is not yet readily available in most rural areas despite the

Table 4. Viability levels for agro-processing business options.

	Peanut butter service milling	Peanut butter production and retailing business	Sunflower oil service pressing	Sunflower oil processing and retailing business	Soya bean oil processing and retailing business
Processing rate (kg/month)*	3000	3000	25000	15000	15000
Break even tonnage (kg)	1000	560	9000	9000	3000
Monthly net margin (US\$)	608	3407	1449	710	2696
Total processing capacity/machine (kg)	4200	4200	40000	40000	40000

*Assuming an 8h working day for 6 days per week.

GoZ-driven accelerated rural electrification programme currently underway.

Even where electricity is available, frequent power cuts threatens the viability of rural industries. The country is currently working on a number of local projects to supplement imported electrical energy so as to reach more rural people. These include rehabilitation and installation of new thermal power stations, promotion of solar electricity systems; and promotion of *Jatropha* production for biofuel. The biofuel initiative is still at its infancy.

Specific cases of small- to medium-scale agro-processing enterprises in Zimbabwe

A sample of commodity-specific case studies of agro-processing enterprises is given in the following sections. The case studies were purposively selected to demonstrate and highlight the status of practice and the typical challenges encountered by players in the small to medium scale agro-processing industry. The sampled enterprises are also the most common in Zimbabwe.

Case 1: Processing of cereals

Cereal flours, especially from maize and sorghum are staple foods which have a high domestic demand (Fellows, 1997a). The processing entails cleaning and milling to flour and, in some cases, dehulling precedes milling. The hammer mill has revolutionised cereal processing into flour in both rural and urban areas. The technology can be easily combined with a dehuller to produce pearl flour preferred by most urban dwellers or to enhance palatability of small grains widely produced in the semi-arid areas of the country. The introduction of dehullers has been largely perceived as one intervention that can alleviate the drudgery women undergo when processing small grains using the traditional pestle and mortar to remove the bran followed by grinding on a

stone mill to produce the flour. Considering the HIV and AIDS pandemic prevalent in the country, and the general labour shortage in most rural areas, traditional processing of cereals, especially small grains, has become a formidable challenge.

With the erratic supply of fuel in some parts of the country, many people in rural areas have to walk up to 20 km to access grinding mills running on electricity instead of the more usual diesel. This is particularly problematic in areas not yet reached by the GoZs' rural electrification programme. Milling charges are comparatively higher on diesel-run grinding mills than those on electricity, which still forces rural dwellers to travel long distances to access the electrical mills. However, even these mills are also often down because of frequent and protracted power cuts, forcing customers to leave their grain for milling in absentia whenever electricity.

Case 2: Vegetable oil processing

Vegetable oil is highly valued throughout the world for cooking, as a source of energy and flavour providing, twice as much energy as the same quantity of carbohydrates (Azam-Ali et al., 2003). There have often been critical shortages of vegetable oil in Zimbabwe because the large scale oil processors have either downsized or closed down due to shortage of raw material and or due to the harsh economic environment; forcing consumers to rely on imports. The imported stock was often not affordable to large numbers of Zimbabwean families. Oil expression has mainly been from sunflower, cotton and soybean seeds using manual ram presses at the lowest level or motorised systems at the medium-scale level. Oil machines also produce a by-product (cake) which is used to make animal feed or other high value foods eg soy meal in the case of soyabeans.

Sunflower is a low management crop which can thrive under marginal conditions (AGRITEX, 1993), which can be grown by many rural households to supply rural

entrepreneurs. Another oilseed whose production is expanding rapidly despite the droughts is soyabean. The University of Zimbabwe and GoZ have made remarkable achievement in the promotion of soybean production in many smallholder farming areas of the country. However, processing soyabean into oil is not common as sunflower processing because further capital investment is required to preheat the soyabean before feeding it into the oil press. The oil processing enterprises are mostly run by small-scale entrepreneurs who do service-pressing and individual farmers who process their own oilseeds and sell the oil and the cake. The quality of the oil produced by these farmers and some of the entrepreneurs is of low quality. This is because there is limited knowledge/information on proper clarification of the crude oil from the oil machines. The oil filters which cost about US\$2,500 are beyond their reach.

In some parts of Zimbabwe, manual presses are still being used even though they are heavy and have poor oil extraction efficiency. One entrepreneur can own several ram presses operated by people specifically employed to press the seed and who are usually paid based on the quantity of oil produced. Mechanised oil expression is based on the Tiny Tech; a technology imported from Asia but now locally manufactured by several companies. Most entrepreneurs are located at RSCs and other smaller business centres. Of late there has been an increased import flow of oil press technologies from Asian countries into Zimbabwe through local dealers like Appropriate Technology Africa (ATA). However, no local technical evaluation of the performance of the machines and accessories has been done on the ground. The models of the motorised oilseed processing machines being imported have capacities ranging from 35 to 60 kg seed/h to 120 to 200kg/h depending on the type of oilseed, with power requirements of 7.5 hp to 15hp, respectively (ATA, personal communication).

Key challenges associated with this enterprise include:

1. Lack of back-up service and spare parts when these machines breakdown;
2. The spare parts may be available but lack standardisation, making it difficult to access the compatible parts. Rural entrepreneurs are forced to travel back to the original sources of the machines which are often located in the cities far from the business sites. This increases downtime of the machines;
3. Limited access to skills training for workers;
4. Shortage of raw material. There have been at least 5 successive drought seasons in the country which have significantly reduced crop production; this meant that sourcing of the pressing seed was an enormous challenge which required entrepreneurial innovation. In most cases, this forced farmers to concentrate on food security crops such as cereals;
5. Low management capacity of entrepreneurs; and
6. Inconsistent supply of raw materials which limit system

capacity utilisation.

The crop is high in protein and can be processed into numerous products which can significantly improve the livelihoods of rural people. Some examples include manufacture of soya mince meat, oil, soya milk, soya yoghurt, baby feeds, stock feeds. However, small- and medium-scale processing of soyabean is yet to be developed. For example, soyabean chemical oil extraction process, can only be recommended for large-scale processors because of the complexities of the procedures and the need for proper handling of solvents

Case 3: Peanut butter processing

Processing of groundnuts into peanut butter is an important household activity in both urban and rural areas of Zimbabwe. Peanut butter is used as a spread on bread, as an ingredient in soups or eaten as a snack and is an essential source of protein and fats in the diet of most Zimbabwean families. There is no need to add preservatives because heat produced during processing, destroys enzymes and microbial contaminants, and because of its relatively low moisture content, recontamination is inhibited (Fellows, 1997a). The traditional processing method of first pounding roasted nuts with a pestle and mortar then fine grinding on a stone mill is characterised by high labour input, low throughput (Mhazo et al., 2002) and is often viewed as unhygienic. The problems associated with food quality, safety and hygiene limit the appeal of traditionally processed peanut butter particularly to the formal markets; hence reducing the income realised by processors.

The Development Technology Centre (DTC) of the University of Zimbabwe introduced mechanised systems for peanut butter processing in 1996 and has since been working towards improvement of the systems. Both manual and motorised peanut butter mills and roasters are now locally manufactured and readily available on the market. Production systems for machines, packaging materials and the related accessories have been established and guidelines for equipment distribution and operation have been developed. Techniques have been developed for producing high quality and safe peanut butter. As the product is often not re-heated before consumption and since it is a low-acid product, strict hygiene rules for safe food handling should be observed. The new systems have tremendously increased the levels of production and quality of peanut butter by small- and medium-scale entrepreneurs, even in urban areas. The groundnuts should be completely and uniformly roasted before grinding to produce a good quality peanut butter. Under-roasting produces a poor flavour, whereas over-roasting results in a darkened product and burnt flavour. The degree of grinding and size of the particles of the product depends on consumer preferences and in Zimbabwe a smooth paste is preferred (Mhazo et al.,

2002). A great number of women groups are now able to supply the formal markets after meeting the high safety and quality standards set by the Standard Association of Zimbabwe (SAZ). A few enterprises have met export requirements to neighbouring countries. A combination of adoption of the medium-scale processing technologies and low groundnut production levels has resulted in a shortage of the raw material for small-scale processors.

The major challenges in the mechanisation of peanut butter processing are:

1. The increase in cost of new machines and spares; especially burrs and electric motors;
2. Lack of enforcement of manufacturing standards for processing equipment. This has resulted in consumers accessing substandard machines as these are normally low priced;
3. Lack of equipment design patents hence unlicensed or backyard manufacturing;
4. Shortage of groundnuts due to frequent droughts and low production;
5. Difficulties in attaining SAZ accreditation so as to access formal markets;
6. High cost of packaging material; and
7. Credit for initial capital is not readily accessible and if so interest are not affordable.

Growth in the peanut butter medium enterprises is evidenced by the numerous brands found on the shelves of most local supermarkets. Suitable groundnut varieties have been identified in Zimbabwe and there is potential to increase production especially considering the sharp rise in inorganic fertiliser costs. Groundnuts are known to improve soil fertility through biological nitrogen fixation.

Case 4: Processing of sweet potatoes

Sweet potato utilisation is traditionally limited to consumption as a snack, dessert or a substitute for bread at breakfast, when the root is boiled. However, during the harvesting period, the market is often flooded for up to three months, thereby depressing the prices and making the production of sweet potatoes a non-viable enterprise. Most rural households are then forced to buy the conventional wheat-based bread, which may not be affordable (up to US\$1 per loaf). Sweet potatoes are widely produced in the country by smallholder farmers. Nyakudya et al. (2004) demonstrated that flour from the dried sweet potato chips has the potential to partially substitute wheat flour at 28 to 30%, which can help reduce the wheat component which makes bread expensive. In addition, Vitamin A deficiency is widespread in rural areas, especially among the under-fives, and yet certain sweet potato cultivars are known to be rich in this nutrient (Faber et al., 2008). In eastern Uganda, Ssebuliba et al. (2006) found that the orange fleshed sweet potato cultivars had a beta-carotene content of least 400 µg/100 g compared to white-fleshed

local variety which typically ranged from 28 to 173 µg/100 g, which makes them a good source of Vitamin A (Woolfe, 1992). Ssebuliba et al. (2006) also found the orange-fleshed cultivars to be more acceptable to children than the white-fleshed ones. In Zimbabwe, the most prevalent sweet potatoes grown are white-fleshed.

The introduction of sweet potato flour may enhance accessibility of the rural poor to bread, many of whom cannot afford the wheat-based bread. Once good quality flour has been produced, numerous baked products such as muffins can be produced as well (Chivinge et al., 2000). Commercial processing of sweet potatoes into baking flour can stimulate production of the crop, increase incomes, improve food and nutritional security, and create employment opportunities, thereby helping to alleviate poverty in rural areas. In the long term, this might also be a strategic intervention at national level in that the much-needed foreign currency being used to import supplementary wheat could be reduced. It can also increase rural incomes through marketing of the raw material when the processing enterprise creates a local demand for the sweet potatoes.

Appropriate processing systems at small-scale level have not yet been fully developed. There are various options of washing, peeling, slicing, drying and grinding the dried sweet potato chips. There are, however, still a number of questions regarding these processing techniques. Previous researchers have noted lack of information on sweet potato flour quality (van Hal, 2000).

The quality of flour is a function of the variety of the raw material used and processing system employed. Mutungamiri et al. (2001) demonstrated that sweet potatoes can be processed into jam. Other by-products that can be derived from sweet potatoes include juice, ketchup and fresh chips. Further work needs to be done to perfect the skills and processes. In other countries, especially East Africa, sweet potatoes are sliced, dried, stored and used per need (Stathers et al., 2005). There is potential for Zimbabwe to learn from these experiences.

Case 5: Fruit and vegetable drying

Fruits and vegetables play an important role in providing the body with essential vitamins and minerals which when deficient, can cause malnutrition (Utete and Tembo, 1996). In the smallholder sector of Zimbabwe, fresh vegetables are available in large quantities in the dry season while fruits are more abundant in the wet season. When production exceeds the family consumption needs and demand levels of the local markets, producers face huge problems in trying to access urban markets. These include lack of market information and marketing intelligence, high perishability of horticultural commodities and lack of refrigerated transport services and poor road networks. More often than not, high value produce is put to waste.

A wide variety of vegetables and fruits are processed into dried products and the majority of vegetables processed are indigenous varieties. Preservation relies on the removal of moisture by drying. An acid dip sulphur dioxide may also be used to reduce the number of contaminating micro-organisms (Fellows, 1997b) but this is not commonly practised in Zimbabwe. Dried products are obtained from apple, mango, guava, banana, paw-paw, tomatoes, onions, cabbages, rape, *covo*, cowpea leaves, pumpkin leaves, mustard leaves and okra. It is more common to find dried vegetables rather than dried fruits on the vendors market. For a significant number of processors, processing is a traditional activity adopted to enhance household food security during the agricultural off-season when access to fresh produce is limited. Some surplus may be sold locally to generate income. The few enterprises that produce the dried products at medium-scale, sell their products in the up-market shops and local tourist resort areas. The Murewa Food Processors' Association is one of the few enterprises which exports small volumes of dried fruits, but it does not have firm contracts.

Most of the existing fruit and vegetable processors are informal in nature and range in size from small to medium. They are normally referred to as cottage industries as they operate from residential homes. Drying of fruits is still a novel idea among both processors and local consumers. However, there is evident increase in the supply of processed fruits and vegetables as various such commodities are now available in the up-market shops in towns and tourist resort areas but in better quality.

There are, however, many constraints that may hinder development of small- and medium-scale fruit and vegetable processing enterprises. These include:

1. Reduced crop production levels as the costs of seed, fertilizers and chemicals are not affordable. Small-scale producers also have limited access to fertile land and irrigation facilities.
2. Lack of appropriate processing technology. Most of the processors use the usual home kitchen utensils as their basic equipment and sun-dry their fruits and vegetables. Grading, peeling and cutting are done by basic hand tools. The vegetables are dried by spreading out cut and blanched/par-boiled pieces in thin layers on flat surfaces. There is lack of cold storage facilities to store raw or semi-processed products for use in the off season.
3. Lack of access to appropriate packaging material for processed products especially for those enterprises who wish to market their products through the formal markets. Some enterprises resort to using recycled packaging materials but this raises food safety and hygiene concerns.
4. Poor marketing of products. Marketing of small-scale processed food products is largely informal. Enterprises located in rural areas rely on demand from local informal

markets, which are small and unreliable. There is a general lack of marketing skills and information.

5. Lack of appropriate training in food processing. A few processors have received formal training in food processing techniques.

6. Failure to adhere to the general food safety requirements and hygiene practices as required by the food safety regulations.

7. Lack of working capital as most processors experience poor cash flows.

There is however, potential to create viable business ventures in fruit and vegetable processing as long as appropriate processing equipment, processing skills, packaging material, and marketing information are made available. Smallholder farmers could form groups and supply small- to medium-scale enterprises with dried produce for example but the major challenge is usually meeting critical volumes and to maintain supply (Mvumi, 1997; Fellows, 1997b).

Case 6: Juice extraction

Despite the high level of fruit production in many districts of Zimbabwe, there is food insecurity, poverty, hunger and malnutrition at household level. There is little processing of fruits at small- or medium-scale level and farmers are losing out as they often sell their fresh fruits within a few weeks of harvesting at give-away prices. Recent case studies by the DTC (Mhazo et al., 2003) suggest that small-scale fruit and vegetable processing has potential to provide improved returns to horticultural producers as long as appropriate processing equipment, processing skills, packaging materials and marketing information are made available.

Pulps/juices can be made from almost any fully ripened fruit, but common types include apple, pineapple, orange, grapefruit, passion-fruit, guava and mango. The pulping, filtering and pasteurising stages of the process should be monitored and controlled to produce a consistent product quality. As the product is acidic there is little risk of food poisoning, but normal hygiene practices should be enforced (Fellows, 1997b). Currently juice extraction is being done by large companies such as Mazoe Citrus Estates. These big companies produce a juice concentrate which they sell to other companies for juice-making.

Most companies that produce the ready-to-drink juices operate at medium-scale level and do not procure the fruits directly for processing. They procure most of their juice concentrate from Mazoe Citrus Estates and blend it with ingredients like sugar, preservatives, citric acid, water, colorants and some flavours. This operation does not require heavy investment in equipment. The equipment that is needed is mainly cold rooms, storage tanks and mixing tanks. Products from these enterprises include

Mr Juice, Jet Juice and Cascade. The challenges being faced by these medium-scale enterprises include shortage of the juice concentrate, high distribution costs and high cost of packaging.

Case 7: Feed processing

The country often experiences critical shortages of livestock feed mainly due to scarcity of raw materials with soyabeans topping the list. For example, during the 2004/05 agricultural season, production was about 40,000 metric tonnes yet the total market demand (including oil extraction) was in excess of 200,000 metric tonnes. Soyabeans is an important protein source for livestock. In an effort to curtail this shortage, the Zimbabwe Government, through the Reserve Bank of Zimbabwe, availed funds to the National Soyabean Promotion Programme, specifically to boost soyabean production in the country but more similar efforts are required.

Equipment for livestock feed manufacturing at medium-scale level is widely available. The addition of a mixer and a bag stitcher/sewing machine to an ordinary grinding mill is all that is required. However, there is lack of information on feed ingredients and limited flexibility in substitutes of raw material. Maphosa et al. (2002) showed that dried sweet potato chips can be used as a partial substitute for maize in manufacturing of broiler chicken feed. Feed formulations are usually commercial secrets.

Typical SME concerns are profiled in Cases 9 and 10 to highlight the real situation in the industry.

Case 9: Tanroy Engineering

Tanroy Engineering is a medium-scale manufacturing operation based in the Msasa Industrial area of Harare. The company is well-equipped and adequately staffed to handle manufacturing of small- and medium-scale agro-processing equipment that include maize mills, dehullers, peanut butter mills, peanut roasters, shellers, chippers and graters. Many of their products have both manual and motorised versions and tailor-made sizes can be fabricated to suit different consumer preferences. The motorised versions of their products are powered by electric motors or diesel engines. All their products bear the brand name "TAN TAN" and this is already a household name in southern Africa. Locally the "TAN TAN" products are retailed in Harare, Mutare and Bulawayo and there are plans to open a branch in Masvingo.

Though the company has made substantial progress in establishing itself in light engineering, there are currently difficulties in sourcing electric motors and engines. Electric motors are sourced from local importers such as

RENOX and Appropriate Technology Africa. However, they have direct import arrangements for diesel engines from Asia. The current shortage of foreign exchange in the country both directly and indirectly affects Tanroy Engineering as this hinders the supply of engines and electric motors..

Case 10: Muchinjike Agricultural Development Oilseed Processing Project; Murewa District; Zimbabwe: a novel agro-processing business model.

In 2002, the Avondale Rotary Club of Harare, introduced a unique crop production and processing innovation in the Muchinjike Communal Area of Murewa District in Mashonaland East province of Zimbabwe. Muchinjike is 15 kilometres to the north-west of Murewa Rural Service Centre (RSC). The innovation is a participatory rural development concept based on the hypothesis that if smallholder farmers pool their land resources together to constitute the size of a commercial farm, have centralised technical planning and management, are provided with adequate production inputs and mechanisation equipment, and have access to technical backup and extension advice, their productivity will improve to commercial level. The argument behind this school of thought is that productivity in communal areas is low because of (i) lack of good planning, (ii) poor management, (iii) low mechanisation inputs, (iv) limited production inputs (seed, fertiliser, chemicals etc.) and (v) lack of crop value addition options.

Fifty households in Muchinjike were selected for the initial registration of the project. These and other unregistered farmers pooled together about 200 ha from their pieces of land as their shareholding contribution. The Rotary Club provided funds to implement the project. The money was used to hire a manager, purchase a 100 horsepower tractor, a 2.5 m Rome harrow, a 3-disc plough, a 5 tonne double axle trailer, a Helix 80 motorised oil press, planting seed, fertiliser and chemicals. The bulk of the planting seed input was hybrid sunflower seed as this was seen to be the most viable cash crop. Hybrid seeds have a soft hull and therefore easier to press compared to open pollinated varieties. In addition, the oil yield of the former is higher than the latter. Sunflower seed was planted on 100 hectares in the first season and this was conceived to be adequate to provide pressing seed for the oil press.

The oil press is temporarily located at rented premises provided by a local businessman at Murewa RSC as the project area is not yet electrified. In the first harvest season, in 2003 (which was a drought year), about 15 metric tonnes of sunflower were produced by the project and an additional 40 metric tonnes were sourced from local farmers for pressing purposes. However, the quantities were too little to match the oil press capacity of 2.5 metric tonnes per day. Typically the machine operated at between 600 and 700 kg per day for a limited

period of time in the year.

A critical participatory evaluation of the project conducted in 2004 revealed that it was more profitable for the project to source sunflower seed from the local farmers than producing its own. Service pressing** was also shown to be a viable income generating window. Based on the findings, the project subsequently reduced the sunflower hectareage to 10 ha only for the sole purpose of producing supplementary seed to the outsourced supply so as to fill machine time. The project has also opened a sunflower planting seed and fertiliser shop that sells the inputs to local farmers at commercial rates. Though the objective is to promote sunflower production to ensure viability of the oil press business, the new venture constitutes a viable business line on its own but without any obligations to the buyers towards the project. The demand for the sunflower seed is impressive, indicating local farmers' realisation of the profitability of value addition to the crop. As the number of growers from outside the project area increases, permanent siting of the oil press at Murewa RSC becomes favourable because the RSC is central and well-serviced with good road and telecommunication networks, and more reliable electrical power supply. The sunflower oil produced is more viscous than commercial brands of vegetable oil and is perceived by the local consumers to cook better for the same quantities of oil; hence cold pressed sunflower oil lasts longer in the home. However, in cold-pressing of oilseeds, aflatoxins presence is of considerable concern. The occurrence of aflatoxin-producing fungi can be reduced by correct drying procedures and by preventing moisture pickup by raw materials in store. When aflatoxins are present in oilseeds, very little pass onto the extracted oil and most will be found in the oil cake. Aflatoxin-contaminated cake presents a great danger if it is used to make animal feeds. The advantages resulting from this model are:

1. It has allowed farmers to add value to their produce without necessarily investing in processing equipment;
2. It has freed up farmer time which would otherwise be wasted using the manual oilseed processing methods which are slow;
3. It has opened up local market opportunities with potential for bulk selling e.g. to boarding schools or hospitals; hence increasing household income levels;
4. In its present form, the model does not call for product certification because the oil belongs to the farmers, and not to the entrepreneur;
5. Incentives for increased production of sunflower and diversification of cropping enterprises which have previously been dominated by maize and no cash crops;

** Service pressing involves farmers bringing their own pressing seed, they get the seed pressed and the resultant crude oil filtered all at a fee. The farmer then carries away the oil. No packaging costs are incurred as the farmers bring their own packaging material. The farmers then have the option to sell the oil within the community or consume it.

and 6. The communities now have improved diets from the cooking oil (which is cholesterol-free; with no artificial additives) or through purchase of food using the income generated from sunflower oil sales.

In this case, it is a win-win situation between the entrepreneur who generates income through service provision at a fee and through selling the cake; while the farmers get the oil. The biggest challenge the entrepreneur has faced in the past is that the GMB refused to sell pressing seed to them; yet the marketing board are the biggest buyer and seller of grain in Zimbabwe. GMB, located within the same RSC, are now setting-up a plant for processing sunflower oil, setting the scene for market competition. However, the flexibility in-built in the medium-scale enterprise, whereby farmers can bring in any quantity of sunflower seed for service pressing, coupled with economies of scale might carry the day for the project.

Conclusion

Small- and medium-scale agro-processing enterprises play a vital role in the national economic development of Zimbabwe yet they do not seem to be receiving due attention from the Government. There is a need to critically look at how equipment manufacturers can be assisted in the manufacture of good quality machines that are affordable to processors. This may call for preferential treatment of the sector by the Ministry of Finance in terms of budget allocation. Research could also contribute by investigating how best equipment production costs can be reduced. Business viability is enhanced by good training, service back-up, attractive financial packages and strategic equipment ownership arrangements. Training institutions and extension services should develop business models that can be adopted by entrepreneurs. Equipment manufacturers and processors need to coordinate with farmer organisations and organise themselves into a lobby group in order to alleviate the constraints faced in the sector.

There is need to review the technology supply chain for a wide range of commodities produced in the country. The dynamic nature of the agro-processing industry necessitates frequent and periodic reviews. The reviews help to identify constrictions in the value chain for purposes of unblocking them.

Based on the review, it is concluded that the country is self-reliant with regards to manufacturing of cereal mills, dehullers, mixers, crop dryers, oil presses and peanut butter mills.

The following are the major sub-sectors that have been identified as having potential to boost indigenous small and medium agro- industries in the country:

1. Establishment of medium-scale grain milling enterprises,
2. Manufacturing of livestock feeds at local level,
3. Processing and marketing of peanut butter,

4. Processing and marketing of processed fruits and vegetable products,
5. Manufacturing of medium-scale vegetable oil processing equipment.

With initial support to medium-scale entrepreneurs in RSCs, the livelihoods of small-holder farmers can be greatly enhanced through local value addition resulting in improved incomes and diets as well as releasing farmers' time for other activities when motorised systems are introduced compared to the conventional manual methods.

RECOMMENDATIONS

The agro-processing industry in Zimbabwe has potential to meet the local needs and export requirements. Medium-scale enterprises have potential to create employment opportunities especially if the enterprises are nurtured to produce for both domestic and export markets. However, the sector currently faces many problems that emanate from various negative aspects of the national economy, uncertainty that exists over access to finance, advice, information and reliable markets.

The major areas that need improvement in the industry are:

1. The response of the agro-processing industry to the changes in the agrarian sector. With the reduced farm sizes and increased number of farmers, there is need to develop a wider diversity of small- and medium-scale processing equipment that cater for the full spectrum of farming practices and agricultural commodities produced in the country. Emphasis should then shift from small-scale farmers aspiring to own the processing technology to improving access to the technology, such as the service-processing case, in order to ensure viability. This can be achieved by creating conditions that favour establishment of agro-processing enterprises to encompass processing of other commodities, as well. Encouraging establishments of processing service providers may lead to optimum utilisation of equipment and will take away from the farmer the worries associated with operation, repairs and maintenance of equipment.
2. There is lack of clear government policy on agro-processing yet it has potential to drive the economy. Government policies that enhance performance of medium grain milling enterprises, livestock feed manufacturers, peanut butter and vegetable oil processors need to be put in place as a tool for empowering indigenous entrepreneurs. The institutional framework to support and enable trade initiatives is provided by organisations such as Zimtrade, Zimbabwe Investment Centre and the Export Processing Zone and most recently, the Common Market for Eastern and Southern Africa (COMESA).

3. Fruit and vegetable processing is a viable business venture given the production potential of the products in the country and a wide range of small- and medium-scale processing equipment available in the country and in the region. Establishment of medium-scale fruit and vegetable processing enterprises will help reduce heavy losses experienced by producers and ensure product availability on the market. Entrepreneurs need to be exposed to available technologies and the range of products that can be manufactured to encourage uptake of this new business.

4. There is need to enforce food safety and hygiene standards as well as protect consumers against nutrient insecurity and undesirable tastes and flavours.

5. Research in agro-processing equipment does not meet national expectations. The public and private sectors must be mandated to undertake collaborative research with the formal equipment manufacturers and offer research and testing services to the informal sector which does not have the capacity to conduct serious and meaningful research.

6. Training offered to agro-processors needs to include business management skills as these are lacking. This entails that training in agricultural colleges and universities should also encompass the same to ensure competence of extension officers in the subject.

7. The Department of Mechanisation in the MAMID should broaden their knowledge and capacity to offer technical assistance and advice, support and extension services that cover a much bigger range of equipment, ownership modalities and financing models.

8. The most critical limiting factor in equipment manufacturing, is limited access to finance. This has led to delayed delivery of orders or complete failure to do so. Agro-processing equipment manufacturing has a strong bearing on the success of the agrarian reform hence the manufacturers need to make a collective presentation to the government for them to be classified as a special facility by the Ministry of Finance of Zimbabwe.

9. The limited capacity of processors to purchase equipment can be alleviated in a number of ways that include conducting research on how costs of production can be reduced, advocating for removal of VAT on imported materials used in manufacturing, introducing low cost finances for both manufacturers and processors, and preferential allocation of finance to manufacturers and promotion of service providers.

10. Establishment of user-groups for lobbying and advocacy at policy level, and resource mobilisation.

ACKNOWLEDGEMENTS

The authors are grateful to Tirivangani Koza, Department of Mechanisation in the Ministry of Agriculture, Mechanisation and Irrigation Development; Mike Morris and Tanya Stathers of Natural Resources Institute, University

of Greenwich, UK for critically reviewing earlier drafts of this document. Small Enterprise Development Corporation is also thanked for providing definitions of SMEs in the Zimbabwean context. This document is an output from a project funded by the Crop Post-Harvest Programme of the UK Department for International Development (DFID) for the benefit of developing countries. The views are not necessarily those of DFID. Project R8460.

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