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Business management for small-scale agro-processors

Agricultural Mangement, Marketing and Finance Service (AGSF)
Agricultural Support Systems Division
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2005

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Preface

This booklet addresses micro- and small-scale entrepreneurs who wish to improve their business operations. It may not require the sophisticated business management techniques that are used by large-scale manufacturers, but simple procedures to plan, monitor and control production, finances, inventories, quality and staff matters. Some types of agro-processing have specific problems or issues that are described in the last chapter. The booklet aims to provide practical advice and information on management aspects to help entrepreneurs or potential investors at micro- and small-scales to run a sustainable agro-processing business. It may be a useful addition to training resources for local and international NGOs, or staff at government institutions who work with small enterprises. Policy makers or students on business, agriculture and food-related courses may also find the booklet useful.

Contents

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Figures

Tables

Glossary

Bottleneck	A hold-up caused when one part of a process is slower than others, one piece of equipment is smaller than the others, or there are too few staff working in a particular part of a process.
Break-even point	The level of production at which all costs are covered.
Budgeting	Planning for the amount of money to be spent on a particular activity or item.
Cash flow	The record of monies received and paid by the company.
Cold chain	A system that maintains a food at the correct temperature from production to consumption.
Competitor	Another business selling similar types of products to the same target customers.
Consumer	The person or household who is the final buyer of a product.
Creditors	People who are owed money by a business.
Customer	A person, firm or institution who buys a product.
Debtors	People who owe money to a business.
Demand	The amount of goods that customers want or need to buy.
Depreciation	Decrease of value of capital equipment due to wear and tear and the passage of time.
Distribution channel	The people or organizations through which products are handled and moved between a producer and a consumer.
Diversification	Expanding a business range by developing new products or new markets.
Efficiency	A measure of the amount of production from a certain level of inputs.
Equity finance	Money put into a business by the owner.
Feasibility Study	Systematic investigation of an idea for a new product or process to see if it can work – i.e. to see if it is feasible.
Fixed costs	Costs of production that do not vary with the amount of goods produced.
Interviewing	A structured way of finding out information about a person or a product.
Inventory	Amount of inputs, unfinished and finished products at a given time.
Investment	Putting money, fixed and current assets into a business.
Invoice	A bill requesting payment.
Ledger	A record containing the summary of financial information.
Limited liability	In a company that has shareholders, their liability is limited to the amount of money they have invested in shares.
Loan financing	Borrowing money for a business.

Manpower planning	Calculating the numbers and types of workers needed for a job.
Market research	Finding out about the types of people who buy particular products and why they buy them, in order to identify market opportunities.
Market size	The total amount of a product that is bought per month or per year in volume or value terms.
Marketing	The series of activities to identify customers and then satisfying their needs by providing them with the products they want.
Occupational health	Workers' protection against health hazards and diseases caused because of work.
Occupational safety	Protection against any hazards or injuries that arise from work.
Order	A written request for goods or services.
Overhead costs	The costs of operating the business.
Planned maintenance	A written schedule showing when particular pieces of equipment should be serviced.
Profitability	Income minus expenses.
Process efficiency	The amount of goods produced compared to the amounts of inputs needed to make it.
Procurement	Buying from suppliers.
Production planning	Calculating and predicting the number and amount of inputs needed to make a product.
Productivity	Output per unit cost.
Product development	Creating or modifying a product to make something different for new or existing markets
Promotion	A set of activities to raise awareness of a product and increase sales
Receipt	A written acknowledgement of payment
Recruitment	A planned and structured way of finding and employing people.
Revenue	Income derived from product sales and from other sources such as interest earned, rents etc.
Scheduling	Ordering a series of activities in a particular sequence or at specific times.
Service contract	A legally binding agreement with an engineer or other service provider to maintain equipment or provide other services at specified times.
Servicing	Planned inspection and maintenance of equipment.
Staff development	Training and other means of increasing a person's effectiveness to do a job.
Stock	Materials waiting to be used or sold.
Stock control	Recording and controlling the amounts of materials that go into or out of a store-room.

Stock taking	Inspection and recording of the amount and quality of stock.
Variable costs	Costs of production that vary according to the amount of goods produced.
Yield	Weight of food after processing compared to weight before processing.

1 Introduction

There is a great diversity of agro-processing worldwide and in some countries it accounts for more than 60% of the employment. Many people start agro-businesses at a small scale, often working from home and selling to neighbours and friends via a roadside stall or in a local marketplace. Characteristically, small-scale production is labour-intensive as there is rarely sufficient money to invest in specialized processing equipment. The quality of products may vary and small enterprises often do not have consistency of supply and so cannot cater for wholesalers or retailers who require guaranteed deliveries of consistent quality. Small-scale processors also may not have contracts with raw material or packaging suppliers but buy materials from local markets.

There are many millions of these businesses in emerging economies, and with advice and assistance some of them can develop into larger scale enterprises. When small-scale processors try to scale up operations a series of issues may be encountered. For example, products may be in direct competition with those of other processors when displayed on retail shelves and so the quality of the packaging becomes much more important. Retailers may negotiate lower prices than processors have experienced when making direct sales to consumers.

Any scaling up of operations brings new challenges: typically these businesses employ more people and the owner must have staff management skills; more careful control is needed over business finance, especially production and distribution costs; business management and financial planning skills are required to stay ahead of competitors; investment decisions are needed for both new equipment and improved packaging. The larger production volumes require production-planning skills and may create a need for environmental protection through waste management. Other issues, such as market research, product development and the business image may also increase in importance.

The booklet addresses micro- and small-scale entrepreneurs who wish to improve their business operations. This may not require the sophisticated business management techniques that are used by large-scale manufacturers, but simple procedures to plan, monitor and control production, finances, inventories, quality, and staff matters. Some types of agro-processing have specific problems or issues that are described in the last chapter. The booklet aims to provide practical advice and information on management aspects to help entrepreneurs or potential investors at micro and small scales to run a sustainable agro-processing business. It may be a useful addition to training resources for local and international NGOs, or for staff at government institutions who work with small enterprises. Policy makers or students on business, agriculture and food-related courses may also find the booklet useful.


apples
pears
pine apple

2 Planning production

There are two stages involved in production planning. The first is during the pre-project planning period when an entrepreneur is developing the idea for a business. The second is the day-to-day planning used to ensure that production can take place correctly. Good production planning at both stages is essential to success.

Poor planning leads to production stoppages

Poor planning can mean that not enough crop is bought, an ingredient is used up mid-way through a production run, there are not enough staff to produce the amount of product required in the time available, or not enough packaging has been ordered to meet demand. When there are frequent stops in production, insufficient amounts of product are made to meet orders, and income from sales is reduced. Failure to meet an order also creates a poor impression to customers, and they may start to consider the business to be unreliable. If this happens regularly, customers may cancel future orders, give the work to competitors, and the processor loses income. When income falls to a level at which a business cannot afford to pay its bills, suppliers will stop supplying inputs and the processor goes out of business. Production planning is therefore essential to success.

Production planning is thinking ahead to make sure that everything is in place to produce the required amount of product in the time available**.**

Pre-project planning

When a new processing business is being planned, it is often difficult to estimate how much product can be sold and many small processors simply make a guess. This is a poor way of deciding, and mistakes are very frequent. An under-estimate leads to an investment in equipment that is too small and cannot make enough products to meet the demand. More commonly, a new processor over-estimates sales and buys equipment that is too large, so that only a small percentage of the installed capacity is used. This has serious consequences because the repayments on loans used to buy the equipment are higher, which in turn puts a strain on the cash flow and profitability of the business.

To avoid mistakes like this, it is necessary to conduct a 'feasibility study' before employing staff or buying any equipment or facilities. This study sets down all the stages that are needed to get production started, and also helps to convince potential investors that the business is feasible. Existing businesses should also prepare a 'business plan' to guide future development and expansion. Market research has to be carried out before buying any equipment or facilities. Information has to be gathered on how much can be

sold, where, at what prices, and whether there are similar products on the market that may be in competition.[1]

When entrepreneurs have decided which products to produce and have completed their market research, pre-project planning is used to decide on:

- equipment needed to achieve the planned production level;
- number of staff required and their different jobs;
- level of stock to be held such as raw materials, ingredients, work-in-progress, equipment spares, packaging and finished products.

These aspects are described in the following sections. Pre-project planning can also identify any potential bottlenecks in a process and improve productivity.

Choosing equipment

The main pre-project planning decisions in relation to buying equipment are:

- which parts of a process require mechanization and which can be done manually;
- the correct size of the equipment (its capacity or throughput) for the intended scale of production to ensure that all equipment has a similar throughput;
- whether to buy equipment from a local engineering company or to import it.

Mechanized versus manual processing

Some processes, such as edible oil extraction from seeds and nuts, or milling cereal grains are difficult and time-consuming to perform manually and product yields are low. They are usually mechanized and these processes therefore require greater start-up capital than most other types of agro-processing. The reliance on machinery also means that the management of maintenance and a spares inventory are important aspects of operating these types of business. Staff numbers are smaller than some types of agro-processing, but training is required to correctly operate and adjust machines to achieve maximum yields and productivity.

The main types of oilseed crops include sunflower, peanut, soybean, maize, sesame, shea nut and palm nut. Oil is extracted on a small scale using presses or expellers. Crops that are milled to flours on a small scale are maize, rice, sorghum, teff and millet, using either hammer mills or plate mills, together with hullers and seed cleaners. Wheat is milled using roller mills, which are considerably more expensive and generally not affordable by small-scale millers.

In other processes, there are stages that are time consuming and highly labour intensive, and introducing small machines can substantially increase throughputs for a relatively small investment. Examples include slicing fruits or bread, separating cream from

[1] For more details see: Market research for agro-processors, Andrew Shepherd, Marketing Extension Guide No. 3, FAO, Rome 2003

milk, filling packages, and mixing dough. When planning production, a processor should therefore compare the costs of employing workers to do a particular job with the investment of buying a machine.

The main investment in fruit and vegetable processing is in stainless steel boiling pans, fermentation vessels etc. Start-up and capital costs are therefore lower than many other types of agro-processing, provided that stainless steel construction facilities are available. If they are not, this is a major constraint on development of fruit and vegetable processing enterprises. Correspondingly, staffing levels may be higher and training in technical skills and staff management may be greater.

Calculating the correct size of equipment

A common mistake is made when processors buy the only equipment that is locally available, without considering whether it is suitably sized for the likely sales volumes. The processor should plan the throughput that is required, research sources of equipment, and select a supplier that can provide a suitable machine.

Sales forecast

The first stage in deciding the size of equipment is to make an accurate assessment of likely sales. For a new business this is done as part of a feasibility study. An existing business can collect these data by adding daily sales records to produce monthly totals. This information can be used to plan for additional equipment or more staff where sales are increasing, or where sales are falling, the need for more product promotion or development of new products.

Production rate

Sales information can be used to find the daily production rate employing the formula below. The production rate is then used to plan the amounts of raw materials, ingredients and packaging that have to be ordered.

$$\text{Production rate (kg/day)} = \frac{\text{Amount of product produced per month (kg)}}{\text{N}^{o}\text{ of days of production per month}}$$

For example, if broiler feed sales are 24 tonnes per month and a feed mill works six days a week, then one tonne of feed has to be produced every day.

Product throughput

The average amount of production per hour is known as the 'product throughput', and is calculated to help finding the required size of equipment.

$$\text{Throughput (units/hour)} = \frac{\text{Amount of product sold per month (units)}}{\text{N}^{o}\text{ of days of production per month x N}^{o}\text{ hours worked per day}}$$

Calculating product throughput

The calculation of throughput enables the processor to decide the size and number of pieces of equipment required. This type of calculation is shown in Examples 1.1 and 1.2.

Example: Calculation of throughput

Using the production rate data above, and assuming that 2 hours per day are available for the staff to mix the feed, then the average throughput of the mixer is:
= 1 tonne per day / 2 hours per day
= 0.5 tonne/hour

If the feed mixer takes 30 min to mix a batch of feed, then two batches per hour are possible and a mixer with a capacity of 0.5/2 = 0.250 tonne is suitable (i.e. a capacity of 300 kg to avoid over-filling).

Modified calculation of throughput
Because of load shedding, the feed mill cannot operate electric mixers on Mondays and Thursdays each week. To achieve the production levels needed to meet planned sales targets, the production rate must therefore be increased on the four days that mixing can take place: i.e. = 24 tonnes/month /16 days/month = 1.5 tonnes/day.

Then the average throughput of the mixer needs to be:
= 1.5 tonnes/day/ 2h/day = 0.750 tonnes/hour
A mixer with a capacity of 0.750 tonnes/hour/2 = 0.475 tonnes is required (a bowl capacity of 500 kg).

Example: Choosing the size of equipment

If 3 hours are available to boil 36 kg of jam per day, the throughput for the boiling stage is: 36/3 = 12 kg per hour.

A batch of jam should be boiled within approximately 15 minutes to maintain the quality of the product, and a maximum of three batches per hour are possible. The processor therefore has a number of choices: 1.) To buy a single, large (e.g. 15-20 litre) stainless steel pan and a large burner to heat one 12 kg batch of product within 15 minutes. This is the most expensive option, but production is straightforward and requires the least organization. 2.) Process two batches of 6 kg using a smaller (e.g. 10 litre capacity) boiling pan and a smaller burner. 3.) Process three batches of 4 kg each using a smaller (e.g. 6 litre capacity) boiling pan and a smaller burner. This is the cheapest level of investment but requires more complex work organization, staff skills and production planning.

Matching equipment throughputs

In agro-processing there is usually a short delay between the different stages in a process, and to avoid bottlenecks it is important that all equipment has a similar throughput. To calculate the requirements for all equipment in a process, the process should be written down as a chart, showing the weights of food at each stage that are needed to achieve the planned production rate.

Figure 1: Use of a process chart to calculate the equipment needed to produce 52 kg of biscuits per day

Process stage	Equipment required	Calculation/assumptions
Ingredient weighing ↓	By hand	-
Dough mixing ↓	Mixer bowl with 15 kg capacity	Mixer needs 20 minutes to mix each batch – i.e. 2 batches per hour. 2 hours mixing requires capacity of 26/2 = 13 kg (capacity of 15 kg to avoid over-filling).
Biscuit forming ↓	Forming machine capacity 1500 pieces per hour	52 kg dough formed into 10 g pieces (5 200 pieces). 3½ hours for forming.
Baking ↓	Oven with 8 trays each capable of holding 50 biscuits	Baking time = 15 minutes – i.e. 3 batches per hour (1 200 biscuits per hour). Total 4.3 hours baking.
Cooling ↓	Rack having 24 shelves	8 trays per hour with one tray per shelf. Temporary storage of biscuits for 3 hours before packing.
Packing in film ↓	Manual filling. Heat sealer capable of 100 packs per hour.	20 biscuits per pack = 260 packs per day. Packing for 2.6 hours.
Packing in cartons	By hand	20 packs per carton = 13 cartons per day.

Sources of equipment

It is preferable to buy equipment from local suppliers or engineering companies because they are close by to service or repair the equipment. The purchasing price is often lower than imported equipment and spare parts can be obtained faster and more easily. However, the quality of workmanship and the willingness or capacity of engineering companies to provide a repair service needs to be taken into consideration before choosing a particular type of equipment.

When importing equipment the main difficulties are finding information on the available types of equipment, the willingness of overseas suppliers to meet small orders for equipment, and the higher costs (freight and clearing charges, import duties and the capital cost). Information on types of equipment, specifications and costs is increasingly available on the Internet (see further readings), and processors may be able to gain access to the

Internet, or seek advice and assistance from offices of development agencies, Chambers of Commerce, university food science and technology departments, manufacturers' associations, or at embassies of exporting countries. When ordering equipment, it is necessary to:

- specify exactly what is required (many manufacturers have a range of similar products);
- describe the throughput required in kg or litres per hour and the type of food to be processed;
- give other information such as model number of machine, single or three-phase power, number and types of spares required.

Estimating staff requirements

The numbers and types of workers needed to operate a processing business depend on the production rate and also on the degree of mechanization of the process. Working hours and off-duty time have to be set. When deciding the number of people needed to produce a particular amount of product, the process is broken down into different stages. The owner then decides which stages will be done manually and which stages will be mechanized. It is then possible to calculate the numbers of people that will be needed for each stage.

An activity chart can be used next to plan the succession of jobs that each worker does during the day. It is also important to include work such as store management, quality assurance and bookkeeping when planning the numbers of staff that are needed.

Figure 2: Activity chart used to plan job allocations for staff in a fruit processing enterprise

Hours during working day										
Activity	8 a.m.	9 a.m.	10 a.m.	11 a.m.	12 p.m.	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.
Washing/sorting	X Y				**L**					
Peeling/ slicing		X Y Z	Y		**U**					
Mixing/ boiling			Z	Z	**N**					
Filling/ sealing			X	X						
Cleaning						Z	X	Z		
Labelling				Y	**C**		Y			
Store management	Z						Z			
Distribution					**H**		M	M	M	M
Management/ book keeping	M	M	M	M		M				

(X,Y and Z are workers and M is the manager)

Figure 3: Production process for making chutney*

Stage in process (50 kg per day)	Activities	Estimated time required (min)	Estimated numbers of staff required
Fruit ↓			
Wash ↓	By hand to remove stones, leaves or soil	20	1
Sort/grade ↓	By hand to select for similar colour	45	1
Peel ↓	By hand using knives	125	2
Cut/slice/core ↓	By hand using knives	90	2
Spices, Mix sugar vinegar ↓	Using an electric mixer	10	1
Heat ↓	Boil in boiling pan, with constant mixing by hand	20	1
Fill & Seal Jars/ ↓	Hot fill into pre-sterilized jars using filling machine and hand seal lids.	45	2
Cool, label & store	Use small labelling machine, pack into boxes by hand.	75	2

* assuming that two staff work for a total of 7.25 hours per day

Example: Calculating staff numbers

If on average it takes a worker 45 seconds to fill and seal a bag of snack food, the time required to fill 250 packs is = 250 x 45 packs = 11250 sec. This equals 188 min or 3 hours 8 min. If 4 people are working together, the time required = 188/4 = 47 min
A packaging machine would reduce both the number of workers and the time required to pack foods.

Routine production planning

For routine production planning, it is important to start with the amount of each product that a processor expects to sell and the levels of stocks to be held. It is then necessary to calculate:

- the weights of raw materials and ingredients to be bought;
- the amount of packaging to be ordered;
- the numbers of extra or temporary staff to employ (if necessary).

Product mix

Most micro- and small-scale processors in emerging economies focus their production on a particular category of product, such as fruit juices, bakery products, cooking oils etc. This is partly because they have an interest or expertise in processing a particular product, and partly because the same equipment can be used to produce different varieties of products in the same category, such as different types of fruit juice. It is rare for small-scale processors to have a product mix that covers more than one category because of the higher levels of investment and expertise that are required. However, once a processor becomes successful, it is common to expand to a related food category. For example, juice processors may move into wine production or even jam and chutney manufacture, and biscuit bakers may expand to produce celebration cakes. In each case they will have developed an understanding of the market and may use the same suppliers for ingredients. It is important however, that a new business plan is created whenever a new product is started. The product mix needs to be flexible so that the enterprise can adapt to different market conditions, product prices and input costs.

Calculating weights of raw materials and ingredients

During routine production, information from sales staff, orders from retailers/wholesalers, and a decision on the amount of product to be held as stock are used to decide the amount of production for the following week. It is then necessary to calculate the weights of raw materials and ingredients that will be required each day using a standard recipe (or 'formulation') for every product.

A recipe for tomato sauce is shown in the left column of Table 1.1, and the amounts of ingredients needed to make 50 kg are shown in the right column, with the calculation in the centre.

Table 1: Calculation of ingredients needed to make 50 kg of tomato sauce

Ingredients	Input needed (kg) per kg output	Calculations to make 50kg	Amount for 50 kg
Tomatoes	1.50	1.50 x 50 kg	75 kg
Sugar	0.30	0.30 x 50 kg	15 kg
Chillies	0.10	0.10 x 50 kg	5 kg
Garlic	0.05	0.05 x 50 kg	2.5 kg
Salt	0.01	0.01 x 50 kg	0.5 kg

Calculating material losses during production

The amounts of raw materials and ingredients calculated from a recipe are not the amounts actually used in a process, because losses arise during processing. These can occur, for example, from spoiled raw materials thrown away during sorting, from spillage during filling into packs, or from food that sticks to equipment and is lost when it is washed down after processing. The calculation of production rate should therefore take into account the losses that occur in a process. These are different for each type of food processed (Table 2). Losses that arise towards the end of the process have had the maximum value added and are therefore much more serious, particularly losses of packaged product. Particular care should be taken to handle final products carefully to avoid damage. To maintain profitability, it is important to reduce losses as much as possible. Buying only good quality raw materials and training staff to reduce wastage by careful processing can achieve this.

Table 2: Typical material losses during food processing

Stage in a process	Typical losses (%)			
	Oil extraction	Fruit & vegetable processing	Cereal milling	Meat & dairy processing
Sorting raw materials	5–30	5–50	5–30	5–20
Preparation	–	5–30	–	10–30
Processing	10–30	5–20*	5–10	10–20
Rejected products	0–5	0–5	0–5	0–5
Packaging	0–5	5–10	5–10	0–5
Accidental spillage	0–5	0–5	5–10	5–10
Distribution	0–5	0–5	0–5	0–5

* excluding water removed during drying or boiling

Losses are calculated by measuring the weight of saleable product obtained from a known weight of raw materials as follows:

Calculation of losses:

$$\text{Yield (\%)} = \frac{\text{Weight of final product}}{\text{Weight of raw material}} \times 100$$

$$\text{Losses (\%)} = 100 - \text{Yield (\%)}$$

In juice processing, 60 kg of passion fruit are bought and used to produce 170 bottles of juice, each containing 200 ml. The yield (%) = ((170 x 0.2)/60) x 100 = 56.7%, and the % losses = 100 – 56.7 = 43.3%.[2]

Losses during drying and boiling

When foods are dried or concentrated by boiling, it is necessary to calculate the amount of water lost in order to find the weight of product produced. To do this it is necessary to know the water (or moisture) content of both the raw material and the product[3].

Calculating the weight and value of fruit after drying: The solids content is calculated as:

Solids content (%) = 100 - moisture content (%)

[2] Providing that one litre of juice equals one kilogram

[3] The moisture content can be measured in a university laboratory, Food Research Institute, Standards Bureau or private laboratories.

Example: Calculation of boiling losses

The moisture content of peeled and de-stoned mango is measured as 83 percent and that of sugar as 2 percent. The solids contents were calculated as shown in the table below, together with the weight of each ingredient in the recipe.

Ingredient	Weight (kg)	Solids content (%)	Weight of solids (kg)
Mangoes	124.4	17	21.15
Sugar	74.8	98	73.30
Total	199.2		94.45

$$\% \text{ solids in batch before boiling} = \frac{94.45}{199.2} \times 100$$

$$= 47.4\%$$

To preserve jam and prevent it going mouldy, the required solids content is 70 percent. Only water is removed during boiling and the solids content is therefore increased from 47.4 percent to 70 percent.
Therefore 94.45 kg equals 70%.

$$\text{The weight of product after boiling} = \frac{100}{70} \times 94.45 \text{ kg} = 135 \text{ kg}$$

Sourcing raw materials and ingredients

When the amount of daily production has been planned, it is necessary to obtain sufficient amounts of raw materials and ingredients to prevent production stoppages. The frequency at which raw materials should be bought depends in part on differences in their stability before processing. Oilseeds and cereals have a long storage life, whereas fresh fruits, vegetables, and especially animal products, have a much shorter storage life (Table 3). Animal products must be fully processed immediately to prevent spoilage. Some fruits and vegetables can be stored for later production after pre-treatment, but this requires more careful work organization and production planning.

Table 3: Storage times for different crops and animal products

Type of food	Spoilage rate and storage life without processing
Animal products (e.g. meat, fish, milk)	Very rapid - a few hours
Leafy vegetables (e.g. cabbage)	Rapid - 24–48 hours
Soft fruits (e.g. berries)	Rapid - 24–48 hours
Hard fruits or those with a protective skin (e.g. citrus, pineapple, banana)	Slow - days or weeks
Roots and tubers (e.g. yams, potatoes, cassava)	Slow - days or weeks
Cereals, nuts, oilseeds	Very slow - months or years

Short shelf-life raw materials

In many countries, fish, meat and milk are available throughout the year Although there may be changes in the amounts produced during, for example a dry season, processors of these products do not have to plan for the seasonality problems experienced by crop processors. Products made from fish, meat and milk are 'high-risk' foods as they are easily contaminated by food poisoning micro-organisms.

Most micro- and small-scale meat processors buy carcasses from local slaughterhouses, wholesale markets or directly from farmers. Similarly, fish processors buy from markets, wholesalers or directly from fishermen. In both cases the suppliers rarely control the temperature of their produce, and to minimize public health risks, processors should carefully inspect the quality of raw meat or fish and ensure that it is cooled as quickly as possible after purchase. Their highly perishable nature means that unless large freezers are affordable, bulk buying of these raw materials for later processing is not an option for small-scale processors. The quality of a meat carcass can have a major influence on profitability. For example, animals that have a low carcass weight have a higher ratio of bone to meat than well-fattened animals, and the yield of useable meat is lower. An important management role is therefore to inspect each carcass that is purchased. The products made by small-scale meat processors include sausages, hamburgers, pates, bacon, hams, dried meats, meat pies and kebabs. Excepting dried meats, these products require refrigerated storage, which is a major cost to processors and limits the amounts of stocks that can be kept.

Milk is often supplied via a complex network, in which supplies from individual farmers are pooled at collection centres and then cooled for distribution. Processors should be confident that the centres have adequate controls in place to ensure good quality milk. The centres should cool it as quickly as possible, and prevent adulteration or dilution of the raw milk. At larger scales of operation, processors may purchase their own vehicle to collect milk and reduce the risk of contamination. The main cost in dairy processing is the milk, and purchasing it directly from farmers with fixed price contracts[4] or price incentives to supply

[4] See Contract farming, partnership for growth, Charles Eaton and Andrew W. Shepherd, AGS Bulletin 145, FAO, Rome 2001

high quality milk with minimal contamination can help to control this. In addition to pasteurizing or boiling milk, dairy processors make yoghurt, flavoured and cultured milks, butter and ghee, cheese and ice cream, all of which require refrigerated storage.

Most short shelf-life crops, especially soft fruits, are purchased daily by urban micro-scale processors in local markets, to minimize the amount of spoilage before processing. Rural processors may buy directly from farmers. Larger scale operations may have their own farms or contracts with farmers, wholesalers or suppliers.

Example: Scheduling raw materials and ingredients

A chutney manufacturer uses tomatoes, sugar, chillies, garlic and salt as ingredients. Because of their short shelf life, tomatoes are bought daily, whereas chillies and garlic are bought fortnightly. Stocks of salt and sugar are replenished monthly. The production supervisor collates ingredients for a week's production onto an order form for the purchasing officer.

Week N° ……..	**Raw material & ingredient order form**				
Day	*Tomatoes (kg)*	*Sugar (kg)*	*Chillies (kg)*	*Garlic (kg)*	*Salt (kg)*
Monday	35	-	1	0.25	50
Tuesday	35	-	-	-	-
Wednesday	35	-	-	-	-
Thursday	35	200	-	-	-
Friday	35	-	-	-	-
Order	**175**	**200**	**1**	**0.25**	**50**
Stock	-	110	0.2	0.85	1
Total	175	310	1.2	1.1	51

Longer shelf-life raw materials

Depending on the geography, climate and soil fertility of a particular area, there may be a single harvest season each year for oilseeds, nuts, cereals, many fruits, root crops and vegetables. In these cases, processors require sufficient working capital to buy crops when prices are lowest. Most cereal and oilseed crops are seasonal with an annual harvest, and processors must therefore buy an adequate supply for a full year's production. To buy a full year's supply at harvest time when prices are lowest, a high level of working capital is required, and this may make cash flow management more difficult than other types of agro-processing. If purchase of a year's supply at harvest time is not possible, changes in price and availability throughout the year may cause difficulties in financial management and production planning.

It is possible to part-process and store crops for later production by drying, by removing water using concentrated sugar syrups, by storing fruits in drums with a chemical preservative, or by storing vegetables with salt. Part processing makes raw materials available throughout the year and therefore evens out production 'peaks', but it has a number of disadvantages:

- money spent on crops is tied up for long periods before crops are processed and products sold, which may lead to difficulty in managing cash flow;
- larger buildings (and hence higher start-up capital expenditure) are needed to store intermediate products;
- capital expenditure on drums or other intermediate packaging can be substantial;
- staff require good inventory management skills;
- production planning becomes more complex;
- there is a risk of spoilage and financial loss if the intermediate products are incorrectly stored.

Intermediate storage is therefore a more expensive and higher risk option, and for this reason it is only practised by more experienced processors.

An alternative to part processing is to process a succession of crops throughout the year. However, this increases the complexity of production planning because a larger number of different ingredients, labels etc. need to be ordered in advance.

Figure 4: Example of a seasonality chart for selected fruits

	Month											
Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Banana	■	■	■	□	□	■	□	□	□	□	■	■
Pine-apple	□	□	□	□	■	■	■	■	■	□	□	□
Passion-fruit	■	■	■	■	■	□	□	□	□	■	■	■
Mango	■	■	□	□	□	□	□	□	□	□	■	■
Papaya	■	■	■	■	■	■	■	■	■	■	■	■
Tomato	■	■	□	□	□	■	■	■	■	■	■	■

■ = main harvest season, □ = crop available

There may also be more frequent changes to production methods, more complex inventory management and a greater level of managerial control required. When a succession of crops is processed, all inputs must be in place and equipment must be working properly at the start of the harvest season. This ensures that sufficient products can be produced to meet the expected demand until the next harvest. Any breakdowns or production stoppages during the harvest period would have serious consequences on profitability of the business for the following year.

Other problems that are specific to fruit and vegetable processing arise because many crops must be harvested when they are fully mature to give the best flavour and colour in products. However, many are soft when fully mature, and therefore more susceptible to damage. This causes moulds and yeasts to grow on fruits or rotting bacteria on vegetables, with a substantial increase in levels of wastage and financial losses. Additionally, damage to a few fruits or vegetables can quickly lead to infection of others and the loss of a whole batch. Staff is required to have good skills in storeroom management and correct processing to keep wastage levels low.

Estimating packaging requirements

The daily production rate is used to calculate the numbers of packages required as shown in the example below.

Example: Calculation of number of packs per day

If 125 kg of dried herbs are produced per day and packed into 30 g bags, and there are 25 bags in each cardboard display box:

$$\text{The number of bags required} = \frac{125 \times 1\,000}{30} = 4\,167 \text{ bags}^*$$

And the number of display boxes = 4 167/25 = 167 boxes

* A safety margin of 10% needs to be built in to allow for damage and loss

Depending on the types of products, processors may face significant problems in obtaining suitable packaging. Products that require glass bottles or jars (e.g. sauces, juices, wine, cooking oils, bottled fruits etc.) are difficult to produce if there is no glass factory in a particular country. Importation is expensive and the level of breakages during transport can be high. In these situations, processors may use plastic pots or bottles, but these may be inferior technically, and may not have the same consumer appeal as glass containers. Where suppliers exist, the minimum order size may be greater than the annual requirement of a small-scale processor, and such expenditure has a significant effect on the cash flow in a business. The lack of availability of specialist plastic films is a similar constraint on biscuit and snack food producers in many countries. Generally, flours are packaged in simple paper bags or sacks made from multi-walled paper, polypropylene, cotton or jute. These are more available and affordable.

Waste management and by-product use

Most types of food processing produces some form of wastes that must be disposed of without risk of local pollution, especially to water sources. There are two types of waste: liquid effluents and solid wastes. Examples of effluents that cause the most serious pollution are shown below (Table 4). Even at the smallest scale of production, responsible

entrepreneurs should install water treatment facilities to reduce environmental pollution. It may be necessary to consult authorities about local regulations, especially if large volumes of wastewater are produced or the processing unit is situated in a residential area. Solid wastes should be placed in bins and there should be a management system in place. This should remove wastes from the building as they are produced, rather than letting them accumulate during the day. In rural areas, composting treats solid wastes and in urban areas they are disposed of by local authorities in landfill sites.

Table 4: Processes producing polluting effluents

Process	Effluents
Brewing	Spent yeast suspension, caustic soda from bottle washing, wash-water
Meat and fish processing	Blood, suspended fats, wash-water, slurries of skin & tissues
Dairy processing	Milk, wash-water containing fats and proteins
Starch processing	Starch suspensions
Fruit and vegetable processing	Wash-water containing starch, pectin and sugars

Waste disposal is an operating cost to the processor, but in some cases the materials can be sold to generate an income. For example, the oilcake that remains after oil extraction has significant amounts of nutrients. This makes it a valuable animal feed, or in the case of hygienically produced groundnut and coconut wastes, a valuable food for humans. Similarly, bran that remains after hulling cereals is suitable for use in poultry or other animal feeds.

Maximizing the productivity of installed capacity

The 'installed capacity' is the maximum throughput that can be achieved with the available staff and equipment. The productivity of processes that are more highly mechanized, for example cereal milling and edible oil extraction, depends to a greater extent on the output of the machinery than processes that depend on staff skills, for example baking and meat processing. To achieve high productivity, the processor must ensure that machinery is properly maintained[5] so that it operates at the designed throughput and prevents breakdowns and downtime. In processes that require skilled operators, the management and organization of the enterprise and in particular the responsibilities and incentives given to staff, are more important in achieving high productivity.[6]

Other ways of improving productivity are:

[5] see chapter on "Managing Equipment"
[6] see chapter on "Managing People"

- reducing operating costs (e.g. reducing idle machine time and waste, increasing the amount of food produced by each operator per day);
- improving procedures for buying materials or changing suppliers of raw materials;
- changing the design or layout of the production facilities to reduce unnecessary movement of foods, staff, or equipment, and making as few journeys as possible to deliver products to wholesalers or retailers;
- finding buyers for waste or by-products;
- reducing energy use by switching off lights and electrical equipment when they are not being used or using solar water heating (e.g. for pre-heating process water or washing equipment).

To assess whether productivity improvements have taken place, it is necessary to keep records that include amounts of materials, labour etc. used in the production process. This information can then be used to calculate the amount of packaging, labour and energy per kg or unit of product. Results need to be compared to data calculated before productivity improvements were introduced.

3 Managing finance

There are two types of finance needed. The first is required before a business is set up and while the processing unit is being established. This is known as investment finance. The second type is required to meet the costs that arise during operation of the processing unit, and this is met by income from sales of products.

Investment finance

The costs incurred before production begins are known as 'start-up' costs, and include those associated with:

- preparation of a business plan;
- travel to obtain licences from authorities and the cost of licences;
- fees to architects, accountants, solicitors etc.;
- building work, supply of equipment and initial packaging and raw materials;
- testing of products;
- recruitment and training of staff.

Some examples of methods used to control investment costs are as follows:

- increase the amount of equity and reduce loan financing to reduce interest payments;
- investigate different options to reduce the cost of borrowing money;
- choose suppliers who offer the best price and quality;
- negotiate with suppliers for special offers, discounts or extended credit facilities;
- set budgets for different types of expenditure (e.g. product promotion, vehicle costs etc.) and do not exceed them;
- develop policies to follow up debtors regularly to shorten payment times and restrict the amount of credit that will be offered to customers.

Sources of finance

Processors need two main types of finance:

- capital for machinery, buildings etc.;
- working capital for some or all of the processing costs.

The most common sources of finance for micro-enterprises are personal money from the owner, or borrowing from family or friends. Investment by the owner is known as 'equity' (or 'internal') finance, and does not have to be repaid. Equity financing is usually from personal savings, or from profits or earnings from another job or business.

Borrowing from family, friends or banks is known as loan (or 'external') financing, and requires repayment. The people involved may also become shareholders in the business.

Small- or medium-scale processing businesses may require more finance than is available from family members or friends. In most emerging economies commercial banks charge high interest rates. This is despite the fact that both for them and the small- and medium-scale processors, the loans are relatively small. Banks claim that the higher administration costs of small loans are the reason for the higher interest rates. The result is that these types of loans are frequently not affordable by small-scale processors. The problem is well recognized in some countries, and special low-cost loans are made available to small enterprises by some NGOs and development banks. In some countries there are also informal associations that offer low-cost credit.

Another source of finance for processors is to seek shareholders who are willing to invest in a business. These are frequently unrelated to the business owner, but they are willing to invest because they can see a high return on their investment from either a share of the profits or payment of an annual dividend.

Both private investors and financial institutions are likely to require a processor to have a business plan to demonstrate the expected profitability and performance of the business. A business plan describes how the business will operate, and from a financier's viewpoint, it describes how the business intends to use the funds and how and when they will be repaid. The main components of a business plan are shown in Table 2.1.The time, money and effort involved in preparing a business plan are worthwhile because it increases the chances of obtaining external funding from financial institutions or shareholders. Further details of conducting a feasibility study and preparing a business plan are given in the references in Annex A.

Table 5: Main components of a business plan*

Component	Examples of aspects to include
Background to the business	Name, address and contact numbers of business owner, type of product(s) proposed. Any relevant experience of the owner.
Market analysis	Expected customers and consumers[7]. Type(s) of markets for the products, estimated present and potential demand, market segments that will be targeted, competitors, proposed market share. The main assumptions that have been made.
Site, factory layout and services	Location of proposed production unit and conditions at the site. Building plans and construction timetable. Description of plant layout and service requirements (power, water, fuel etc.). Any environmental impacts (waste production, air/water pollution, noise etc.).

[7] See Glossary for the difference between these two groups

Plant and equipment	Proposed production capacity, sources and costs of equipment, production inputs (raw materials, ingredients, packaging), other equipment (e.g. vehicles, office equipment). Machinery commissioning plans and timetable.
Staff	Production and administration staff (number of people and skills required) and training to be given. Staff recruitment plan/timetable.
Production and marketing plans	Production rates to meet identified demand, advertising and promotion, distribution methods, sales outlets, projected increase in demand.
Financial plan	Cost of site, equipment and buildings, working capital, (total investment cost), total production costs, sources of finance, cash-flow analysis, balance sheet, profitability calculations (rates of return, break-even analysis, sensitivity analysis).

*(Adapted from 'Opportunities in food processing'

Routine financial management

Calculating costs

Many small-scale processors do not attempt to find out what their production costs are, because they believe that it is too complicated or too difficult. As a result they have no idea whether they are making a profit or how much it is. However, when the different costs in a business are understood, it is a relatively straightforward procedure to calculate them. The calculations can also show which products are the most profitable and how expansion of their production would benefit the business.

For a business to operate successfully, it must be profitable over the long term. This means that the income must be greater than the total expenditure.

Gross profit = income – expenditure before taxes are paid

There are two basic ways to maximize gross profits. The first is to reduce expenditure, and to do this a processor must first identify where costs occur in the business. The second is to increase income, either by increasing the price of products, increasing sales of products, or by finding buyers for by-products that were previously discarded.

The costs incurred before production begins are known as 'start-up' costs. The costs of buildings, machinery and other equipment are known as 'capital costs', and the costs that arise during processing and selling the products are 'operating costs'.

Operating costs are categorized into two types: 'fixed' and 'variable'. Fixed costs (also known as 'overheads') are those that do not change if there is an increase or decrease in the amount of production. Examples include:

- salaries[8];
- rent;
- utilities (service charges for telephone, water and electricity)[9];
- interest paid on loans;
- some types of taxes;
- depreciation of equipment.

Variable costs change according to the volume of production. Examples include:

- raw materials and ingredients;
- packaging materials;
- salaries for operational staff;
- electricity, gas and water charges;
- fuel for vehicles;
- office materials.

Operating costs can also be described as 'direct' and 'indirect' costs. Direct costs are those that arise directly from the production process (e.g. materials and labour costs for production workers), whereas indirect costs include salaries for office staff and delivery drivers, vehicle costs etc.

[8] Fixed salary costs are those paid to staff and management disregarding to whether anything is produced or not.

[9] Although the use of water and power changes with the amount of production, there is usually a fixed charge paid to utility companies regardless of the amount used. In detailed financial planning this service charge is treated as a fixed cost and the remainder of the utility bill is a variable cost. However, in practice, many processors treat the whole bill as a variable cost.

Example: Calculating costs A small dairy has four workers and one supervisor. The working week is 48 hours and processing takes place for 45 weeks per year. 30 kg of cheese is produced in an average 8-hour day.		
Direct costs	**Calculation**	**$**
Salaries for 4 workers (@ $75 per month each)	= 4 x 75 x 12	3 600
Salary for one supervisor (@ $120 per month)	= 1 x 120 x 12	1 440
Total salary cost	= 3 600 + 1 440	5 040
Number of hours worked per year	= 48 x 45 x 5 staff = 10 800 hours	
Labour cost per hour	= 5 040/10 800	0.47
Direct labour cost per kg cheese	= (8 x 0.47)/30	0.125
Direct material costs (milk, rennet, packaging = $96 per day). Therefore direct material costs per kg cheese	= 96/30	3.2
Direct fuel and power costs are $6.3 per day. Therefore direct fuel/power costs per kg cheese	= 6.3/30	0.21
Total direct costs per kg cheese	**0.125 + 3.2 + 0.21**	**3.53**
Indirect costs		
These are as follows: Rent for dairy = $750 per year, telephone = $40 per month, utilities = $24 per month, delivery vehicle = $95 per month, maintenance and depreciation = $29 per month, interest on loan = $14 per month and taxes = $720 per year.		
Total indirect costs per day ($)	= (750/(45 x 6)) + (40/24) + (24/24) + (95/24) + (29/24) + (14/24) + ((720/(45 x 6))	13.87
Total indirect costs per kg cheese	= 13.87/30	**0.46**
Total fixed costs per kg cheese (Labour and indirect costs)	= 0.12 + 0.46	0.58
Total variable costs per kg cheese (Materials, fuel and power costs)	= 3.2 + 0.21	3.41
Total cost of producing cheese ($/kg)	**= 3.53 + 0.46**	**3.99**

These cost calculations should be included in a business plan and be regularly reviewed to take account of changes in prices for raw materials, utilities etc., to ensure that profitability is maintained. If a company makes a number of different products, calculating the production costs of each enables the owner to find out which are the most expensive and where costs might be reduced.

Apportioning indirect costs to multiple products

Where the time and materials required to produce and sell different products are similar, it may be reasonable to split indirect costs equally between them. If however, the overheads for one product are higher, or the production and sales are more diverse and complex, or the competition is stronger, it may be beneficial to use 'activity-based costing'. This more accurately assess the true level of indirect costs and involves identifying all of the indirect activities needed to make and sell each product and allocates an accurate cost for each. These costs are then added together.

Example: Activity-based costing
A cheese maker produces approximately equal amounts of cottage cheese and Cheddar cheese. Previously, overhead costs were allocated equally to each product, but an activity based costing exercise was carried out to determine whether the price for the cottage cheese could be reduced to make it more competitive. The indirect costs at each stage of production were found to be as follows:

Activity	Costs, $ p.a.		
	Cheddar cheese	**Cottage cheese**	**Total**
Milk procurement	450	450	900
Processing	375	120	495
Maturing	560	0	560
Packing	160	140	300
Storage of finished product	53	12	65
Distribution	220	220	440
Sales	130	90	220
Total	**1 948**	**1 032**	**2 980**
Previous allocation of overheads	1 490	1 490	2 980

The results indicate that the price of cottage cheese could be reduced by $458 p.a.

Calculating the price for products

The price charged for a product should ensure that the income meets all of the costs and generates sufficient profit. The simplest method to determine the correct price for a product is to add up all the costs of production and then add on a percentage profit (mark-up pricing). Many processors use a profit margin of 20–30 percent, although lower margins are possible if the efficiency and productivity of the business are high. Conversely, if a product has little competition and/or a high demand, a higher profit margin may be possible.

Example: Calculating the price of a product

Total production costs per kg cheese	= $4.44
Add 23% profit margin	= $1.02
Selling price ($/kg)	= $4.4 + $1.02 = $5.46/kg

This pricing strategy does not include the capital costs of the equipment used nor does it allow for the fact that the price of a product depends largely on what the market will accept and the price that competitors are charging. A judgement must therefore be made about how much a product can be sold for in a particular market and whether the costs of making it will produce an acceptable profit. A company should have a policy on how the prices of its products compare with those of its competitors. It may simply follow what competitors do, cutting or raising prices when they do (Competitive pricing). Alternatively, it may have a low-pricing policy to increase its market share, or a high-pricing policy to create a perception that its product is of better quality or is more prestigious than competing products.

It is important to know what customers are willing to pay (i.e. what the market will accept). Few customers buy solely on the basis of price, and the leading company or product in most markets is rarely the cheapest. Customers do not buy a product simply because it is cheap, and sometimes customers believe that a low price is evidence of low quality. They buy a product because of a specific want, and they may prefer to pay a higher price for an identical product if they perceive that the quality is higher. Other factors that influence the buying behaviour of customers include easy payment terms, friendliness of staff, or the availability of the product. It is therefore important to learn what motivates customers to buy a product, and to find ways to use this knowledge to both set the product price and use appropriate promotion and marketing techniques. Price is the most flexible element of the marketing mix[10] because it can be changed quickly and easily.

Other considerations may apply to specific products:

- a new product may be introduced at a special low price;
- the price of an old product that is facing increased competition from new or better products may be cut (or the product can be improved);
- the business may also consider how much demand may be reduced by increases in price (a product's price sensitivity or price elasticity of demand).

Pricing flexibility can give salespeople the discretion to vary the price for different customers. It also allows a different pricing policy in different markets: for example a low- or middle-price policy in the local town but a high-priced policy in the capital city where there is greater demand or because the market will bear it. On occasions, a company may price a product below production cost to reduce stocks or to gain a greater share of the market. In some countries the price for basic foods such as cooking oil or bread is controlled by legislation, and under these conditions processors must carefully manage production costs to ensure a profitable operation.

[10] See Glossary, Annex B

The following principles assist in setting a price:

- produce products for which there is a strong demand;
- be aware of current market prices and conditions and how these translate into product prices;
- know the break-even cost of production and marketing.

The following formula provides a more complex calculation of selling price that relates production costs, invested capital, the amount of food sold and profit required:

Selling price: $P = v + F/Q + r\,K/Q$

where P = selling price ; v = unit variable cost of the product; F = fixed costs; Q = quantity produced and sold; r = interest rate; K= invested capital

Some processors underestimate the importance of price setting and simply try to undercut their competitors. However, prices that are too low make little or no profit, and poor pricing can result in no money being available for effective marketing. Methods used to find information about markets, and promotion and marketing are beyond the scope of this booklet and readers are referred to the further reading section in the annex.

Simple methods for financial management

Financial management causes some of the most common and serious problems for many small-scale processors. Causes of failure include:

- over-spending;
- treating profits as personal income;
- incorrect costing of inputs and/or pricing of products;
- poor record keeping;
- too many debts or creditors.

To manage finances successfully, processors must have a good idea of how cash comes into a business, where it is at any time and where it goes. This requires financial records.

Record keeping

In some small-scale processing businesses, the owners keep all the financial information in their heads and write nothing down on paper. Some may be illiterate, whereas others believe that if they do not keep records they can avoid paying taxes. This is not usually successful, and if the owner falls ill, no one else will know what is happening in the business. The basis of good financial management is to keep and use records.

Keeping records is useless unless they are used to

monitor, evaluate and control a business

Processing enterprises at all scales of operation need to keep financial records. From these they know how much income from sales has been received, how much has been spent and for what purpose. Depending on the size and type of business, processors may also keep records of production, stocks, sales, staff, equipment maintenance, quality assurance and cleaning schedules.

The benefits of keeping records include:

- being able to analyse business finances to reduce costs;
- knowing how much profit/loss is made and whether a product range should be expanded or reduced;
- conforming to tax laws;
- knowing which customers owe money and how much;
- knowing who are the creditors of the business;
- detecting fraud or theft.

Copies of all records should be made, usually by using carbon paper under the page of a duplicate record book.

Records of income

When a customer buys products on credit (i.e. they do not pay immediately), the processor should give an invoice (Fig. 4) that has an individual number, the customer's name, the products that were bought and how much is owed.

Figure 4: Example of a page from an invoice book

INVOICE No. …… Date: .....
To: ……..
Address: …….
Order no: …….

Quantity	Products	$
…….	…….	….

Please settle this account within 30 days.
Signed ……
Manager

A delivery note signed by the customer can also be used to prove that items have been delivered in good condition. When the customer pays the bill, a receipt should be issued.

Figure 5: Example of a page from a receipt book

RECEIPT No..... Date:
Address:

Received from …….
The sum of $ ……
Being payment for: ……
$Cash □ Cheque no. □
Signed
Manager

A cashbook is used to record all transactions that are made in cash.

Figure 6: Example of a page from a cashbook

Cash income					**Cash expenditure**			
Date	Amount received	Customer	Products sold		Date	Amount spent	Seller	Materials bought
2.6.05	24.50	JC Stores	Pineapple juice					
					3.6.03	2.56	Mohammed stationery	Paper
6.6.05	12.00	Star shop	Tomato sauce		6.6.03	10.45	Market	Plastic bags

Each week or month, sales records are compiled from invoices and entries in the cashbook to show the total sales income.

Figure 7: Example of a sales record

Sales Year: 2003 **; Month:** April								
Date	Customer	Product type and amount	Invoice number	Date sent	Invoiced Amount ($)	Amount received ($)		Bank paying in no.
						Cheque no.	Amount	
8.4.03	JC Stores	12 * Tomato sauce	00265	1.4.05	15.00	23330	15.00	00038
10.4.03	JC Stores	20* Mango juice	00266	2.4.05	18.00	23410	10.00	00039
11.4.03	Star shop	5 * Tomato sauce	00267	9.4.05	6.25		6.25	00040

Records of expenditure

Order books have an individual number for each purchase, and together with cashbooks are used to record all expenditure made by the processing company. When goods have been paid for, the receipts should be kept in date order in a separate file.

Figure 8: Example of a page from an order book

Order No**.** Date: …….

To: …….
Address:.....

Please supply the following items and charge our account, quoting our order number in your invoice.

Amount Goods Cost ($)

……...

Signed
Manager

Records of purchases taken from the cash and order books are compiled each week or month and entered into an expenditure book to show how much money the processor has spent on materials, services or salaries.

Figure 9: Example of a page from an expenditure book

Expenditure year: 2003; Month: May									
				Amount ($)					
Date	Order no.	Cheque no.	Cash	Raw material	Ingre-dient	Office materials	Vehicle	Staff costs	Miscell-aneous *
2.5.03	00232	00394				21.30			
2.5.03	00233		10.25				10.25		
15.5.03								15.00	

* miscellaneous entries can include purchases that are made infrequently, such as machinery, office furniture etc.

A General Ledger contains a summary of all business income and expenditure in date order so that the owner can see the day-to-day activities of the business. It is based on a 'double entry' system, which has two parts, known as the 'debit' (in) part and the 'credit' (out) part. Every activity is entered in the ledger and has a date, a short description of the transaction, an identification number and the amount of money involved. However, double-entry bookkeeping is more complex than many small businesses require and a simplified recording system based on a sales book and an expenditure book may be easier to use and to understand.

Financial statements

Record keeping in micro- and small-scale enterprises often involves a simple single-entry recording system. This is based on a sales and expenditure book in which the date of a transaction, its nature, and the amount of money involved are recorded in different columns. Larger businesses use a double-entry system as described above.

Other financial statements used in a business include:

- bank statements to show bank account transactions;
- balance sheet statements, which show the financial position at a particular time;
- cash flow statements, which show the increase or decrease in available cash at a particular time;
- profit and loss accounts;
- break-even analysis.

The financial position of a business is presented in a balance sheet and the operating results are displayed in a profit and loss statement. These financial statements show the past performance of the business and are used to project what might happen in the future.

There are two categories of accounting information:

- financial accounting for the public, shareholders, customers, suppliers, creditors, regulatory bodies or tax authorities: this includes the financial position, liquidity[11] and profitability of an enterprise;
- managerial accounting for internal use within the business: this includes the relationship between production costs, profits and sales volumes, productivity, pricing decisions, capital budgets etc).

A balance sheet shows the company's value, providing information about its assets, liabilities, and owners' equity at a particular time. Assets can be current assets (those that the owner could convert into cash) and include products in stock, cash and any short-term investments; or fixed assets. These include land, buildings, machinery, vehicles, furniture, and fixtures. They also include patents and trademarks. Liabilities are obligations to others, including creditors and employees. Current liabilities are those that the owner expects to pay within a short time, including salaries, taxes, short-term loans and money owed to suppliers. Long-term liabilities are debts such as long-term loans. When a business is operated by a single owner or as a partnership, the balance sheet may show the amount of each owner's equity. When shareholders own the business, the balance sheet shows the amount originally invested by the shareholders, and the amount reinvested from income (i.e. retained earnings that are not distributed to shareholders as dividends).

Figure 10: Example of balance sheet

Assets	**Amount ($)**	**Liabilities ($)**	**Amount ($)**
Cash Debtors Stocks Machinery Less: prepaid expenses		Creditors Loan Dividends Taxes owed	
Total assets			
Total liabilities			

A cash flow statement is similar to an income and expenditure statement, but also indicates the flow of money in and out of the business and whether the business is generating profits or making losses.

[11] The ability to convert assets to cash

Figure 11: Example of a cash flow statement

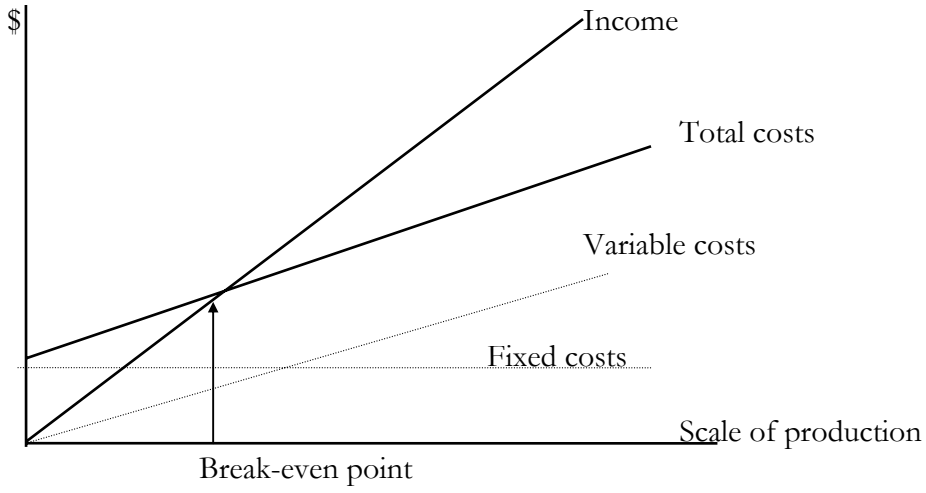
Month	1	2	3	4	5
Cash inflow:					
Balance b/f*		(350)	(200)	400	550
Sales		2 000	2 350	1 800	2 000
Equity	2 500				
Total income	2 500	1 650	2 150	2 200	2 550
Cash outflow:					
Investment	1000				
Expenditure	950	950	950	950	950
Rent	200	200	200	200	200
Labour	200	200	200	200	200
Stock	500	500	400	300	200
Total expenditure	2 850	1 850	1 750	1 650	1 550
Net cash flow	*(350)*	*(200)*	*400*	*550*	*1000*

* b/f = brought forward)

A break-even analysis is used to determine the production level at which revenues are equal to the costs incurred. (i.e. the business is neither making a profit nor loss). The level of production should always be above this level to ensure that the business is profitable.

$$\text{Break-even point (no. of units)} = \frac{\text{Total fixed costs}}{\text{Unit selling price - Unit variable costs}}$$

Figure 12: Break-even analysis



Example: Calculating the break-even point

A business sells a pack of bacon for $4.95 and the total fixed costs are calculated at $260 per day. The unit variable cost is $2.65 per pack.
The break-even point = $260/day / ($4.95/pack-$2.65/pack) = 113 packs per day
The maximum bacon production level is 350 packs per day, and the break-even point expressed as a percentage of the volume of production is therefore = (113/350) x 100 = 32%.

Managing finances

Successful processors not only keep and analyse records of their finances as described above, but also take active steps to reduce costs and maximize their income. Some examples of methods used for cost control are:

- train staff to prevent wastage of materials and to have a high productivity;
- set budgets for different types of expenditure (e.g. product promotion, vehicle costs etc.) and do not exceed them;
- negotiate with suppliers for special offers, discounts or extended credit facilities;
- choose suppliers who offer the best price and quality;
- check income and expenditure records each week and follow up any anomalies;
- increase the amount of equity and reduce loan financing to reduce interest payments;
- investigate different options to reduce the cost of borrowing money;
- follow up debtors regularly to shorten payment times and restrict the amount of credit that is offered to customers;
- minimise the amounts of materials held as stock.

Of the methods described above, negotiating with suppliers is an area in which all businesses can reduce their expenditure. Savings can be made in purchases of raw materials, packaging, office stationery and all other inputs by competitive bidding, buying from wholesalers, negotiating lower prices and ensuring timely deliveries and higher quality. Good working relationships with suppliers and written contracts all help to improve productivity.

Management methods that increase income include:

- increasing the demand for products using advertising and promotions based on the results of market research;
- increasing the production capacity of existing equipment (to both increase productivity and reduce fixed costs as a percentage of total costs);

- investing in improved packaging to add value to a product and relocate it upmarket, where a higher price can be achieved.

Managing working capital

Many small businesses concentrate on maximizing profits by increasing sales and reducing production costs and overheads. However, too few companies consider the importance of managing working capital. This can make the difference between business survival and failure. Many profitable processors fail because they are not able to pay the bills.

Working Capital (or 'net current assets') includes:

- stocks of raw materials, part-processed foods and finished products awaiting sale;
- amounts owed to the business by customers for sales made on credit;
- cash in the bank.

Strategies to improve working capital include:

- increase credit lines with suppliers i.e. amounts owed by the business to suppliers of raw materials and services;
- set budgets and monitor actual expenditure against them;
- control stock levels and minimize the amounts of materials held as stock;
- check the credit worthiness of customers and improve credit control methods (e.g. follow up debtors regularly to shorten payment times and restrict the amount of credit that is offered to customers);

Example: Improving working capital

An analysis of a small fruit processing business shows that it holds stocks of juice that are equivalent to 90 days' sales, worth $2 400; it offers 60 days' credit to customers and has $3 000 outstanding in unpaid bills and $500 in the bank. It also owes $1 500 to creditors who have a 30-day credit limit. The total amount of money tied up as working capital is therefore: 2 400 + 3 000 + 500 +1 500 = $7 400.

The problems with this situation are numerous. Stock is expensive to keep and the high stock levels require larger warehouse facilities, higher rent and electricity etc. and there is a higher chance of stock becoming damaged or stolen. If debtors are allowed a longer period for payment, there is a greater chance that debts will turn into bad debts, or they will take more effort and cost to collect. This is in addition to the costs involved in financing the working capital. By using improved management of working capital, the company could make the following savings:

- reduce stock levels to 30 days' worth of sales, valued at $800, to release $1 600.
- insist that customers pay within 30 days (the same as the credit limit offered by suppliers) and release $1 500, so halving the working capital tied up as debts.

This increases the amount in the bank from $500 to $3 600 - money that has previously been used to finance the extra stock and debtors. It also saves on the costs of warehousing and bad debts. This money could then be invested (e.g. a return of 12% p.a) would earn an extra $432 profit in a full year), or it could be used to finance improved marketing of the juice.

4 Inventory management

Advantages and limitations of keeping stocks

The stocks held by processors include raw materials, ingredients, packaging materials, spare parts for machinery and finished products. In some types of processing, there are also stocks of part-processed foods also known as goods in progress. An example is fruits that are processed during harvest time to preserve them and then held in stock until they are used throughout the year to make juices, pickles, jams, sauces or wines.

The benefit of holding stocks is that materials are always available when they are needed and there is no risk of a production stoppage caused by a shortage. Similarly, if stocks of products are held, an order can be met without delay. This gives an improved service to customers, which may gain a processor an advantage over competitors. However, because value is added to foods as they progress through a process, the value of stocks of finished products is higher than other stocks. The disadvantage of keeping stocks is therefore that money spent on them is tied up for many weeks until they are used. This may cause cash flow difficulties if there is a large expenditure to buy the materials. For some materials that deteriorate over time, storage as stock may result in spoilage causing losses, and for others there may be wastage or theft.

The relative costs and benefits of holding stocks of materials therefore depend on a number of factors including:

- the cost of the material;
- the cost of storage (e.g. additional building space or electricity for cold storage);
- the minimum order size from a supplier;
- the amounts that are used each week;
- the available cash in the business;
- the time or distance needed to visit a supplier and the cost of transport;
- the likelihood of suppliers having materials in stock (reliability of supplies);
- seasonality of crop supplies.

There is therefore a range of options from keeping no stocks to always keeping an adequate supply in store. An example of one end of this range is small-scale meat and dairy processors, who do not keep stocks of raw materials because they are relatively expensive to buy, they are highly perishable and they require refrigerated storage, which is also expensive. At the other end of the range, processors who use salt or sugar are able to keep large stocks because these materials are readily available, low cost, and do not deteriorate or require special storage conditions. Some packaging materials are expensive to buy, may not always be available from suppliers and often have a large minimum order size. Keeping a stock of packaging is therefore a major investment for many processors.

Deciding on stock levels

One method of estimating the size of stocks to be kept is the ABC analysis (also known as 'Pareto' analysis). First, different types of stocks are placed into one of three categories: category A - stock items that have a high value but low volume (i.e. there are relatively few but they are expensive); category B - stock items that have a medium value and a medium volume; category C - stock items that have a low value but high volume (i.e. there are many items but they are cheap).

Table 5: Different categories of stock in an ABC analysis

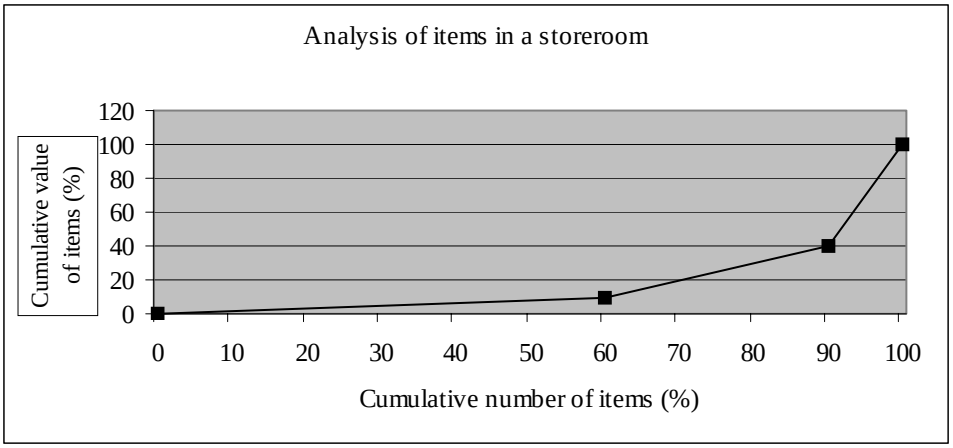
Classification	% of total value	% of total units
A	60	10
B	30	30
C	10	60

From the table, stock controllers can see that items in Category A should be stored and handled carefully, but Category C items are less important and can be controlled in a more relaxed way. If the data in Table 6 are revised to accumulate the percentages and add a "dummy" row where both percentages are set at 0%, the data can be plotted as a Pareto curve.

Table 6: Different categories of stock in an ABC analysis shown as accumulating percentages

Classification	Cum. % of total value	Cum. % of total units
	0	0
A	60	10
B	90	40
C	100	100

Figure 14: Pareto curve showing value and number of items in a storeroom



This type of exercise makes it obvious to processors which stock items are responsible for the majority of the inventory cost and this helps inform decisions on the levels of stock to hold.

In order to achieve high productivity, process inputs should be ordered and received in good time, in the correct amounts and of the right quality. Many micro-scale processors buy small quantities of materials from retailers when they are needed, because their cash flow is insufficient to buy larger amounts for stock. However, this is more expensive than buying in bulk from wholesalers because the unit cost charged by retailers is higher. This approach also increases the risk of lost production due to an intermittent supply if the retailer runs out of stock. Where supplies of ingredients and packaging materials are unreliable, processors are therefore forced to buy larger amounts of stock to protect themselves against shortages. The dilemma for small-scale processors is to either suffer a negative cash flow or risk disruption to production. The problem can be addressed by adequate financing of the business, such as taking a phased loan to pay for inputs over a period of time and build up a stock of materials until an adequate cash flow is achieved.

Storeroom management

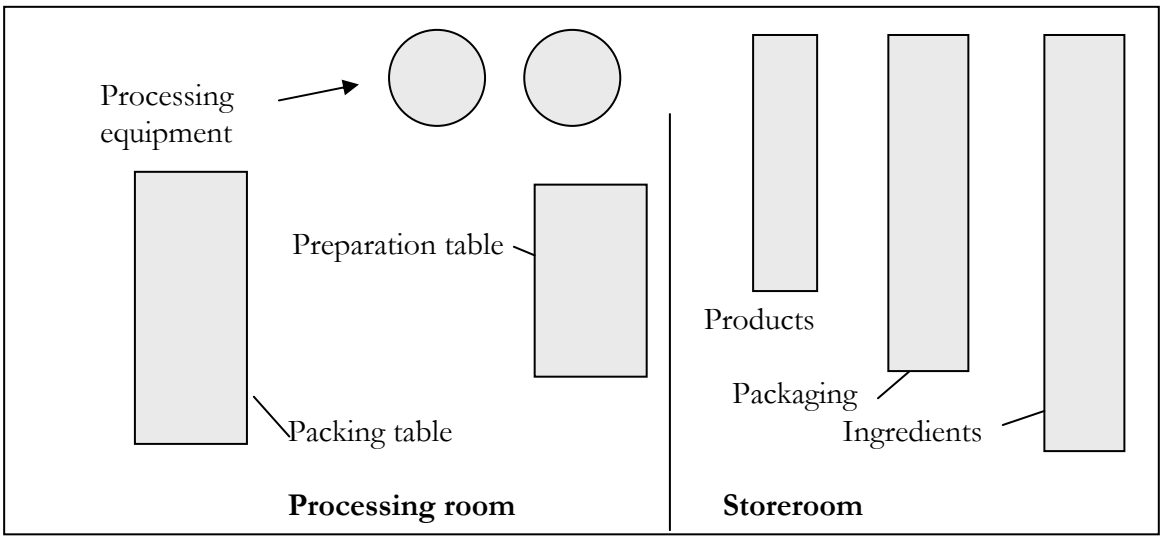
Part of the financial management of a processing enterprise involves knowing the amount and value of stocks that are held. Depending on the type of stock, checks are made daily (for work in progress and finished products), weekly (cash, raw materials and perishable ingredients), monthly (ingredients that have a long shelf life) or annually (facilities in the processing room, spares for machinery and equipment). Stocktaking sheets are used to record the following details:

- the date when the checks were made;
- types of stock;
- amount and value of the stocks;
- who did the counting and who checked that the results were correct.

Results of stock checks should be compared to production records or maintenance records to ensure that all materials are accounted for. If evidence of theft is found, the frequency of stocktaking should be increased and management of the storeroom changed (e.g. the staff member responsible for ordering materials should be different to the person who records stocks or their use in production).

The management of stocks should also ensure that materials are used before their quality deteriorates. This is most easily done using a FIFO (first in first out) system, and storeroom shelves should be designed to assist this. For example, shelving can be positioned so that staff have access to both sides. They are then trained to place new stock at the front of the shelves and remove stock for use in processing from the rear of the shelves.

Figure 15: Layout of storeroom and processing room



In large or complex processing operations, a Stores Requisition Card is used to record the issuing of stock from a store. This helps to prevent theft and assists in stock management, but is likely to be unnecessarily complex for a small-scale operation. However, simple bin cards may be useful.

Figure 16: Example of a bin card

Bin Card
Item: ……

Date:	Quantity/ received	Quantity issued	Balance in stock
	…...	…...	…...
……	……	……	……
……	……	……	……

Signed
Manager

Individual bin cards are fixed on each container of material in a storeroom for easy identification of different ingredients, work in progress and finished goods. Waste or spoiled foods can also be recorded in this way. Another method, used particularly to identify materials that have a short shelf life, is to use coloured cards.

Other aspects of food storeroom management include checking that there is adequate protection against rodents and insects, and that stores are regularly cleaned to ensure that any spillages do not attract pests. Cleaning should be monitored and controlled using cleaning schedules. These should record who is responsible for the cleaning, the time required and the expected standard of cleanliness to be achieved. This is especially important in finished product stores, where rodents spoil products overnight, causing significant financial losses. A supervisor, manager or the business owner needs to check that the cleaning is satisfactory.

5 Managing people

Of all the different resources needed to operate a small processing enterprise, the staff are the most important because they have unlimited potential if they are properly trained, managed and motivated. However, owners of small businesses frequently overlook this and they recruit friends, relations or neighbours to work in the business. This may be because owners feel that these people are more trustworthy, but they may not have the best skills for the jobs that need doing. Likewise, many small business owners refuse to train their staff because they think that a more skilled worker will ask for higher pay, or they will be tempted away by a competitor. Both attitudes are short-sighted, and the correct selection of staff and investment in their development are keys to the success of a small processing business.

Human resource planning or staff planning refers to methods used to decide the numbers and types of staff that are needed to run a processing enterprise. This is first based on the intended production volumes and an assessment of which parts of the process are mechanized and which require manual operation. A processor can use the same methods to decide when it is time to bring in more workers by analysing the workloads of existing workers and comparing them to new production targets.

The numbers of staff required for other types of work, including sales, deliveries to retailers, accounts/record keeping and quality assurance are then considered. A convenient way of planning this is to draw an activity chart (see Chapter 2), which shows the type of work to be done, the number of people involved and the sequence of work that individuals do during the day.

When the total number of employees has been decided, the business owner should then set about recruiting, training and managing suitable staff in a systematic way. This requires the owner to develop policies and employment conditions that attract and keep competent staff.

Recruitment

Before starting to recruit new staff, it is important that the processor prepares a job description for each job. This helps in deciding exactly what type of work the new person will be expected to do, and what skills, qualifications or experience are needed to do the job. This can be written simply as a 'person profile'.

Figure 17: Example of a person profile used in recruitment of new staff

Person Profile Date: …….

Job: Sales Assistant

Essential requirements:

- education to Standard 6;
- good arithmetic skills (without calculator);
- friendly disposition and good communicator.

Desirable requirements:

- two years' experience in retail sales;
- flexibility in working hours.

Jobs are then advertised in newspapers, radio, by public notices, by recommendation of friends or through other employees. The owner then compares applications with the criteria in the person profile and selects potentially suitable people for interview. Business owners should also operate a policy of not discriminating against applicants because of their sex, religion, race or age. Interviews are useful for a number of reasons: they help show the personality, communication skills and any hidden abilities of the applicant; they can be used to reveal decision-making or technical skills; and they give the applicant a chance to understand the job and what will be required of them.

After an applicant has been selected, a letter should be sent, confirming the appointment and when the person should start work. The new employee should be given an employment contract, containing the job description and details of the salary and other benefits (e.g. holidays, assistance with transport to work etc.). For most countries, the law requires a medical examination for workers who handle foods to ensure that they have no illness that could be passed on to consumers and cause food poisoning.

Training and staff motivation

It is important to introduce new employees to the business, so that they get to know the workplace and other staff, and quickly become productive. This can either be done formally using an induction course, or less formally by a supervisor or owner taking them around the factory to introduce them to fellow workers and to explain the work. New staff should also be given any company literature such as promotion leaflets or advertisements, and samples of products.

Many small-scale processors prefer to recruit staff that are relatively inexperienced, and then train them in the particular methods that are used in their process. They believe that this is not only cheaper (because inexperienced workers are paid a lower salary than experienced ones), but also because they can be trained from the beginning to do their job in the way that the owner wants it to be done. However, it is important that training is

planned, so that the correct skills, attitudes and techniques are built up in a systematic way. 'On the job' training is popular with small-scale processors because new employees are working and producing products while they are being trained by more experienced staff. Specialist courses are available from college or university departments and from some international development agencies. There are often subsidies or grants available to small enterprises from government institutions or development agencies for training and staff development. Details of training techniques are beyond the scope of this booklet, but examples of successful approaches to training in food processing are given in a reference in Annex A.

A characteristic of successful businesses of any size is that they have workers who are willing to work for the company because they feel that they have a future with it – in other words the staff are motivated. As a minimum, the owner should ensure that staff are reasonably paid, their salaries are paid on time, and that there are good working conditions. However, an even more important motivating factor is that staff can see what their part is in the business, and how their own individual activities can help the enterprise achieve success. When staff are supported in their work by the enterprise owner, they are more likely to be motivated and improve their productivity. Other benefits that keep workers motivated include:

- housing, travel or medical allowances;
- a contribution to the cost of educating their children or medical bills;
- subsidized meals or the ability to buy products at a reduced cost;
- reasonable working hours with time off to attend special family occasions or visit health centres.

Staff management

The relationship between the owner and workers in micro- and small-scale businesses is frequently based on instruction and command, with the managers having an authoritarian role within a defined hierarchy. Union membership is uncommon and individual employees are notified of their salaries and working conditions by the owner or manager. More recent management methods are more participative and open. The aim is to promote cooperative relations between the management and staff and to avoid the often adversarial behaviour in traditional industrial relations. If successful, employees become more committed to their long-term future with the business. Modern staff management requires different measures including:

- involving employees in business decisions;
- relating pay to an employee's performance;
- carefully recruiting and training, as well as fair treatment;
- integrating staff management policies with other policies such as production, marketing, and sales.

Good management involves motivating staff to achieve their best performance. This means giving employees a clear understanding of the aims of the business and how each person can help to achieve company goals. Providing necessary tools, skills and

working conditions and resources to enable workers to do their jobs properly is also essential. The owner can do this by setting clear targets for the amount of work and the quality standards that employees are expected to achieve, by assessing performance fairly, by giving constructive criticism when improvements are needed, and by rewarding successful employees with increased responsibilities.

Some tips on good management style are:

- involve staff in decisions on any changes to their work and consult regularly with them;
- enforce discipline firmly but fairly;
- set achievable deadlines or targets, and check on progress regularly;
- give credit for initiative and intelligence, and show appreciation for a job that is well done;
- discuss weaknesses with individual staff members and make suggestions on how to improve.

Relating pay to performance is another way of motivating people. Although some small-scale businesses offer overtime payments or pay staff on a piecework basis (i.e. workers are paid per pack of food produced), more commonly it is a fixed rate of pay for a particular job. In newer management methods, the pay varies according to an individual's performance and/or the profitability of the business. This involves a regular appraisal of each employee's performance and development of a clear profit-sharing scheme. Everyone should know how he or she would benefit from bonus pay arising from an improvement in the performance of the business. An alternative for limited companies is to offer employees shares in the company, which should be held for several years. These help bind the staff to the long-term development of the company. Both profit sharing and employee share schemes mean that the workers are also sharing some of the risks in the operation of the company with its owner.

Modern staff management methods are also known as human resource management (HRM). Methods aim to employ people who can operate flexibly and adapt to different jobs or changing work arrangements, instead of having rigidly defined job descriptions. Also in larger businesses, employee relations become the responsibility of all managers, not just personnel managers. Personnel matters are usually integrated with other areas of the company, including marketing, sales, production and others.

Experience has shown that businesses with modern staff management methods have higher productivity than those with authoritarian-style staff management.

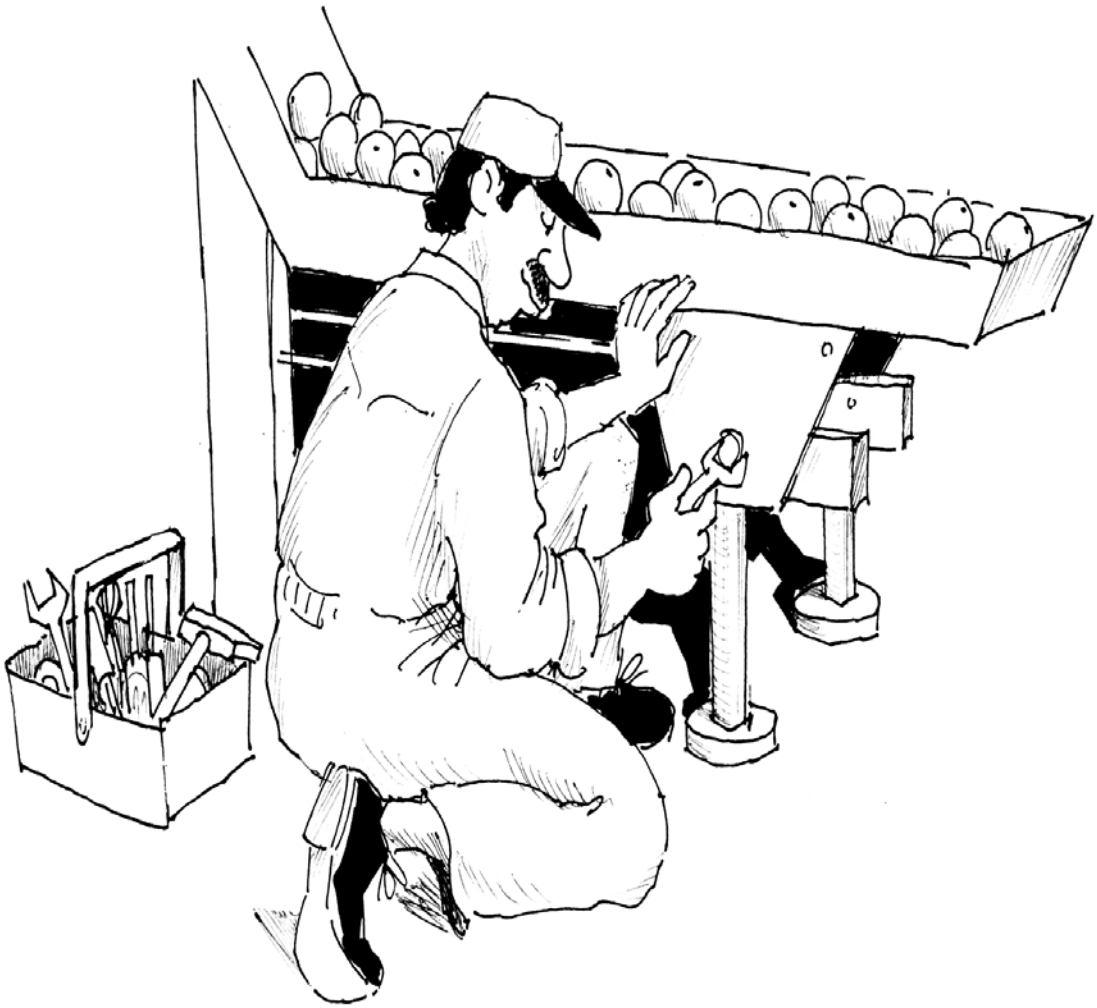
Health and safety

All processors have a responsibility to provide safe and healthy working conditions for their staff to prevent illness or injuries at work. This is a legal responsibility in some countries, but even if laws do not exist, it is in the processor's interest to avoid accidents or poor working conditions. The costs of prevention are smaller than the cost of damage to equipment, medical or legal fees, increased insurance premiums, or losing skilled staff due

to permanent disability arising from injuries. Also, a safe and healthy working environment enhances the public image of the business. The main dangers in food processing are burns from equipment operated at high temperatures, cuts from moving blades, injuries caused by powered machinery, and an unhealthy environment caused by dust, fumes or smoke. Part of an owner's responsibility is to ensure that machinery operates safely and that guards are in place, equipment is regularly maintained, and that staff are properly trained in its use.

Staff records

Different types of records are needed to keep information on employees and their jobs. Personnel files are records of the performance of individual employees at work, their salaries, promotions, holidays, correspondences from labour ministries or income tax offices, P.A.Y.E contributions etc. Register books are used in some larger businesses to record attendance and time keeping, but these are rarely needed for small-scale operations.



6 Managing equipment

Poorly maintained machines are a potential hazard to operators, produce substandard products and can contaminate products with metal fragments. Proper maintenance ensures that machinery operates correctly and safely and prolongs its life, thus reducing capital and operating expenditure. A common reason for lost production is delays caused by equipment breakdowns and waiting for spare parts. This causes a processing unit to operate at below planned capacity and reduces its profitability.

Example: Effect of machinery breakdowns on plant utilization and profitability

At full capacity, the output from a maize mill is 4 000 kg/day, and the total production cost of the flour is calculated as $1 600 per day, comprising $1 000 fixed costs and $600 variable costs. All the flour can be sold for $0.75/kg.

At full capacity, the income = 4 000 x 0.75
= $3 000 per day
and the profit/loss = 3 000 - 1 600
= $1 400 profit per day.

However, if machinery breakdowns halve the output of the mill (to an average of 2 000 kg/day),
the income = 2 000 x 0.75
= $1 500
The fixed costs remain the same ($1 000) and variable costs are halved ($300)
The profit/loss = 1 500 - 1 300
= $200 profit per day.

Most small-scale producers do not keep a stock of spare parts because of the cost, but few producers have compared the cost of keeping a stock of spares with the cost of delayed production. This is especially important if delivery times for spare parts (e.g. for imported equipment) are several weeks. In most processes, a few items of equipment are likely to wear out more quickly than others (e.g. cutter blades, motors or bearings, heating elements etc.). The processor should identify these priority spares for each process, and ensure that a spare component is always kept in stock. A spares record is useful to keep track of expenditure on spares in larger businesses (Fig. 18).

Figure 18: An example of a spares record

Type of spare:				
No. purchased	Cost	No. in stock	No. used	Date fitted

Similarly, many small-scale processors do not have a programme of planned maintenance to replace parts before they wear out. They believe that it is cheaper to continue using a machine until it breaks down and then repair it. Decisions regarding the costs and benefits of planned maintenance depend on the speed at which repairs can be done, the value of the spares that have to be held in stock and the value of lost production caused by stoppages. Processors should monitor the equipment, and as their experience of the rate of failure accumulates, they should service the machine before a replacement part is needed. Arrangements can be made with a local mechanic to repair equipment as a priority, if the processor pays an annual service fee or guarantees that they will handle all such work.

Table 7: Example of planned maintenance in a flourmill

D A I L Y	**Mechanical** • check and grease bearings, replace if faulty; • check pulley wheels for cracks or chips and replace if necessary to avoid damaging belts; • check bolts and nuts for tightness; • check the oil level in diesel engines and top up with the correct oil if required; • remove flour dust from equipment each day. A build-up of dust causes rust to develop and on electrical equipment it causes moving parts to jam.
	Electrical • clean flour dust off motors and other electrical equipment. • for machines not in use, switch off mains power This is very important when power cuts occur, because when power returns a machine that has been left on can injure an operator or cause a fire.
	Housekeeping • store tools and equipment in pre-determined places so they are easy to find and it will be noticed if they go missing; • always keep walkways clear of tools and equipment; • clean diesel engine cooling fins every day to prevent dust settling and causing the engine to overheat and eventually seize; • when re-fuelling diesel engines, pour the fuel through a filter to prevent rust deposits in the fuel drum getting mixed with the fuel and damaging the engine; • clean the machinery and floor.

Table 7 continued

WEEKKY	• check hammers for wear and replace if necessary; • check the shaft (especially if locally manufactured machines are not tested for strength or alignment); • check that locking nuts on the shaft are tight; • check that fan bolts and nuts are tight. If they work loose, the fan becomes very dangerous. • check the bearing mountings as this area is prone to cracking; • check the engine oil and oil filter on diesel engines and change them every 160 working hours; change the fuel filter every 320 working hours.
MONTHLY	• check the body casting and welds for cracks; • tighten floor nuts and look for any cracks in the mill foundation; • check the fan key and make sure that the fan is a slide fit on the shaft for easy removal. If the blades are worn always replace with the correct thickness of steel and then check for balance. • check that cables are secured and there is no obvious sign of insulation breakdown. • check the acid level in batteries that are used to start diesel engines. Keep the terminals clean.

A maintenance schedule shows how often a machine should be serviced, gives details of what should be done during the service, and how the machine should be dismantled and re-assembled.

Management of maintenance therefore involves identifying the priority equipment and preparing a maintenance budget in order to implement the maintenance schedule. Staff should be trained to routinely check machinery during operation, and to undertake the maintenance schedule. The results should be written down so that the cost can be evaluated and to check whether the schedule prevents breakdowns.

Maintenance records

Maintenance and repair records provide information on the performance of equipment, and maintenance costs that are included in calculations of operating costs.

Figure 19: Maintenance and repair records

Date	Work carried out	Time spent	Cost of labour	Parts used	Cost of parts

Depreciation of equipment[12]

Equipment gradually wears out when it is used, and depreciation is a method to accumulate sufficient funds to buy a replacement at the end of its working life. When a machine, a vehicle or office equipment is purchased, the processor should estimate the number of years that it is expected to last before it requires replacement (or its expected working life). The value of the equipment is then divided by this time, and the depreciation figure is included in the annual company accounts.

Example: Linear or straight line method of depreciation

When a meat processing business is established, the following equipment was purchased:

Equipment	Value ($)	Expected working life (years)	Depreciation per year ($)
Delivery vehicle	15 000	10	1 500
Bowl chopper	8 000	15	533
Refrigerator	2 500	15	167
Stainless steel tables	500	25	20
Hand tools (knives, sharpeners etc.)	120	5	24
Sausage stuffer	1 500	15	100
Mixer	1 200	15	80
Office furniture and equipment	400	25	16
Total	29 220		2 440

Example: Straight-line method of depreciation
A new delivery van is bought for $21 000. It is estimated to have a life of 5 years with a residual value of $2 000. Using the straight-line method, the annual depreciation is:

$21 000 - $2 000 = $19 000/5 = $3 800 per annum. The balance sheet value of the vehicle would be reduced by the same amount each year.

Reducing balance method

In this method, the depreciation in the early years of an asset's life is higher than in later years and the asset is written off using the same percentage each year. It can be expressed as a formula:

[12] also see the chapter on Managing Finance

Depreciation (%) = (1 – n R/C) x 100

where:
n = life of the asset in years
R = residual value of the asset
C = cost of the asset

Example: Reducing balance depreciation
A machine is bought for $8 000 and has a life of 4 years. A 40 percent charge is made each year, so in the first year the depreciation is 40 percent of $8 000 ($3 200), which reduces its book value to $4 800 (8 000-3 200). In the second year the depreciation is 40 percent of the book value ($4 800 x 40%) - i.e. $1 920 – and so on over 4 years.

Example: Reducing balance depreciation
Equipment is bought for $2 500 and it is expected to last for 6 years and to have a residual value of $200. Using the formula:
Depreciation % = (1 – 6 x 200/2 500) x 100%
= (1 – 6 x 0.08) x 100%
= (1 – 0.48) x 100%
= 52% - i.e. a rate of 52% would be used.
The effect of applying 52 percent to the reducing balance is that around 70 percent of the asset is written off in the first 2 years of its life.

Sum of digits method

This is a variation of the reducing balance method and also charges higher depreciation in the first years of the asset's life.

Example: Sum of digits method
If a machine is bought for $12 000 and has a $1 000 residual value after 4 years
Sum of digits: 4 years + 3 years + 2 years + 1 year = 10

Year 1: 4/10 x (12 000-1 000) =	$ 4 400	Cumulative charge	= $ 4 400
Year 2: 3/10 x (12 000-1 000) =	$ 3 300		= $ 7 700
Year 3: 2/10 x (12 000-1 000) =	$ 2 200		= $ 9 900
Year 4: 1/10 x (12 000-1 000) =	$ 1 100		= $11 000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7 Managing quality

It is necessary for processors to standardize the quality of their products and also ensure that they are safe to eat. This is because consumers expect foods to be nutritious and produced hygienically, and also because there are serious penalties for those who contravene hygiene and food safety legislation. Quality Assurance (QA) is an essential component of production planning, and is used to predict and control the quality of a product before, during and after processing. To implement a QA system, the owner should work with staff to identify where factors exist in a process that could affect either product quality or safety. They then develop measures to monitor and control these risks.

For safety, a component of QA named 'Hazard Analysis and Critical Control Point' (HACCP) involves the following stages:

- identify potential risks (or 'hazards') in a process and assess the level of risk;
- design and implement procedures for monitoring and controlling hazards;
- train all staff in the procedures;
- develop appropriate monitoring and reporting procedures.

Most small-scale processors need advice on how to do this from professionals such as staff at the Bureau of Standards, a university or manufacturers' association. During development of a QA system, processors should identify sources of contamination, the effect of contamination on the process and product, and the probability of micro-organisms surviving the process and growing in the product. Examples of factors that should be examined in a process are the formulation of ingredients, the types of micro-organisms that may contaminate the raw materials, the acidity or moisture content of the product and any preservatives that are used. Monitoring and control procedures can then be developed to prevent contamination.

The parts of a process that affect product safety and their controls are known as 'Critical Control Points' (CCPs). The processor sets a target for each control point and also the limits (or tolerances) that will be allowed (Figure 6.1). An essential part of a QA scheme is checking that targets are achieved. It is also necessary for a processor to decide:

- who is responsible for checking that CCP targets are being met;
- who ensures that they are doing it properly;
- how are the results of checks recorded;
- what to do if CCPs are not within tolerances?

Figure 20: Example of a quality assurance record

QA record **Refractometer solids**

Product: Pineapple jam. Target: 70% solids

Date	Sample number	Solids (%)	Action taken	Signature
……	……..	…….	…….....	……
……	……..	…….	…….....	……

Staff should be trained in conducting QA checks during production, and in what decisions they should make if a target is not met (e.g. inform the owner or put the food to one side until a decision is made). It is important for results to be recorded so that the processor can be sure that the product is of good quality when it is sold (e.g. in the event of a customer complaint).

Other components of a QA plan include:

- cleaning schedules for buildings and equipment to prevent contamination;
- cleaning procedures to remove wastes from processing rooms as they arise;
- planned maintenance of equipment to prevent parts falling off into foods;
- training operators in correct personal hygiene and food handling techniques.

Proper cleaning of equipment, floors, tables etc. is essential to all food processing and this can be monitored and controlled using cleaning schedules as part of a QA plan. The schedule records:

- which cleaning jobs are allocated to each worker;
- the time required;
- the cleaning materials involved in doing each job;
- the expected standard of cleanliness to be achieved.

The worker should initial the schedule report when a cleaning job is finished and checked and it should then be countersigned by a supervisor, manager or business owner.

Figure 21: Process chart showing potential hazards and CCPs in sauce production

Stages in process	Potential hazards	Level of risk and measures to address risks	CCPs
Fruit Wash/ Sort	Mouldy fruit, contamination with soil, leaves etc.	High risk: mould contamination could affect flavour and shelf life of product. Moderate risk: extraneous matter such as insects could contaminate product if not removed during inspection.	No mouldy fruit or insect contamination.
Peel	Seeds and skins not removed	Low risk: cosmetic faults in fruit, other contaminants that would be removed later in the process.	No peel or seeds in product.
Pulp			
Mix	Contamination of spices with dust, moulds, bacteria or foreign bodies. Correct pH of mixture	High risk: shelf life depends on correct mixture of acid, salt and sugar. Ingredient weight should be checked. Moderate risk: contamination of spices. Remove mouldy items and other contaminants during inspection and washing. High risk: incorrect pH. Product depends, in part, on acidity for preservation. Check pH.	Correct ingredient weights +/- 5%, correct pH +/- 0.2 units, no mouldy or contaminated spices.
Heat	Insufficient heating	High risk: adequate heating needed to destroy enzymes and contaminating micro-organisms and produce required consistency in product. Check time and temperature of heating.	Heating at 100°C for 20 minutes +/- 5 minutes.
Fill/seal	Faults in glass Inadequate seal	High risk: faults in glass could injure consumers. Check by 100% inspection of bottles. High risk: faulty seal on cap could allow re-contamination. Check caps are correctly sealed.	No glass faults. No faulty cap seals Fill weight 305g +/- 5g (Net weight on label = 300g)
Pasteurize		High risk - inadequate pasteurization results in spoilage during storage.	Pasteurize at 88°C +/- 2°C for 20 minutes +/- 1 minute.
Cool Label/store			

Table 8: Checklist of quality procedures

DAILY	• check raw materials; • check processing conditions; • check packaging materials, fill weights and quality of seals; • clean processing equipment and factory floors; • clean toilets and washrooms
WEEKLY	• check equipment for loose or worn parts ; • clean storerooms and other non-production areas; • check and clean drains; • send protective clothes to laundry ; • check stocks for signs of damage.
MONTHY	• clean windows; • check machinery for service requirements; • do full stock check of ingredients and packaging materials; • check measuring equipment to ensure it is accurate.
YEARLY	• review QA procedures, staff training and recording systems to ensure that they remain appropriate to the needs of the business.

The requirements for different types of food processing vary according to the nature of the product and the process. For example dairy and meat processing require the highest levels of hygiene and sanitation, whereas those that have a lower risk (e.g. oil extraction, milling or baking) have a lower requirement that can be met by good housekeeping.

8 Sector-specific guidelines for business management

The differing requirements of the four types of processing described in this chapter arise in part from differences in the stability of the raw materials before processing. Oilseeds and cereals have a long storage life, whereas fresh fruits, vegetables, and especially animal products, have a much shorter storage life. Fruits and vegetables cannot be stored for later production without some form of pre-treatment, and animal products must be fully processed immediately. Processing must take place quickly after harvest to prevent spoilage, and this requires more careful work organization and production planning than are needed for cereal or oilseed processing. Oilseeds, nuts, cereals and many fruits and vegetables also have a single harvest season each year, and processors require sufficient working capital to buy crops when prices are lowest. The implications of these differences are described in this chapter for each of the four product groups.

EDIBLE OIL EXTRACTION

Raw material supply and production planning

The main crops for small-scale oil extraction are nuts (e.g. groundnut, coconut, shea nut and palm kernel), oilseeds (e.g. sesame, sunflower and mustard seed), and oil palm fruit. Other types of oilseed are not usually processed at a small scale.

Specific quality problems in oil processing are concerned with immature crops and/or inadequate post-harvest storage. Small-scale farmers require an income from their crops as soon as possible to pay debts and to buy farming inputs for the following year. This causes some to harvest the crop before it is fully mature. For others, a lack of knowledge of post-harvest processing and storage, together with financial pressures to sell the crop as quickly as possible, mean that oilseeds and nuts are not properly dried or stored.

Immature crops have both lower oil content and a lower oil yield when processed. Nuts and oilseeds that are improperly dried and stored have higher moisture contents, which permit mould growth. Contamination of nuts and oilseeds by moulds produces a musty flavour in the oil, and some species of moulds produce a range of poisons, collectively known as 'mycotoxins'. These have no taste and may be eaten without knowing that the oil is contaminated. Aflatoxins are a common type of mycotoxin, and cause kidney and liver damage, cancer or bleeding in the brain and lungs. Adequately drying crops and storing them in structures that keep them dry prevent mycotoxin contamination.

Contracts with farmers enable processors to have greater control over the quality and price of their raw materials. A contract enables the processor to explain quality requirements to farmers and to ensure that post-harvest handling and storage is done correctly. Contracts also increase the likelihood of an assured supply of raw material, and this makes production planning easier. However, for contractual agreements to work, both parties must keep their side of the bargain, and this requires a high level of trust and understanding.

Production management and finance

Except at the smallest scale of micro-enterprise in which oil may be extracted manually, oil processing is mechanized, using either presses or expellers. Processors therefore require greater start-up capital than most other types of agro-processing. This reliance on extraction machinery also means that management of maintenance and a spares inventory are important aspects of operating this type of business. The numbers of staff are smaller than some types of agro-processing, but training is required to correctly operate and adjust presses and expellers in order to achieve maximum oil yields.

Most crops are seasonal with an annual harvest, and processors must therefore buy an adequate supply for a full year's production. A high level of working capital is required at harvest time when prices are lowest, and this may make cashflow management more difficult than some other types of processing. If purchase of a year's supply at harvest time is not possible, changes in price throughout the year may cause difficulties in financial management and production planning.

There is a high demand for cooking oil in most countries, and it is a valuable product that can command high prices. Therefore, provided that the processor ensures a high quality product, sales income can be more confidently predicted than for some other products. However, in some countries the price for oil is controlled by legislation, and processors must carefully manage production costs to ensure a profitable operation. Speciality oils (for cosmetics or food applications) have a higher value than cooking oil, and diversification of production to include an income component from these oils may be required to make production profitable if cooking oil prices are controlled.

A major problem for processors in some countries is availability and cost of suitable packaging materials. Oils should be packaged in moisture proof, airtight and lightproof containers, but coloured glass bottles or suitable types of metal or plastic cans are often expensive and/or difficult to obtain. Where suppliers exist, there is frequently a minimum order size that is greater than the annual requirement of a small-scale processor, and such expenditure has a significant effect on the cashflow in a business.

By-product use

The oilcake by-product that remains after oil extraction has significant amounts of protein, and other nutrients, which make it a valuable animal feed. Selling the by-product generates additional income, and in the case of groundnut and coconut, the by-products can be used for human food if hygienically extracted. Sales to bakeries or other food processors can generate significant levels of income. In countries where the price of oil is controlled, this may make the difference between profitable operation and losses.


apples
apples
apples
apples

FRUIT AND VEGETABLE PROCESSING

Raw material supply and production planning

All fruit and vegetable processing inputs must be in place and equipment must be working properly at the start of the harvest season, so that crops can be processed to produce sufficient product for the following year. Any breakdowns or production stoppages during the harvest period would have serious consequences on profitability of the business for the following year.

It is possible to part-process and store intermediate products for later production, by drying, by removing water using concentrated sugar syrups, by storing fruits in drums with a chemical preservative, or by storing vegetables with salt. Part-processing makes raw materials available throughout the year and therefore evens out production 'peaks', but it has a number of disadvantages: money spent on crops is tied up for long periods before crops are processed and products sold, which may lead to negative cash flows; larger buildings (and hence higher capital expenditure) are needed to store intermediate products; capital expenditure on drums or other intermediate packaging can be substantial; staff require good inventory management skills; production planning becomes more complex; and there is a risk of spoilage and financial loss if the intermediate products are incorrectly stored.

Intermediate storage is therefore a more expensive and higher risk option, and for this reason it is only practised by more experienced processors. An alternative to part-processing is to process a succession of crops throughout the year (see chapter on production planning. However, this increases the complexity of production planning because a larger number of different ingredients, labels etc. need to be ordered in advance. There may also be more frequent changes to production methods, more complex inventory management and a greater level of managerial control required.

Other problems that are specific to fruit and vegetable processing arise because most crops must be harvested when they are fully mature to give the best flavour and colour in products. However, many are soft when fully mature, and therefore more susceptible to damage. This causes moulds and yeasts to grow on fruits or rotting bacteria on vegetables, with a substantial increase in levels of wastage and financial losses. Additionally, damage to a few fruits or vegetables can quickly lead to infection of others and the loss of a whole batch. Staff therefore require skills in storeroom management and processing to keep wastage levels low.

Damage to fruits and vegetables also arises during harvest and transport to the processing unit, but processors often have no control over these operations. It is advantageous therefore for the processor to contract farmers and advise them of harvest methods that improve the quality of raw materials. See chapter 1 for more details.

Production management and finance

Processors should have their own vehicles to collect crops, but this clearly increases start-up costs and capital, although operating costs may be reduced compared with payments to commercial transport operators. Fruit and vegetable processing also requires a plentiful supply of clean water and facilities for disposal of large amounts of wastewater. This increases capital costs (for water treatment plants) and where water charges are made, it also increases operating costs. Depending on the range of products that are produced, processors may face significant problems in obtaining suitable packaging.

Products that require glass bottles (sauces, juices, wine, bottled fruits etc.) are difficult to produce if there is no glass factory in a particular country, because importation is expensive and the level of breakages during transport can be high. In these situations, processors may use plastic pots or bottles, but these may be inferior technically, and may not have the same consumer appeal as glass containers. Where suppliers exist, the minimum order size may be greater than the annual requirement of a small-scale processor, and such expenditure has a significant effect on the cash flow in a business.

At small scales of operation, fruit and vegetable processing is often less mechanized than oil or cereal processing, but equipment must be constructed from stainless steel because acids in fruits corrode mild steel. Small machines may be used for cutting fruits or packaging products, but the main investment is in boiling pans, fermentation vessels etc. The start-up and capital costs of fruit and vegetable processing are therefore lower than many other types of agro-processing providing stainless steel construction facilities are available. If they are not, this is a major constraint on development of fruit and vegetable processing enterprises. Correspondingly, staffing levels may be higher and training in technical skills and staff management requirements may be greater than with oil or cereal processing.

CEREAL MILLING

Raw material supply and production planning

The main types of crops that are milled at a small scale are maize, rice, sorghum, tef and millet, using either hammer mills or plate mills. Wheat is milled using roller mills, which are considerably more expensive and generally not affordable by small-scale millers. As in oilseed processing, the main problem facing small-scale millers is to ensure an adequate working capital to buy raw materials for a full year's production, and the negative effect that this has on the cash flow of the business. There may also be similar problems of immature crops and poor post-harvest handling and storage that cause mould growth. Contract farming offers benefits to millers, including an assured supply of grain and easier production planning because of guaranteed supplies, reduced uncertainty over the cost of grain, and better understanding by farmers of millers' quality requirements. Whereas cooking oil is a high value product, the value and sales income from flour is much lower, and good production planning is needed in a flourmill to reduce production costs.

Production management and finance

At all scales of operation, cereal milling is mechanized, using either hammer mills or plate mills, together with dehullers and seed cleaners. Millers therefore require greater start-up capital than some other types of agro-processing. The main operating considerations are:

- management of maintenance and keeping a stock of spare parts to prevent breakdowns and production stoppages;
- training staff to ensure high product quality; and full utilization of staff and machinery to maximize productivity.

The numbers of staff are smaller than some types of agro-processing, but training is required to correctly operate and adjust mills and dehullers to achieve the correct grade of flour and to maximum productivity. Generally, flours are packaged in simple paper bags or sacks made from multi-walled paper, polypropylene, cotton or jute, which are available and affordable. Bran that remains after de-hulling cereals is suitable for use in poultry-feed or other animal feeds. Selling the by-product generates additional income and contributes to the profitability of a mill.

MEAT AND DAIRY PROCESSING

The products made by small-scale meat processors include sausages, hamburgers, pates, bacon, hams, dried meats, meat pies and kebabs. In addition to pasteurizing or boiling milk, dairy processors make yoghurt and cultured milks, butter and ghee, cheese, and ice cream. Both meat and milk are highly perishable and can only be stored for a short time before processing. They are known as 'high-risk' products and can be easily contaminated by food poisoning micro-organisms. An important management consideration in running both a dairy and meat processing business is therefore to minimize the risk of contamination of products.

Raw material supply and production planning

In most countries, both meat and milk are available throughout the year, and although there may be changes in the amounts produced during for example a dry season, meat and dairy processors do not have the same problems of seasonality that other processors have to plan for. If the supply of meat is not assured, its highly perishable nature means that bulk buying for later processing is not an option for small-scale processors, unless large freezers are available. Most small-scale meat processors buy carcasses from a local slaughterhouse, where there is often no temperature control after slaughter. To minimize public health risks, processors should carefully inspect the quality of raw meat and ensure that it is cooled as quickly as possible after purchase. The quality of a carcass can have a major influence on profitability. For example, animals that have a low carcass weight have a higher ratio of bone to meat than well-fattened animals and the yield of useable meat is lower. An important management role is therefore inspection of each carcass that is purchased.

Milk is often supplied via a complex collection network, in which supplies from individual farmers are pooled at collection centres and then cooled for distribution. Processors should be confident that the centres have adequate controls in place to ensure the quality of milk, cool it as quickly as possible, and prevent adulteration or dilution of the raw milk. At larger scales of operation, processors may purchase their own vehicle to collect milk and reduce the risk of contamination. The main cost in dairy processing is the milk, and purchasing it directly from farmers with fixed price contracts or price incentives to supply high quality milk with minimal contamination can help to control this.

Production management and finance

Meat processing has higher start-up and capital costs than many other types of food processing because of the requirements for refrigerated storage and specialized equipment, including bowl choppers and mincers, smokers and sausage stuffers that are relatively expensive. Dairy processing has similar requirements for refrigerated storage, and depending on the products, may require expensive cream separators or pasteurizers.

However, micro- and small-scale dairies can be equipped with low-cost equipment for the production of yoghurt, cultured milks, butter and cheese.

The building costs for dairies and meat processing units are higher than other types of agro-processing units because of the need to have separate cold rooms for incoming meat or milk, and for finished products. There should also be separate areas for preparation (e.g. boning and trimming meat) and production of finished products. Both meat and dairy processing rooms must be constructed to a high standard, using materials that are easily cleaned (e.g. wall and floor tiles) and this increases the capital costs when getting started.

An important management role is to ensure that meat and dairy processing takes place under conditions of strictly enforced hygiene. Cleaning schedules should be devised and inspections made, with time and materials budgeted to ensure that cleaning is done properly. Another important management role in both meat and dairy processing is control over the cold chain[13]. Processors should seek the agreement of vehicle drivers and retailers on their role in the safety of the cold chain, to ensure that the product temperature does not rise during distribution and display at retailers. Waste management is important because both meat and dairy wastes are highly polluting. Solid animal wastes (skin, bones and trimmings) and liquid effluents (blood, wash-water or used brines that contain small meat particles and fat) should either be discharged to the municipal drains or stored in plastic drums that can be taken to a municipal drainage site. At larger scales of operation, processors should have their own treatment plant, which increases capital costs.

The main operating costs are for raw materials, labour (especially skilled butchers) and energy for refrigeration and ice production. Financial control measures include:

- training staff to minimize meat or milk wastage;
- reducing energy costs by routine checking of refrigeration temperatures;
- enforcing rules over leaving cold room doors open etc.;
- minimizing losses and costs related to the short shelf life of the products (e.g. caused by unsold stocks of products or returned goods).

[13] A cold chain is a system of transporting, storing and selling foods at chilled or frozen temperatures.

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