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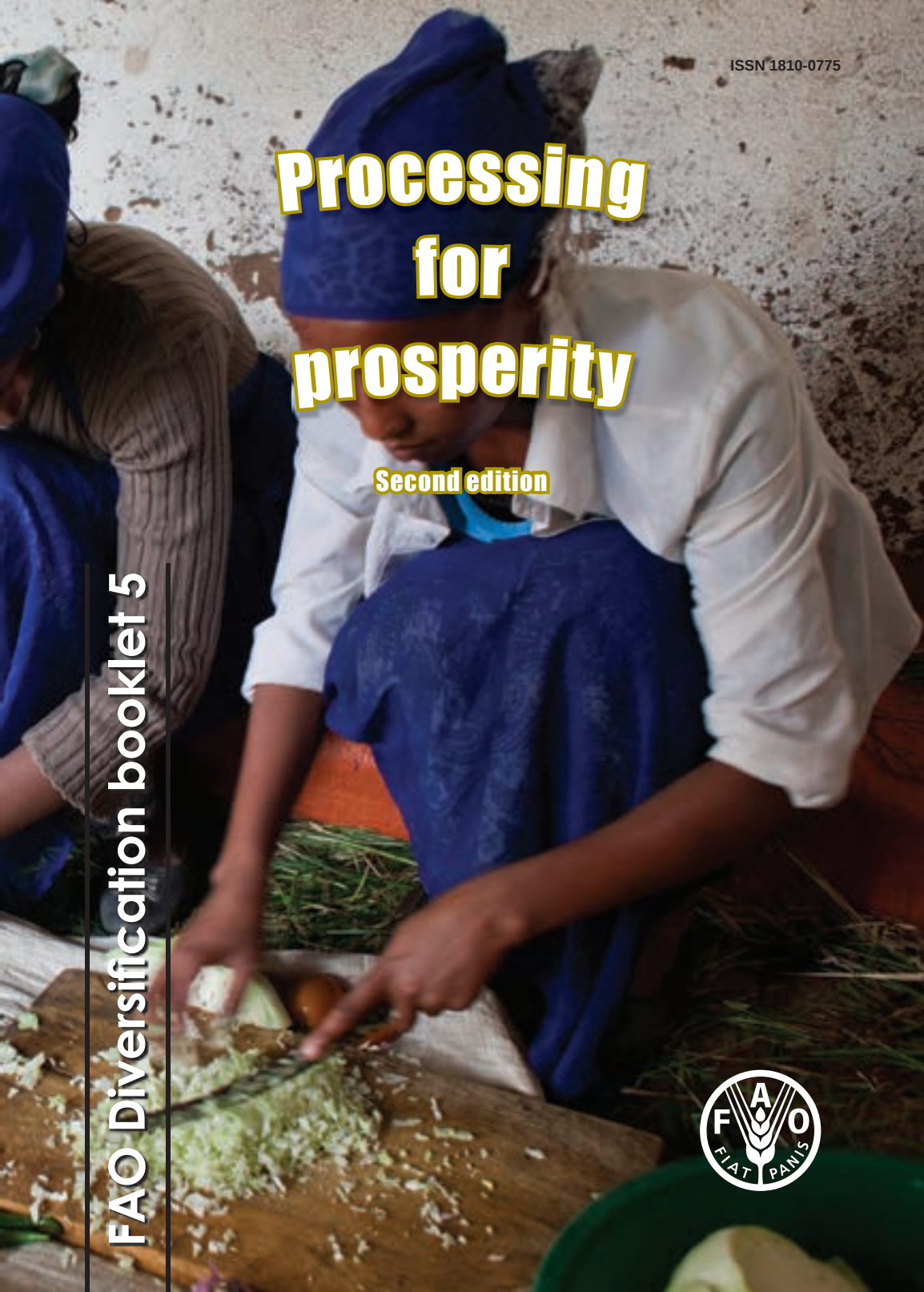
Processing for prosperity

Second edition

FAO Diversification booklet 5



Diversification booklet number 5

Second edition

Processing for prosperity

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Preface

The purpose of the FAO Diversification booklets is to raise awareness and provide decision support information about opportunities at farm and local community level to increase the incomes of small-scale farmers.

Each booklet focuses on a farm or non-farm enterprise that can be integrated into small farms to increase incomes and enhance livelihoods. The enterprises profiled in the FAO Diversification booklets are suitable for smallholder farmers in terms of resource requirements, additional costs, exposure to risk and complexity. The products or services generated by the enterprises are suitable for meeting demand on a growing, or already strong, local market and are not dependent on an export market. However in this particular booklet, export markets are also considered as international trade in processed foods, in particular snack foods, can affect local markets and potential does exist for smallholders to export products under certain organizational schemes such as Fair Trade.

The main target audience for these booklets are people and organizations that provide advisory, business and technical support services to resource-poor small-scale farmers and local communities in low- and middle-income countries. It is hoped that enough information is given to help these support service providers to consider new income-generating opportunities and how these might enable small-scale farmers to take action. What are the potential benefits? What are farmer requirements and constraints? What are critical 'success factors'?

The FAO Diversification booklets are also targeted to policy-makers and programme managers in government and non-governmental organizations. What actions might policy-makers take to create enabling environments for small-scale farmers to diversify into new income-generating activities?

The FAO Diversification booklets are not intended to be technical 'how to do it' guidelines. Readers will need to seek more information or technical

support, so as to provide farmer advisory and support activities relating to the introduction of new income-generating activities. To assist in this respect, each booklet identifies additional sources of information, technical support and website addresses.

A CD has been prepared with a full series of FAO Diversification booklets and FAO technical guides, together with complementary guides on market research, financing, business planning, etc. Copies of the CD are available on request from FAO. FAO Diversification booklets can also be downloaded from the FAO Internet site.

If you find this booklet of value, we would like to hear from you. Tell your colleagues and friends about it. FAO would welcome suggestions about possible changes for enhancing our next edition or regarding relevant topics for other booklets. By sharing your views and ideas with us we can provide better services to you.

Acknowledgements

I would like to thank the large number of small-scale food processing entrepreneurs in Africa, Asia and the Caribbean who have freely given their time and expertise over the years, sharing with me their experiences of the problems and successes of operating their processing enterprises, and in doing so, contributing to the success of others.

Peter Fellows

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Introduction

Food has been processed for thousands of years in every region of the world providing distinctive traditional processed foods that are well suited to the local climate, the socio-economic conditions and cultural traditions. These traditional foods can have a high local demand and may attract people from other areas who travel to buy them, helping farmers develop local food businesses. These small-scale operations can be a major source of employment and diversified income.

Food processing brings many benefits to small-scale farmers. It slows down the natural decay of foods, preserves them for extended periods and acts as a reserve against times of shortage, increasing food security. It adds value to crops and animal products and provides farmers with a portfolio of diverse products. Farmers can sell processed foods out of season when prices are higher, creating opportunities for additional income generation and this also enables earning income over a longer period then solely at harvest time. It also creates special foods for cultural or religious occasions, thus reinforcing social and cultural identity, as well as adding interest, variety and choice to the diet.

Existing skill levels within the farming family are normally sufficient to start a household-scale food processing enterprise as they will derive from traditional culinary knowledge. The technologies that are used for household-scale production are simple, easily adaptable and assimilated, cost effective and capable of being used with minimum training. However in some cases it will be necessary to train small-scale farmers in processing skills, especially in terms of improved food hygiene, quality and safety.

Examples of the types of processing that are possible at this scale include fruit farmers making jams, chutney and other sugar preserves, fruit juices or fruit syrups (see also FAO Diversification booklet No. 16 *Fruit products for profits*); vegetable farmers making vegetable pickles (see also FAO Diversification Booklet No.2 *Livelihoods grow in gardens* and FAO Diversification booklet No. 11 *Growing vegetables for home and market*), livestock

BOX 1 **Advantages of food processing compared to other income-generating activities**

- Many types of food processing are readily accessible to farming families. People are familiar with the food that they grow and eat and, compared with some other types of business, there are fewer aspects to learn when getting started.
- Small-scale food processing is particularly suitable for women, who may be the specific intended beneficiaries of development programmes.
- The crops or animals that are the raw materials for processing are readily available to farming families.
- If chosen correctly, processed foods can have a good demand and offer the opportunity to generate high profits by adding value to raw materials.
- The high added value means that farmers can earn a reasonable income from relatively small scales of production.
- Small-scale production requires levels of investment in equipment and materials that are affordable to farmers. For many processes, existing domestic kitchen utensils are suitable as a starting point for small food processing businesses.
- When production expands, local metal workshops or carpenters are able to manufacture many types of processing equipment, thus creating additional employment and income-generating opportunities.
- Most types of small-scale processing have few negative environmental impacts when properly managed.

farmers making yoghurt (see also Diversification booklet No. 6 *Milk for health and wealth*) or dried meat strips, such as biltong, cereal farmers making flat breads or biscuits, beekeepers collecting and processing honey from their hives (see also FAO Diversification booklet No.1 *Beekeeping for sustainable livelihoods*).

The type of processing that is described in this booklet is known as 'secondary processing'. This type of processing transforms harvested and slaughtered farm products or products that have been minimally processed (refereed to as 'primary processed products') into food products that are ready for immediate consumption. Readers who are interested in learning about opportunities for small-scale farmers in 'primary processing', for example drying crops, milling cereals and extracting cooking oils from oilseeds, should read the accompanying second edition in this series: FAO Diversification booklet No. 4 *Value from village processing*.

Processed foods

Secondary processing of foods can include:

- Bakery products and flour confectionery.
- Confectionery products, honey and fruit syrups.
- Dairy products (milk, butter/ ghee, cheese, cream and dairy confectionery).
- Dried and smoked foods, including dried fruits, vegetables, meats, and smoked meats and fish.
- Fruit and vegetable preserves and pickles.
- Alcoholic and non-alcoholic beverages (fruit juices and wines, squashes and cordials).

These products are likely to be suitable for processing by large numbers of farming families in different areas of the world. They meet the requirements of:

- Readily available raw materials.
- Relatively low investments required in equipment and skill development.
- A high consumer demand.
- High added value.

Most of these foods, if processed appropriately, also have a low risk of causing food poisoning

FIGURE 1 Making jam in a small-scale enterprise
(Photo: FAO/21862/A. Proto)

compared to other types of processed foods. Other processed foods that are suitable for farming families to make are described in the accompanying booklet in this series FAO Diversification booklet No. 18 *Selling street and snack foods*

Although farming families, like every other family, prepare processed foods for their own consumption, there are important differences between producing foods for family members and processing them for sale. Advisers should work with farmers to carefully select the method of processing and the types of processed foods that can produce maximum benefits with minimum risks.

All types of food processing have some similar basic requirements: there must be a demand for the processed food; the foods must be safe to eat and they must have a quality and price that can compete with other similar products. Within these broad considerations, there are a number of livelihood strategies that can be adopted by small-scale farmers, which depend on the type of animal or crop that they farm; their levels of skills, knowledge and expertise; the amount that they are able to invest in a new processing venture; and the support that is available to assist them.

Purpose of the booklet

The booklet is intended to raise awareness about the opportunities that exist for farmers to diversify their sources of income by starting a processing enterprise. It is intended to provide information so as to help and support advisers, government officials, community leaders and development agency staff to initiate programmes intended to promote food processing as a diversification enterprise for small-scale farmers. The booklet is not intended to provide technical 'how to' information and this can be found by readers following up the sources in the sections on *Selected further reading* and *Sources of further information and support* at the end of the booklet.

Processing and livelihood opportunities

Market potential

Many families eat processed foods as part of their daily diet. These may be such foods as cured meats, relishes that accompany meals, including pickled vegetables, chutneys, yoghurt, etc., or occasional special treats, such as cake or dairy confectionery. These foods are bought from a wide variety of retail outlets, including urban and rural shops, urban supermarkets, roadside stalls and itinerant vendors. There is also a large demand for processed foods from food service outlets, including cafés, bars, takeaways, hotels and restaurants. The opportunities for farmers to sell processed foods are therefore many and varied.

In rural areas, consumers are often characterised as having small amounts of disposable income because of high levels of poverty. However, there are often large numbers of poor consumers and their small daily purchases can combine to produce a very large demand for processed foods.

Farmers situated in peri-urban and urban areas have access to urban consumers who have a different set of requirements: the rise in cost of living in most urban centres has resulted in both adults in a family needing to go out to work to earn sufficient income to pay rent and other living expenses. It has also reduced the numbers of families that employ domestic help to cook meals. These trends have increased the demand for processed foods because the family has less time available to prepare meals each day. By supplying urban centres farmers have a ready market for their products that is potentially many thousands of customers (see FAO Diversification booklet No. 18 *Selling street and snack foods*).

Where small-scale farmers are able to sell processed foods directly to final consumers, and hence become part of the retailing sector, they may in certain circumstances have a competitive advantage because of the shorter supply chain between production and consumption, which can possibly translate into lower prices and/or higher profits. In some countries, traceability of processed foods back to their source of production is becoming important to consumers and this can offer farmers another competitive advantage.

FIGURE 2 Processed food products for sale in a small food retail shop
(Photo: FAO/19848)

Income benefits

Processing spreads income from sales over a larger proportion of the year as farm products are not only sold at harvest time. The enterprise therefore produces a more regular flow of cash into the farm household. Processing also means that more of the crop/livestock can be used, for example, over-ripe fruits that are not saleable in fresh form can be used to make jams or fruit syrups. This reduces waste and can thus increase quantities of farm produce sold.

A portfolio of various processed products means that there are more opportunities for selling and hence generating income. The more options that are available to sell the greater is the reduction in marketing risks. A diversified product portfolio also enables small-scale farms to tap into various and different markets, for example local rural markets, urban markets, retail markets, etc., and hence potentially be able to earn more income. Moreover processing adds value and allows the small-scale farmer to move 'down stream' in the supply chain and earn more of the consumers' 'food dollar'.

Being in direct contact with consumers and/or retailers, provides opportunities of knowing what processed products are liked and disliked the most. This information will enable the farmer to market popular products and provide more opportunities of earning income. This will also enable more accurate estimates of what to grow, process and sell, what not to sell, and what are the potential opportunities of earning income from different crops and livestock. Moreover by meeting with customers and/or retailers regularly can help develop a farmer's sales network.

However it must be clear that earnings will be directly related to the level of investment in a processing enterprise. A 'kitchen' processing enterprise cannot earn the same income as a small-scale processing enterprise.

The income earned from the processing enterprise can be used to buy more diverse foods and provide a more varied diet for the farm family. It can also be used to provide health care when needed, pay school fees and other normal family expenses or those incurred on special occasions, such as the costs of weddings and other festivities.

Overall diversified selling options and increased income sources that depart from the common harvest-sale cycle enable a greater sense of security, a safety net in hard times, a good source of money for savings or re-investment in the enterprise, as well as more purchasing power for the farm family.

Improved quality and safety of foods

Product quality is affected by the type and condition of raw materials, the processing conditions, the amount and type of handling before, during and after processing, the packaging and the storage conditions for processed foods. This means that everything, from growing the food; through handling and transport to storage of ingredients; preparation and processing of the foods; and their packaging and storage; should emphasise maintaining the quality and safety of the product - from farm to fork (further details of hygiene, safety and quality requirements of foods are given in the section *The livelihood enterprise*).

Processing, if carried out properly, can enhance the quality and safety of foods as well as its shelf-life. This provides

opportunities for improved foods for farm families, but also and importantly for consumers. Consumers consider eating quality to be the main factor when buying processed foods, after price. For foods to have a good demand they should fit in with traditional eating habits and cultural expectations of texture, flavour, taste, colour and appearance. Nutritional quality (for example, protein content, vitamins and minerals, etc.) is also an important consideration for some foods, especially those intended for young children, the sick or the elderly. Processing provides nutritional characteristics of foods to be preserved over time. An important element of processing is thus food quality and safety: all products must be safe to eat, and not risk poisoning or injuring consumers.

FIGURE 3 Quality starts in the field: An extension worker demonstrating the difference in quality of respective potato harvests
(Photo: FAO/19865/R. Jones)

Increased involvement in the supply chain

Involvement in a food processing enterprise allows farmers to move further down the food supply chain to develop contacts with buyers in retailing and other market sectors. This involvement can address a lack of entrepreneurial skills among farmers and it enables interactions with other businesses that build networks outside the farmer's normal community. Selling foods in urban areas may also provide important information to small-scale farmers on opportunities to sell their farm produce. They may also sell some produce to other processors and become their suppliers. If successful, these opportunities may develop into a local supply network and provide more income.

Small-scale processing activities require linkages in supply chains between farmer processors, their ingredient and packaging suppliers and the customers of their products. Such linkages are often complex in nature and rely on relationships and networks that are built up over many years. Development of these networks needs to be assisted by advisers in support services (see the section on *Support services to promote processing as a livelihood enterprise*).

Gender benefits

A food processing enterprise is particularly accessible for women compared to other types of income-generating activities: it requires the types of practical skills and knowledge that are often passed down from mother to daughter; and it can operate, at kitchen enterprise level of operations, with flexible working hours. Women's involvement in work increases their self-reliance and confidence and reduces dependency, and it gives them greater status in the family and community.

Operating a food processing enterprise requires a need for literacy and numeracy and this may provide incentives for women's participation in training programmes as these can be seen as a way of increasing family income. If women are involved in sales, leaving the farm to meet customers also gives them an opportunity to create new business and social relationships, and it introduces new knowledge from interactions with different types of people. More generally, involvement in a food processing enterprise is an opportunity for farmers and their families to learn about trade and to actively participate in different parts of the food chain.

FIGURE 4 Women making yoghurt for sale in a kitchen scale processing enterprise (Photo: FAO/19009/ R. Faidutti)

Increased opportunities for smallholder farmer groups

There are several reasons why it is advantageous for small-scale farmers to form a group or association to undertake food processing. On the input side:

- Some types of small-scale processing are too expensive for a single farming family and it requires a group of farmers to invest in and manage the enterprise.
- Higher investments can be made in a building and processing equipment because credit sources are more accessible for a group than for a single farmer acting alone.
- There may be minimum order sizes for packaging and other materials that are too large for a single small-scale farmer and the materials are better shared among a number of farmers to take advantage of lower prices from bulk orders (i.e. lower unit costs).
- It allows farmers to share hired haulage costs.
- Associations are an efficient route for support organizations to provide training in literacy, numeracy, business management, financial management, marketing, etc., and other forms of assistance, such as technical assistance, group savings schemes, laboratory services, legal and accounting

support, gathering market information, or product advertising campaigns.

On the output side:

- Producer groups enable many farmers to process different products under a collective single brand name, which can be promoted in different markets and develop a strong reputation for quality and/or value for money.
- Processing can take place for a longer period of the year and lead to a guaranteed supply of products.
- A group of processors working together can supply larger orders from customers or new customers that have large minimum order sizes that they would otherwise not be able to supply as individuals. This opens up opportunities for example in supplying government contracts for institutional foods (for example processed foods for schools, hospitals, military barracks, etc.) and for export to buyers in other countries or Fair Trade organizations (for example dried fruits, nuts, etc.), (see Case Study 1). Indeed it is a contractual requirement by some Fair Trade organizations that a community group of some type is established to use the income from sales of processed foods.

CASE STUDY 1 **Fair Trade fruit drying**

Fruits of the Nile is a Ugandan Fair Trade company producing dried fruit. It has helped to get spare fruit produced by rural growers to international markets, and in doing so has introduced new skills and income along the whole supply chain. The company buys fruits from small-scale farmers in more than 100 primary producer groups, which it has trained in organic farming, hygiene, fruit drying and business management. They in turn buy fresh fruit from more than 800 other small-scale farmers who have also been trained by the company. Most farmers use simple, timber-framed solar cabinet driers to dry bananas and pineapples. Many smallholders grow fruit as their main cash crop, but much of the fruit goes to waste, particularly during the peak production months because there is insufficient market within a reasonable transport distance. Drying preserves their fruits and adds value to them. Fruits of the Nile conduct regular rigorous training with suppliers in safe and hygienic handling and processing of fruits, and organic agriculture systems. Current exports to Tropical Wholefoods in the United Kingdom amount to 100 tonnes of dried fruit a year. In 2008, the company won an award for pioneering renewable energy that is testament to their dedication in bringing real social and economic benefits to their local communities.

Source: Adapted from Tropical Wholefoods, 2008 (Available at www.fullwellmill.co.uk/partners/fon.htm)

There are different types of farmers' and processors' associations, but perhaps the most useful are marketing groups. These buy processed foods from individual farmers and sell them to identified markets on their behalf. This enables individual farmers to concentrate on cultivation or husbandry and processing of their foods. These associations are often focused on a commodity that is regularly produced by large numbers of farmers in a particular area (for example honey/ beekeepers associations, dairy groups, etc.). Such groups may grow to also operate savings and loans schemes. They range from informal voluntary groups to fully staffed associations capable of entering into commercial contracts with other enterprises. Their success depends on how they are created and managed and whether they have members with the skills and honesty to make the group financially sustainable. Those that are set up by their members with access to comprehensive training in business skills and group strengthening techniques are more likely to be successful.

In summary, decision-makers should recognise that food processing is a livelihood opportunity that can benefit small-scale farmers. Processing their crops or animal products enables farmers to diversify their sources of income, spread their incomes over a larger part of the year, and increase their total overall income by adding value to their farm produce. It can create employment for many farm family members, and nationally with proper support it can provide employment for many thousands of people who are poor and unskilled with limited education.

Feasibility of processing as an enterprise

There is no point in spending money on processing foods if they then rot on the shelf because consumers do not buy them. Small-scale farmers may not realise this and think that because there is an annual glut of a particular crop in an area, it should be processed to avoid wastage. However, most small-scale farmers in rural communities are isolated and have little access to information on the demand for processed foods. A second consideration is whether the types of crops or animals that are grown by small-scale farmers are likely to be available in the amounts that will be required, the cost of their production, their quality in relation to similar raw materials produced in other areas, and whether their breeds or varieties are suitable for processing. Individual farmers need to balance these 'supply' and 'demand' factors when making decisions on the type of processing and which processed products to make.

The types of products that are likely to be suitable for smallholder farmers in many areas are shown in Table 1.

TABLE 1 **Products that are likely to be suitable for processing by small-scale farmers**

Products
Bakery products (cakes, breads, biscuits, buns, etc.)
Beverages (beers, wines, juices, squashes, cordials)
Confectionery products from milk, honey, fruit syrups
Dried or smoked foods (fruits, root crops, vegetables, meat, fish, etc.)
Vegetable pickles and fruit preserves (jams, pastes, chutneys, sauces, etc.)
Snack foods (see FAO Diversification booklet No. 18 *Selling street and snack foods*)
Dairy products (yoghurt, milk, butter/ghee, cheese)

Each of these products:

- Often has a high demand and a high added-value;
- Is relatively safe from causing food-borne illness;
- Is not technologically complex to process;
- Requires equipment that can often be made and repaired locally;
- Does not have sophisticated packaging requirements.

However, choosing the type of product is only part of the 'consideration process'. Small-scale farmers will also need to know for example: whether they have the skills and expertise to process the food or whether they need further training; the availability of equipment and the costs involved in setting up and operating the business; and the availability and cost of credit. Some of the factors that should be taken into account when deciding what to produce are shown in Table 2.

TABLE 2 **Factors that influence the choice of food to process**

Choices	Factors that influence decisions
Which foods to process?	Types, amounts, cost and quality of crops or animals grown on the farm and suitability of varieties for processing. Decision to keep existing crops or animals or change to different types or varieties.
	Types of processed foods that can be made from the crop or animal and estimated size of the current and future demand for the processed products.
What type of process to use?	Extent of existing knowledge and skills to operate a process or availability of training to learn new skills.
	Resources available to establish production at a particular scale, local availability and costs of equipment, resources to maintain/ repair equipment.
	Local availability and costs of ingredients and packaging.
	Requirements of the process for electricity, fuels and clean water supplies, any waste disposal or air/water pollution issues.

TABLE 2 **Factors that influence the choice of food to process** *(Cont.)*

Choices	Factors that influence decisions
What scale of production to choose?	Size of demand for processed products and share of market (from a market investigation).
	Cost of processing and packaging equipment with the required throughput, and amount of technical assistance required to set up and operate the equipment.
	Existing knowledge and skills to operate the process, plan production and produce sufficient quantities of processed food having required quality. Availability of training and support to fill any shortfalls.
	Numbers of people trained in administration, finance, marketing, etc., and skills required, availability of training and support to fill any shortfalls.
What facilities are needed and where should they be located?	Availability of a suitable room/building on the farm or near to raw materials, large enough for production capacity required to meet estimated size of current and future demand for the processed products.
What infra-structrure services are available?	Availability of access roads and utility services required (electricity, water supply, transport, communications, etc.).
Who owns, manages and operates the processing facility?	Individual family based production or group of farmers? Decision influenced by degree of cohesion and cooperation between families in the community, and willingness to invest time and resources in community ventures.
How to process food with the required quality?	Extent of knowledge and skills to process the food safely and to produce the quality required by customers. Number of staff trained in quality assurance, amount of training and technical assistance required and available.

TABLE 2 **Factors that influence the choice of food to process** *(Cont.)*

Choices	Factors that influence decisions
What marketing and selling techniques to use?	Expected types of consumers, choice of advertising and promotion methods, distribution methods and sales outlets to be used. The main competitors and their marketing and selling techniques (from a market investigation).
How much finance is needed?	Total investment costs, sources of finance, production costs, expected income, cash flow and profitability.

All in all smallholder farmers who are interested in starting a processing enterprise need to carry out a feasibility study to verify and evaluate if the business has a chance of being successful or not (see Box 2).

BOX 2 **Information required for a feasibility study for a food processing enterprise**

Market feasibility

Which foods are the most popular in a particular area?
Who are the main types of customers (for example women buying for family meals, office workers, bus travellers, etc.)?
What is the quality required by customers?
What are the likely sales outlets and where are they located?
How often will customers buy the food?
How much will they buy?
What is the level of competition?
Which product(s) to make and sell?

Technical feasibility

Which processing and preparation methods are needed for the quantities required?
What are the hygiene and safety requirements for processing?
Is there enough farm produce available to supply raw materials for processing?
What equipment is needed?
What are the labour and skills required?

BOX 2 **Information required for a feasibility study for a food processing enterprise** *(Cont.)*

Financial feasibility

What are the start-up costs – for example costs of equipment required to produce the food?
What are the operating costs – for example cost of ingredients, the amount, type and cost of fuel required to process the food, the numbers of people that need to be involved and their wages?
What is the sale price(s) of the product(s) and potential income?
Which product(s) is likely to be the most profitable?
Will income always be greater than expenses (i.e. a positive cash flow)?
Will any loans be required?

Source: Adapted from FAO. 1997a.Guidelines for small scale fruit and vegetable processors, by P. Fellows, FAO Agricultural Services Bulletin No. 127, Rome

Market research: What products to make and how much to produce?

Small-scale farmers need information to estimate demand for processed products. In most cases, smallholders will not have the necessary knowledge or confidence to do a market survey and they will need assistance from advisers in the form of training, confidence-building measures and provision of information. Most farmers will then be able to go to areas where they expect to find consumers and ask potential customers for their views.

Farmers need two types of information: first information about their product and the consumers' views on its quality; and secondly information about how much people will buy, how often and for what price. Farmers should also gather information on for example the types of similar foods that are in demand and which are most popular, the quality that consumers expect in a particular food (preferred taste/colour, etc.), who currently sells that particular type of food, and the strengths and weaknesses of likely competitors.

Farmers need a different set of questions when assessing the weight of a food that is bought per month or per year (or the size of the market) and the amount of money spent on that product each month or year (the value of the market). They can ask consumers about the amount that they buy per week or per month; the amount they buy each time; what prices they pay for different sized packs; whether they

buy different amounts at different times of the year and whether prices change at different times of the year. This information gives farmers a good idea of the total demand for the product and the value of the market.

Once farmers have collected information, with assistance from advisers they can then estimate potential sales and this will give them some indication of how much of the market they could supply (see Table 3). For example, using the information from Table 3, if a farmer aimed to supply 5 percent of the market this would require producing 720 kilos of yoghurt per month (or 36 kilos per day) and would give an income of around US$3 450 per month.

Equipment, materials and staffing

Once potential demand has been estimated, small-scale farmers will need to estimate what equipment, materials and staff they may need for the processing enterprise. Equipment needs to be identified not only in terms of price, but also type and size that gives a production rate (in kilos per hour) that is suitable to meet market demand; the availability

TABLE 3 **Results of a calculation of the size and value of the market for yoghurt in a rural town**

Type of customer	Number in each category[1]	Amount of yoghurt bought per month (kg)[2]	Total demand (kg per month)	Cost per kg of yoghurt[3] ($)	Value of market (US$ per month)
Low income	18 430	0.4	7 372	4.8	35 386
Medium income	5 485	1.2	6 582	4.1	26 986
High income	196	2.25	432	4.1	1 771
TOTAL			14 386		64 143

[1] From official census statistics of the town
[2] Average of information given by 50 customers interviewed
[3] Smaller packs are more expensive per kilo than larger packs

of local engineering workshops that have people who are skilled in maintenance and repairs, the complexity of operating the equipment and possible training required; electricity supply for mechanized processing equipment, the continuity of supply and its costs; and fuel needed for generators may not be available regularly, or if they are connected to mains electricity there may be down-times in the supply.

The criteria used to estimate whether equipment is suitable are complex and interrelated and may differ in different communities, but a summary of the main aspects to consider are given in Table 4.

TABLE 4 **Some criteria for assessing the suitability of processing equipment**

Conformity to local traditions, beliefs and food habits.
Conformity with existing administrative or social structures.
Technical effectiveness - can the process produce foods in the required amount and to the required quality standards?
Costs of purchase and maintenance/repair of equipment and any ancillary services required.
Cost and availability of fuels and power; alternative sources of energy (e.g. solar, biomass, wind or water power).
Operating costs, expected sales income and overall financial profitability.
Distribution of profits within the family and/or community.
Effect on increase in employment or displacement of workers.
Training for skill levels required.
Health and safety issues.
Environmental impact (e.g. noise or dust production, pollution of air or local water supplies).

Source: Adapted from Azam-Ali, S. et al.2003. Small scale food processing- a directory of equipment and methods, Second Edition, Practical Action, Rugby, United Kingdom

CASE STUDY 2 **Support for local equipment manufacture**

The expansion of global markets has the potential to bring good quality, affordable tools and equipment within reach of more communities, but the reality is often different. Imported technologies are likely to be unaffordable and they may be unsuitable for local conditions and processes. Also, the cost of adapting, repairing and maintaining them may be prohibitive, and the opening up of markets frequently wipes out local capacity to produce equipment for the local market. Farmers and small-scale processors may get the worst of both worlds - losing their local supply of tools and equipment and being unable to afford the global market goods.

Part of Practical Action's strategy is to support the production of appropriate low-cost tools and equipment for low-income markets by working with micro- and small-scale enterprises (MSEs) at different levels: first, it helps MSEs to identify promising market opportunities with a sustainable future; and then helps partners find ways to produce better quality goods with more added value for these markets. This may involve a wide range of business development services such as training in technical and business skills which is adapted to the needs of MSEs; creating information services which can supply knowledge and understanding of new technology options and markets; or helping MSEs to improve their product design and production techniques.

Practical Action also helps MSEs to increase their influence on markets and on relevant policies by bringing together associations of small-scale producers and building their capacity to organise and represent themselves. It also works with such producers' associations to research the policy environment with a view to changing it in favour of small-scale producers, for example by reducing bureaucratic obstruction or harassment by police and officials; or by addressing the taxes, fees and subsidy biases which favour large-scale over small-scale production. It also includes providing service centres where machine-tools can be hired out to equipment manufacturers who could not otherwise afford them. At the same time Practical Action is involved in building links between technology institutions, those who manufacture equipment, and the end-users.

Source: Adapted from Manufacturing Enterprise, Practical Action,2010 (Available at http://practicalaction.org/?id=manufacturing)

Estimates for packaging materials

Farmers need to estimate which packaging materials to use: there are the technical requirements to protect the food from damage; the promotional and marketing requirements of a package; and the relative cost and availability of different types of packaging materials.

Estimating the required staffing levels and skills

Nearly all types of processing, especially at household-scale, are labour-intensive and work is likely to

FIGURE 5 Specialist food processing equipment - a mixer for making dough (Photo by P. Fellows)

be done by members of the farming family. However, small-scale farmers need to estimate the costs involved, the skills levels required and the relative benefits of employing a larger number of workers or buying machinery to do a particular job. Often when considering manual or mechanized processing, a simple cost comparison is made between the cost of the equipment and the cost of employing people.

Small-scale farmers should also estimate the 'opportunity cost' of other farm activities that need to be given up: for example the relative benefits of having family members working in a processing unit or on the farm. They also need to consider other factors, for example: workers can be retrained to do different jobs if a process changes, whereas altering specialist food equipment is more difficult; they commit money for many years when buying equipment, whereas they can hire temporary labour when needed; and there may also be strong social and cultural factors that favour employment over mechanized processing

Investment for processing

Small-scale farmers need to make estimates on two types of finance when setting up a food processing unit: the first, known as 'investment finance', is required before the unit is established and is needed to pay for 'start-up' costs such as travel costs to conduct the feasibility study; fees to register a business and obtain licences or for a hygiene inspection and certificate; cost of any building work needed for a processing room; and costs of equipment and initial stock of packaging materials and ingredients. The second type of finance that needs to be estimated is that required to meet the operating costs that arise when the unit is in production.

Credit availability and access

Small-scale farmers need to make estimates on loans that may be needed to start the processing enterprise. Smallholders may need short-term loans to buy small items such as cooking utensils, whereas specialised equipment requires more money and hence a longer term loan. Typically, lenders make short term loans easier to obtain but they are more expensive, whereas long term loans are less expensive, but more difficult to obtain (farmers should be advised to exercise caution when taking out a loan because the burden of repayments, especially for a long-term loan, may undermine the business if it is not planned properly). In most countries, the high interest rates charged by commercial banks may make loans too expensive for smallholders to afford. Instead, advisors should make farmers aware of any development banks, development agencies, or informal associations that offer low-cost credit and/or longer payback periods. Smallholders can also consider seeking shareholders who are willing to invest in the business in return for either a share of the profits or payment of an annual dividend.

If the smallholder takes out a loan, both private investors and financial institutions are likely to want to see a feasibility study that shows the expected profitability and performance of the business.

Regulatory requirements

With the help of advisers, small-scale farmers need to be aware of the laws that relate to the production of foods and registration of enterprises for taxation purposes, as these factors will affect the feasibility of a food processing enterprise. Although many countries do not have laws governing food preparation or

selling, other countries do and others are considering introducing new laws. There may also be local municipal authority byelaws that require an enterprise to be registered as a business, and nearly all countries have laws relating to food safety, hygiene and adulteration in food processing and preparation.

Pre-packaged foods are also likely to be covered by laws governing labelling, which specifies the design and wording of the label (for example the list of ingredients, the name of the producer, weight of food in the package, etc.). Careful label design is important, both to attract consumers and to avoid prosecution. Other food-related laws concern hygiene in the food processing room and some products require analytical checks to make sure that their composition meets legal standards. Farmers need to understand these laws and support agencies have a role in finding the information and explaining the laws as well as seeking advice on the farmers' behalf from the Bureau of Standards or its equivalent.

Once a typology of formal enterprise has been estimated smallholders will need assistance in finding out the number of registration procedures that are needed before the enterprise can begin production. These vary in different countries in both the number of procedures and their degree of complexity. Advisers should be experienced in the regulations in the particular country so that they can advise the farmer in estimating the tasks required, the time and costs for the registration process. This may involve, for example, such aspects as notifying tax authorities (for example sales tax commissioner or VAT office) and completing 'notification of business intention' forms or their equivalent. Commonly for a business licence the local government office (for example the Town Council or District Council), is approached and to the Ministry of Health, Bureau of Standards or equivalent, is usually approached for a food inspector to visit the premises to examine the facilities. All these aspects need to be estimated and taken into account in the feasibility study.

If farmers intend to buy imported ingredients, packaging materials or equipment , they will also need help to contact the Ministry of Finance, Department of Customs, and local government tax authority or VAT office to see if there are opportunities for remission of taxes. This type of help is also needed to reclaim VAT or other types of sales tax where these are levied.

Services and infrastructure

All smallholder processing enterprises require water as an ingredient or for washing equipment. This is an important element in food processing and farmers have to estimate where the most cost-effective water can be sourced. Most of the products described in The livelihood enterprise section of this booklet do not require electricity to produce them at household- or cottage-scale production, but larger equipment used in small-scale operations for some products is likely to be powered. If mains electricity is not available, farmers should consider a diesel-powered generator, although the cost may be prohibitive for many. Support agencies could also help farmers investigate the local potential of wind- or water-powered turbines for power generation, or photovoltaic cells for lighting or for topping up batteries.

Farmers need fuels for processes that involve heating (for example boiling, drying, smoking, etc.) and these can be an important constraint in some areas, particularly where wood or charcoal supplies are reduced because of deforestation. LPG gas in cylinders is the preferred fuel if the cost is affordable. Where gas cylinders are not available, farmers can make estimates about constructing a biogas generator to provide fuel, if the use of manure in the generator does not detract from its use as fertilizer and if there are sufficient quantities to produce enough gas for processing. Solar heaters may also be useful to pre-heat water. In each case advisers can help farmers to source the technical information and prices for these forms of heating.

Farmers need to transport incoming ingredients and packaging, and send products to customers. The condition of roads is also an important consideration if a farmer intends to supply markets other than the local village. Feeder roads in rural areas are often in poor condition, and may only be open during part of the year. Poor quality roads cause delays in farmers' deliveries, add to the cost of their processing, and cause damage to raw materials and packages (especially glass containers). Estimates also need to be made about these factors as well.

Costs, income and profits

To operate successfully over the long term, farmers' enterprises must be profitable. Farmers need to estimate their costs, income and importantly profits. With the previous estimates made about potential market demand, cost of equipment, materials and any loans that may be needed and

so forth, farmers, with assistance from advisors, need to work out all the costs, and potential income and importantly profit for the processing enterprise.

Costs

Farmers' operating costs can be either 'fixed' costs (or 'overheads'), which do not change if there is an increase or decrease in the amount of production; or 'variable' costs that change according to the amount of production. Examples of fixed costs include:

- Salaries for permanent staff.
- Service charges for utilities (mobile phone, water, electricity)[1]
- Interest paid on loans.
- Some types of taxes.
- Depreciation of equipment.

Examples of variable costs include:

- Raw materials and ingredients.
- Packaging materials.
- Salaries for seasonal staff.
- Electricity, gas and water charges.
- Hire of vehicles.
- Paper and other office materials.

A farmer's total operating costs are the sum of fixed and variable costs.

[1] Depending on whether water is paid for, whether there is a fixed annual cost, or water and electricity are paid for according to the amounts used.

Income

Farmers' income depends on the amount of food sold and the price that is paid. It is important for the farmer to know what customers are willing to pay because few people buy a product simply because it is cheap.

Profits

It is important for farmers to know the smallest level of production that can make a profit, and advisers can assist farmers to work out what are the fixed costs, and how do the variable costs and the income change at different levels of production, so that they know the minimum production level that they should aim for (known as a 'break-even analysis'). This shows the production level at which the income is equal to the costs of production (i.e. the business is neither making profits nor losses).

Estimates of profits are important as it gives an indication to the farmer of the returns he or she may get from the enterprise and also importantly provides an indication to credit institutions/ donors about the feasibility of the entire business operation in case the farmer requires a loan.

Evaluation of the livelihood activity

It is important that the farmer and his or her family make the overall

evaluation of a potential food processing enterprise, and the decision whether to go ahead or not. Advisors can support small-scale farmers by providing information about for example markets, equipment and packaging suppliers, but farmers should make the decision on whether or not to start a processing enterprise, based on his or her evaluation of the livelihood activity. The decision to start an enterprise is likely to be influenced by the potential profit, but it may also include other factors, including the extra work imposed on the farm family; their confidence about selling processed foods in new, unknown markets; their willingness to learn new skills; and other social and cultural factors.

The livelyhood enterprise

The enterprise

Different scales of commercial food processing can be described in five categories (see Table 5). Household-scale processing is a good entry level for resource-poor farmers. Typically, this type of processing takes place in a room in the farm household and requires no specialised food processing equipment, using instead existing kitchen utensils such as pots, spoons, buckets, etc., and a kitchen cooker or fire. This type of business has low barriers to entry as it requires negligible capital investment in equipment and the main raw materials are obtained from the farm.

TABLE 5 **Scales of commercial food processing**

Scale of operation	Characteristics
Household-scale	No employees, little or no capital investment
Cottage- (or Micro-) scale	Less than 5 employees, capital investment less than US$1 000
Small-scale	5-15 employees, capital investment US$1 000-50 000
Medium-scale	6-50 employees, capital investment US$50 000 -1 000 000
Large-scale	More than 50 employees, capital investment over US$1 000 000

Depending on the location of the farm, the processed foods are most likely to be sold from the processing room to neighbours, in local village markets, to rural shops, or from roadside stalls. Provided that there is a demand for the products and there is an adequate sale price, this scale of processing can provide real benefits to farming families from the additional income.

FIGURE 6 Household-scale frying of banana chips
(Photo by A. Molina, by courtesy Bioversity International)

A second type of livelihood opportunity for small-scale farmers is cottage- (or micro-scale) processing (see Table 5). This requires a higher investment by farmers, but it is affordable for those who have savings, or those who have access to loans from family, friends or commercial lenders. Some farmers start with household-scale processing and expand to become a cottage-scale enterprise by re-investing some of the profits.

At this scale, investment for processing operations is typically needed for a dedicated room within the farm household, and some specialised manual food processing equipment; additional fuel; and possibly a supply of new packaging materials. A supply of electricity is not essential. Farmers who operate cottage-scale processing enterprises can make the same products as household-scale processors, but also products such as smoked meat and fish, butter/ghee and dairy confectionery made by livestock farmers, and breads and cakes by agricultural farmers. Sales are made in the same outlets to those from household-scale enterprises and additionally through retail shops, cafés or bars, and daily markets in rural towns.

FIGURE 7 Cottage-scale bread making
(Photo: FAO/16197/ L. Spaventa)

This scale of processing requires additional technical training in processing techniques, quality assurance and packaging. Furthermore, because this scale of operation is in competition with larger established food processing businesses, a range of entrepreneurial skills are required, including negotiating skills to deal with suppliers and retailers or other buyers; and adequate numeracy and literacy to calculate profitability, loan repayment requirements, and weekly or monthly cash flows (money in versus money out of the enterprise).

The third livelihood opportunity considered is small-scale processing (medium- and large-scale processing requires levels of investment that are beyond the means of small-scale farmers - see Table 5). Products include those produced at household- and cottage-scales of operation, plus for example, cured meats, pasteurized milk, cream and cheeses, or leavened breads.

This scale of processing requires investment in a separate building on the farm, larger specialist food processing equipment that may require electricity or gas heating; a guaranteed supply of potable water; new packaging materials with the business's own labels;

FIGURE 8 Small-scale jam making
(Photo: FAO/21861/A. Proto)

advertising materials; and wages of family members or other staff who are employed in the business on a full-time basis. Farmers need to devote more time to this type of enterprise to plan production, meet suppliers and buyers, manage product quality, manage staff and develop the business. Some farmers may delegate farm work to other family members, with an employed farm supervisor to run it and focus on the processing enterprise, treating the farm as a source of raw materials.

At this level of processing, small-scale farmers with the necessary expertise have opportunities to sell their products in a number of different outlets as well as the outlets used by household- and cottage-scale processors. These include hotels and other visitor/tourist accommodation, restaurants, supermarkets and wholesale merchants, each of which may be local or spread throughout the country. Farmers can also sell directly to final consumers by setting up their own outlets in markets or rural towns, or they can

produce packaged snack foods such as biscuits, cakes, etc., for sale to street vendors. These options may be more profitable outlets for farmers' commodities, and each increases and diversifies their income sources. The more options that are available to sell processed farm produce, the greater the reduction in risks and potentially the greater the increase in income.

At this scale of operation, competition from other food companies may be intense and to be successful, farmers require attractive packaging, more advanced marketing and quality assurance techniques and business management capabilities, each of which may require training from support agencies. Obtaining specialist processing equipment and packaging materials can also be a challenge for small-scale farmers (see example in Table 6 for the equipment needed in a bakery at different scales of operation) and assistance may be needed from support organizations.

FIGURE 9 Pickles from different processors. Note: The products in the centre are from a household-scale processor, but the labels would not be legal in some countries. The products on the right have labels printed by the processor using a computer printer, and the product on the left is from a larger scale operation, using professionally printed labels, but one label is spoiled by product leakage.
(Photo by P. Fellows)

TABLE 6 **Equipment needed for a farm bakery at different scales of operation**

Household-scale	Cottage-scale	Small-scale
Baking trays Biscuit cutters Buckets, bowls Cake tins Cooling racks Flour sieve Glaze brushes Knives Measuring jugs, scoops Oven (small wood/ charcoal fired) Oven gloves Pastry cutters Rolling pins Waste bins Whisks	As for household-scale plus: Bread tins Cake hoops Funnels Mixer (small, electric) Oven (commercial scale, wood or charcoal fired) Oven peel Piping tubes and bag Proving cabinet (home-made) Sandwich tins Scales (mechanical) Spatulas Thermometer (glass)	As for cottage-scale plus: Bread slicer Dough divider Dough moulder Dusting boxes Oven (larger commercial scale charcoal, coal, electric of gas-heated) Proving cabinet (electric) Scales (electronic) Storage bins Thermometer (electronic) Mixer (larger, electric)

In many countries, cottage- and small-scale processing operations are considered to be part of the formal sector and farmers are also likely to require advice in finance and legal or regulatory aspects of running the business. National or local governments may require registration of these businesses as both food producers and for taxation purposes. As food producers, they may be required by authorities to have inspection of premises to ensure that they meet hygiene and health requirements; registration of food handlers with annual or bi-annual medical screening for infectious diseases or other illnesses that could cause food poisoning; and a requirement to send samples of products for testing at government laboratories for both composition and safety.

Small-scale processing can also have a large impact on agricultural production, using significant amounts of crops that are produced in a particular area, and small-scale farmers who are successful processors may use other neighbouring farmers as suppliers of raw materials to meet their requirements.

CASE STUDY 3 **Rural dairy processing**

Created in October 1992, Paramount Dairies Ltd (PDL) started as a small family business with a focus of producing fine Uganda cheese. It has experienced steady growth to emerge as a leading dairy brand in Uganda and some regional markets. The company is reliant on local resources and skills; a living demonstration that dairy-processing can be an affordable rural-based business. Today, PDL produces more than eight cheese types in a variety of packaging; all now found in the supermarkets of the capital and in many of the larger towns of Uganda. As a social-developer, PDL employs, trains and engages more than 50 men and women, mostly rural-based, and supports dozens of small-scale dairy farmers in a just and fair milk market. The company seeks to provide good quality, reasonably priced dairy products, using local expertise, manpower, and resources. It also creates a fair milk market and gives timely payments to dairy farmers and incentives to those who use best practices to provide quality milk.

Source: Adapted from Paramount Dairies (Available at www.paramountcheese.com/index.php?fuseaction=home.aboutus)

The building

All processing rooms have common features, regardless of the scale of operation: their sites are fenced to keep out animals and located away from obvious sources of smells or insects (for example swampy areas); and they have a place away from the building where wastes can be either buried or turned into compost. There is sufficient space within the building for people to operate the process safely, and space for separate storage of ingredients, packaging materials and finished products. The construction of internal walls with plaster or concrete render ensures that they have no cracks that could harbour dirt or insects; and similarly floors are made of good quality concrete without holes or cracks. The layout of equipment within the room enables foods to move through the process in such a way that finished products cannot be contaminated by incoming, often dirty, raw materials.

Overhanging roofs keep the building cool, using tiles rather than iron sheets to provide greater insulation against the sun's heat. A panelled ceiling is fitted, rather than exposed roof beams that would allow dust to accumulate and also provide paths for rodents and birds that could contaminate products. The ceiling and the roof/wall joints are sealed against pests. Lower parts of walls are painted with white gloss paint, or tiled if this is affordable.

Higher parts of walls can be painted with emulsion paint.

The number and size of windows depends on how much a farmer can invest, and the security risk in a particular area: windows are more expensive than walls, especially when security bars or grilles are needed. All windows are screened with mosquito mesh, but storerooms do not need to have windows. Doors are close-fitting in the frames to prevent crawling pests from entering. If doors are used regularly, thin metal chains or strips of plastic can be hung from door lintels to deter flying insects or mesh door screens can be fitted. The floor can be curved up to meet the wall to prevent dirt collecting in corners. Except in dry processes (for example baking), floors normally slope to a drainage channel, fitted with metal gratings that are easily removed for cleaning. A wire mesh cover over the drain opening prevents rats and crawling insects from entering the room. Toilets are separated from the processing room or in a separate building and have hand-washing facilities with soap and clean towels.

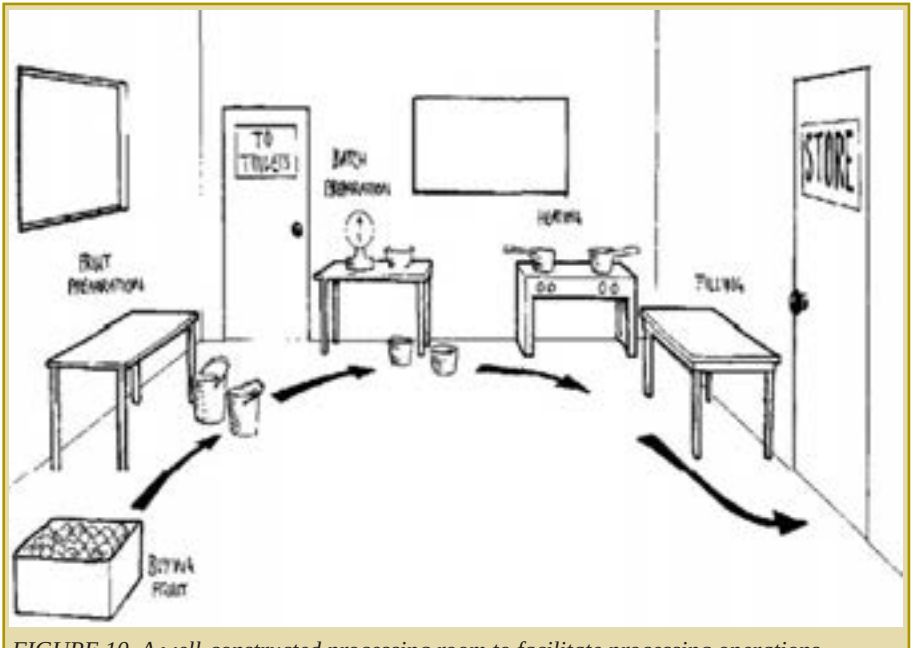

FIGURE 10 A well-constructed processing room to facilitate processing operations
(Source: FAO, 1995)

Processing foods and required equipment

In this subsection, the processing of selected foods is described for household-level to small-scale processing. Most are simple techniques that require only utensils such as knives and pans, but specialised equipment is identified for higher production levels.

Bakery and snack food products

There is a wide range of bakery products that are suitable for cereal farmers to process, including biscuits, cookies, leavened or unleavened breads, cakes, pastries, pies, pizzas and scones. Each can be made with different shapes, sizes, flavours, etc., and the range of potential products is therefore extremely large. Products such as pies that contain meat, fish or vegetables, or cakes that contain cream, have a greater risk of causing food poisoning. In general these products should not be produced unless farmers have gained experience of their production and understand the risks involved. Careful food handling, strict hygiene and thorough cleaning of equipment are essential to produce these products safely.

The main item of equipment for making bread, cakes, etc, in a farm bakery is the oven, and a local bricklayer can build this. However, if only flat breads and biscuits are made, the farmer can bake these products on a hotplate. Ovens can be either heated internally or have an external firebox. Internally heated ovens are simple and relatively cheap to construct, but the food can be contaminated by smoke and ash from the burning fuel. An externally heated oven consists of a brick or earth structure that contains a steel baking chamber (for example an oil drum) over the firebox. This design provides for continuous baking without the need to re-light the fire, has good fuel economy and no contamination of products by smoke or ash.

The other important piece of equipment for a bakery is a mixer. Mixing by hand is possible at household-scale (see Figure 12), but when larger quantities are required an electric mixer (see Figure 5) is necessary to ensure that doughs and batters are uniformly mixed in a reasonably short time. A simple proving cabinet for fermented doughs can be made from a wooden framework, covered in polythene sheeting, with a gently boiling pan of water inside to create the correct temperature and humidity. Bakeries also require a range of baking trays and tins and small hand-tools, such as dough or pastry cutters, flour sieves, glazing brushes, rolling pins and whisks.

FIGURE 11 Baking bread in an oven
(Photo: FAO/16196/ L. Spaventa)

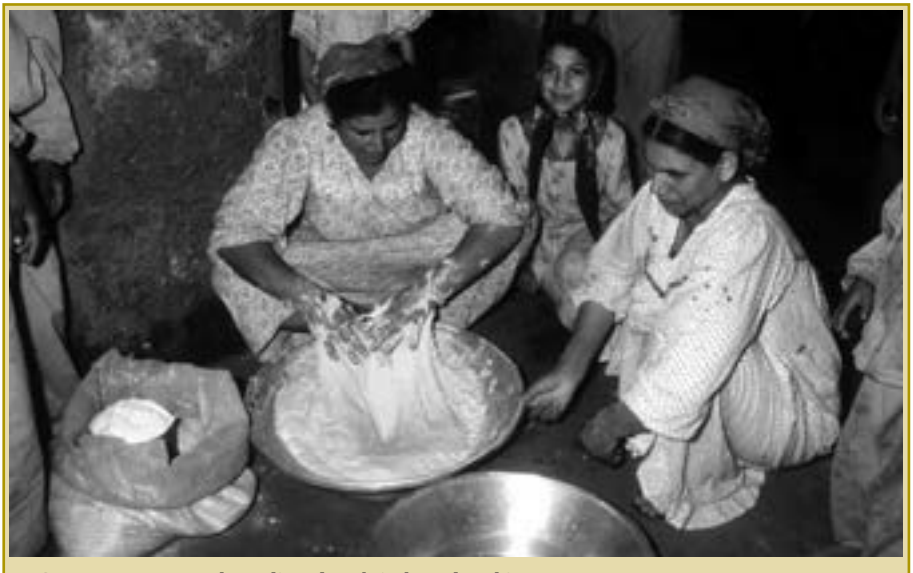

FIGURE 12 Woman kneading dough in bread making
(Photo: FAO/16198/G. Bizzarri)

The basic ingredients for making breads are 'strong' wheat flour (that has a higher level of gluten), water and salt, with optional fat. Leavened breads also contain yeast or baking soda. Differences in the amounts of ingredients and the conditions used at each stage of the process give rise to the wide variety of breads and unleavened flat breads that can be produced.

Biscuit dough is made by mixing flour, sugar, baking powder and egg, together with any nuts, dried fruit or flavourings that are required. Biscuits can be decorated as required with sugar crystals, chocolate chips, crystallized fruit, etc. Pastries are made from flour, egg, butter/ghee and salt. Pastry cases can be filled with many different types of sweet or savoury fillings. Cakes and scones rely on baking powder to produce an aerated product. Cake batters contain flour, baking powder with fat or butter, sugar and any colouring or essences required. Other ingredients (fruit, nuts, etc.) can be mixed into the batter before it is baked in an oven. Scones are made from flour, baking powder, fat, sugar and dried fruit, and are baked on a hotplate.

Most products from small-scale bakeries are not packaged, except in simple polythene or paper bags to protect them from dust and insects (see Figure 13). However, biscuits require more sophisticated packaging for a longer shelf-life: they may be packed in cardboard cartons that are covered with a moisture-proof and airtight film such as cellulose, polyester or polypropylene, or stored in airtight tins or jars.

Details of different types of snack foods that can be made by small-scale farmers are given in the accompanying booklet in this series on *Selling street and snack foods*. As an example of the types of products that can be made by farmers, sliced root crops (yam, cassava, sweet potato, Irish potato) and some types of starchy fruits, (jackfruit, breadfruit, banana/ plantain) can be fried and eaten as snack foods (see Figure 6). No specialized equipment is required at household-scale production, but at a larger scale, a deep fat fryer and a slicing machine are used to produce more uniform products and reduce the time and effort involved in processing. Products can be stored for a short time in polythene bags, but rapidly develop a rancid flavour and polypropylene film is needed for longer storage. Another example is samosas, which are triangular packages of 'filo' pastry that are filled with vegetables, fish or minced meat and deep fried.

FIGURE 13 Bread that has been packed and is being sold via street hawking
(Photo: FAO/18468/ P. Cenini)

Confectionery products, honey and fruit syrups

Confectionery products are made by boiling sugar syrup and a wide variety of products are possible by varying the other ingredients, the temperature of boiling and the method of shaping the sweets. Fondant is made by boiling sugar syrup with glucose syrup and beating the boiled mixture to ensure that there are only small sugar crystals, which give a smooth feel when eaten. Gums, jellies, pastilles and marshmallows are made by boiling sugar and added flavours and colours with gelatine to produce the chewy texture. Toffees and caramels are made by boiling together sugar, milk and fat. Hard-boiled sweets are made from sugar syrup with added flavourings and colourings, which are boiled to a high temperature and then cooled to form hard crystalline products.

For each product, the temperature of boiling can be measured using

a special sugar thermometer that measures higher temperatures. Alternatively, a sample of product is cooled and, when cold, it is checked for the correct texture. Sweets can also be made using moulds made from plastic or metal, or using impressions formed in a tray of corn (maize) starch. In areas of high humidity, unpackaged sweets quickly absorb moisture from the air and become sticky. Waxed paper, aluminium foil or plastic films are used to wrap individual sweets by hand. Sweets can also be stored in glass jars or tins with close-fitting lids.

Fruit syrups are made by gently boiling fruit juices until they have the consistency of honey. They are not widely used in the home but may have a demand from other food processors, including bakeries and ice cream makers. Honey can be either collected from the wild or from beehives (see FAO Diversification booklet No.1 *Beekeeping and sustainable livelihoods*). It is extracted from beehive honeycomb using manually or electrically operated honey centrifuges. The honey is then filtered to remove pieces of honeycomb and checked to make sure it has the correct moisture content - if it contains too much moisture it ferments during storage. The correct moisture content can be assessed by experienced honey producers or checked using a refractometer, although this is likely to be too expensive for most small-scale producers. It is then packed into glass or plastic jars or bottles.

FIGURE 14 Beekeeper at work in his laboratory for honey production and other apiculture products (pollen, propolis, etc.)
(Photo: FAO/21087/ R. Faidutti)

Dairy products

If a dairy farmer does not have sufficient on-farm production, milk supplies from other farmers may be pooled at a collection centre to obtain enough milk for processing. Milk is a low acid food that can contain pathogenic bacteria (ones that can cause food poisoning), and it should be handled carefully and hygienically and kept cool until it is used, to avoid causing food poisoning (see FAO Diversification booklet No.6 *Milk for health and wealth*). Farmers should also check the colour, odour and taste - there should be no hint of rancidity. There are chemical tests that show the quality of the milk, but these are not likely to be possible on farms and samples are sent for testing in laboratories at larger scales of operation. Milk should be processed as quickly as possible by pasteurizing, boiling, making yoghurt, flavoured and cultured milks, butter or ghee, yoghurt or cheese.

The demand for pasteurized milk is low in many countries, especially those where a high proportion of the population suffers from lactose intolerance. At household- and cottage-scales of production, milk is pasteurized by heating it in a stainless steel pan and hot-filling it into bottles or plastic bags, which are then sealed to prevent the milk becoming contaminated. Flavoured milks are made in a similar way, but with added chocolate, vanilla or fruit flavours. At larger scales of operation a plate pasteurizer can be used to produce pasteurized milk, but the investment is considerably higher and skilled operators are needed to use the equipment. All pasteurized milks should be stored for not more than a few days in a refrigerator before they are sold.

Milk products, including yoghurt, cultured milks and butter or ghee each have the lactose (milk sugar) removed during processing and demand for these products is often higher. Yoghurt is produced by fermenting milk using two types of lactic acid bacteria that change lactose into lactic acid. This forms the characteristic curd and restricts spoilage so that yoghurt is preserved for up to ten days in a refrigerator. In the process, a starter culture of the bacteria is added to pasteurized milk and the warm milk is placed in an incubator. Either the starter can be bought as a powder or it can be taken from a previous batch of yoghurt. A simple incubator can be made using a thick block of polystyrene with indentations to hold pots of fermenting yoghurt and maintain the temperature of the product during the 4 to 6 hour fermentation. Alternatively, pots are placed in an insulated box, fitted with an electric

light bulb, where the heat from the bulb maintains the temperature. At very small scales of production, the warm yoghurt mix can also be filled into large thermos flasks to keep it warm. These processes produce 'set' yoghurt. For liquid yoghurt, the set yoghurt is stirred to break down the gel and it is then poured into pots. Chopped fruits or nuts can be added to each type of yoghurt, but care is needed to ensure that they are thoroughly cleaned to avoid contamination by moulds. Acidic fruits (lemon, lime, pineapple, etc.) may cause curdling and separation of the yoghurt whereas less acidic fruits such as melon or papaya are more successful because they do not react with the milk.

Cultured milk products are made using a similar process, but the fermentation is stopped before the curd is formed and the product is a thick, clotted liquid with an acidic taste. It has a shelf-life of three to eight days at ambient temperatures and is used as a drink or as an accompaniment to meals. It may be sold in portions directly from the culture vessel, or it is packed in polythene bags or plastic pots.

Milk can be separated into cream and skim milk. Cream is not used in most households but is more common as a bakery ingredient in some countries and is used to make butter and ghee. The simplest method of separating cream is to allow it to float to the surface of the milk and then skim it off with a ladle. However, this is time-consuming and even at a household-scale a cream separator (see Figure 15) is preferable. The equipment can be either manual or electric with capacities from 50 to 150 litres per hour. Cream is very susceptible to spoilage caused by rancidity and it can also support the growth of food poisoning bacteria. It should therefore be refrigerated and sold within one day.

Butter is milk fat that has a market as a spread, for cooking, or as a baking ingredient. There are five types of butter, which can be made from cream or fermented milk, or from the whey that remains after cheese making. These are fresh (or 'sweet') butter, ghee, cultured (or 'lactic') butter, salted butter and whey butter. At household-scale, butter is made from cream by allowing it to stand and sour naturally and then churning it using small manual butter churns (see Figure 16). In cottage- and small-scale processing, chilled cream or fermented milk is churned in manual or electric churns. At larger scales of production, a specially shaped manual or electrically powered drum is rotated end-over-end to churn the cream.

FIGURE 15 Cream separator
(Photo by P. Fellows)

FIGURE 16 Small butter churn
(Photo by P. Fellows)

Churning makes the milk fat form into grains of butter. The by-product is 'buttermilk', which is either drunk or fed to animals. Salted butter has salt added to the grains as a preservative to improve the shelf-life by suppressing the growth of micro-organisms, and also to improve the flavour. The butter is then washed and 'worked' with butter pats (see Figure 17) to produce blocks of butter, which are either pressed into butter moulds and packaged in greaseproof paper, plastic bags or aluminium foil, or placed in plastic tubs. Alternatively butter can be shaped in small butter moulds, especially for use in restaurants, cafés and hotels.

If a refrigerator or chilled water is not available, it is possible to make butter but there may be a reduced butter yield because some of the butterfat remains liquid and is lost with the buttermilk. Water used for washing butter must be potable or else it will contaminate the butter and reduce its shelf-life. At refrigeration temperatures, butter has a shelf-life

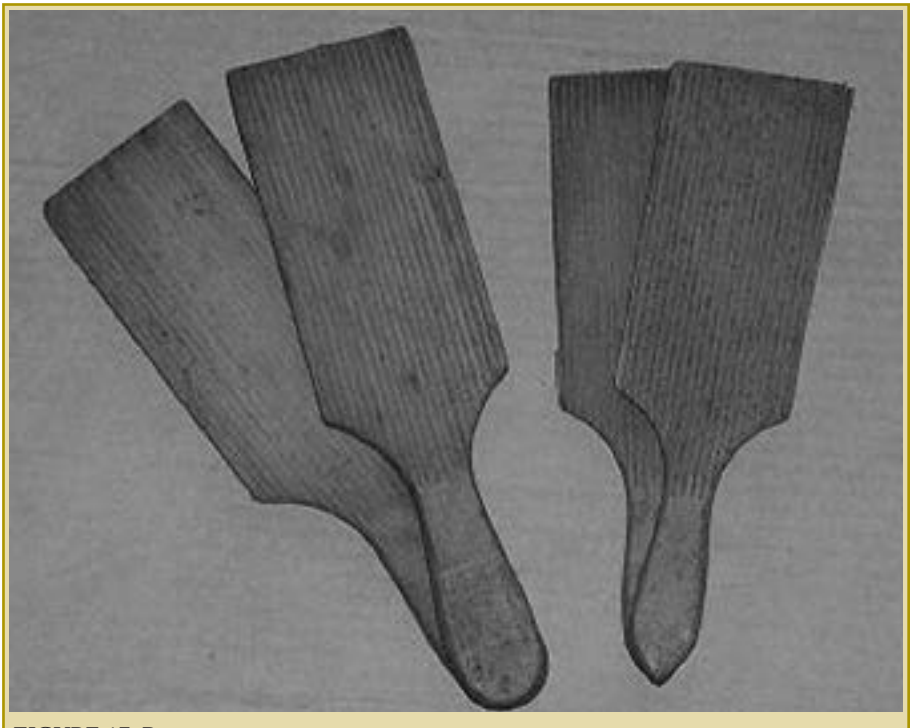

FIGURE 17 Butter pats
(Photo by P. Fellows)

of several months, but at high ambient temperatures off-odours develop after only a few days.

Ghee is made by heating cream to release the water and boiling it off to leave a clear golden fat with a characteristic flavour. It is made from cow or buffalo milk and has a high demand in some countries as domestic cooking oil and as an ingredient for bakeries or confectionery manufacturers. It has a long shelf-life if it is stored in a cool place, using airtight, lightproof and moisture-proof containers to slow down the development of rancidity.

There are hundreds of varieties of cheese produced in different parts of the world, but each relies on similar principles of coagulating the proteins in milk to form curds, and then separating them from the liquid whey. The different cheese flavours and textures arise from variations in the type of milk, the fat content in the milk, bacteria that are used to ferment the milk and variations in the processing conditions.

Cheeses may be grouped into 'soft', 'semi-hard' and 'hard' cheeses. Production of soft cheeses is more straightforward than hard cheeses, and these are the more common traditional types that are in demand in many countries. The demand for hard cheeses may be more limited and a careful market analysis is needed before starting their production. Cheese making is more difficult than many other food processes, and only experienced dairy farmers should undertake it because there are significant risks of causing food poisoning if mistakes are made. There is also a requirement for more expensive equipment and strictly hygienic facilities, which adds to the investment costs.

Coagulation of milk proteins can be achieved using rennet, obtained from calfs' stomachs or made synthetically, adding acid (for example lime juice or vinegar) or by boiling. The milk is coagulated in cheese vats to form curds. The curd is cut into small cubes using curd cutters made of thin wires or blades and the whey drains from the curds. They are then poured into cheese moulds and pressed to remove more whey. At cottage-scale operation, simple cheese moulds are made from plastic drainage pipes that have holes drilled in them and these are pressed by placing weights on the cheese in the moulds. Small-scale manual cheese presses have a steel plate that is raised and lowered by a screw. A muslin or cotton bag full of curd is placed in the mould and the press plate is lowered to press out the whey.

Dairy confectionery products such as rasagolla, rasmali, and gulab jamun are popular in Asian communities and are made from intermediary products (channa and khova) obtained by heat coagulation and heat-acid coagulation milk respectively. Rasagolla is a round, creamy white sweet made from channa and stored in sugar syrup. It has a distinct spongy texture and characteristic flavour. Gulab jamun is a fried sweet made from khova, refined flour and sugar. It is round or elliptical in shape with a brown crisp outer surface and a white, soft, porous interior, and is also stored in sugar syrup

Dried and smoked foods

Dried foods can be either high volume, lower value staple crops (cereals, legumes, root crops etc.), or lower volume, higher value foods (for example dried fruits, vegetables, herbs and spices and dried meat and fish). The first category is described in FAO Diversification booklet No.4 *Value from village processing*. The second category, described here, offers better opportunities for profitable production by small-scale farmers.

Drying removes most of the water from foods to extend their shelf-life and to increase their convenience and value. The loss of weight also makes transport cheaper and easier. Care and attention to hygiene are essential during drying, especially when processing low-acid foods such as vegetables, herbs and spices or meat and fish. The temperature during drying is not usually high enough to kill any bacteria or moulds that contaminate the food and, they can grow again and cause spoilage or food poisoning when the food is rehydrated.

Preparation of dried foods involves cutting them into uniform sized pieces so that each dries in a similar time. At household-scale this is done manually using a sharp knife, but this is too slow and inaccurate for larger scales of operation. Here manual or electric slicing equipment is required (see Figure 18).

Blanching is needed to prevent changes to the colour, flavour and texture of dried vegetables during storage. It involves heating sliced vegetables for a short time in a wire basket in hot water. Dipping in citric acid solution or lemon or lime juice is also used to prevent browning of light coloured foods (for example sliced fruits such as apple). Sulphur dioxide prevents browning in dried fruits such as apple, apricot and pineapple, and in root crops and coconut. In sulphuring, cut or shredded foods are exposed to burning sulphur in an enclosed cabinet. In sulphiting, the food is soaked in a solution of sodium sulphite or sodium metabisulphite.

FIGURE 18 Manual slicing equipment to prepare foods for drying
(Photo by P. Fellows)

Syrup pre-treatment can also be used to extract some of the water from fruit pieces before drying. Fruit is heated for a few minutes in a sugar syrup and soaked overnight. This produces a succulent, soft texture in the dried product.

Sun drying has the lowest cost but it is only possible in areas where the weather allows foods to be fully dried within a short time (i.e. in hot, dry air). The main problems with sun drying are variable quality products as a result of slow drying in cloudy weather and at night; damage because the food is exposed to pests; no protection from rain or dew that can cause mould growth; and over- or under-drying. Solar dryers protect foods from dust and insects and they increase the rate of drying compared to sun drying. They can be constructed from locally available materials at relatively low cost and there are no fuel costs. However, they cannot dry foods at night and the control over drying conditions is only slightly improved, so the extra

FIGURE 19 Solar dryer fitted with a fuel-fired heater to allow continuous drying (Photo by P. Fellows)

investment in dryer construction may not be recovered by higher incomes. Higher value products may justify investment in a fuel-fired dryer. These are more complex and expensive to build, operate and maintain, and they require skilled labour for their operation. A compromise is to fit a fuel-fired heater to a solar dryer (see Figure 19) to produce a higher quality product because there is better control over the drying conditions, and drying can continue uninterrupted at night or in cloudy weather.

Dried foods can be stored in sealed earthenware pots or metal tins, but smaller display packs are required for sales to consumers. Sealed polythene film is only suitable for storing dried foods for a short time in humid climates before they pick up moisture, soften and go mouldy. Polypropylene gives a longer shelf-life, but it is usually more expensive and it may not be available in some countries.

Dried fruits, including grapes (raisins), sultanas and sliced/diced apple, pineapple or mango often have a high demand in both local and fair trade export markets, and dried strips of meat (for example 'biltong' in Southern Africa) also have a high local demand as a snack food. It is

important when producing dried meats and fish that the raw materials are soaked in brine or rubbed with salt to prevent pathogens from growing before the moisture is removed.

There are two methods of smoking foods: cold smoking changes the colour and flavour of the food, but it is not cooked and has a relatively short shelf-life; hot smoking cooks and dries the product as well as changing the colour and flavour. This food has a longer shelf-life and is more suitable for on-farm processing. Locally-constructed smokers can be made from wood or brick. The smoke can be produced in the smoking chamber or the smoker may have an external smoke generator. The latter type gives greater control over the time and temperature of smoking and produces a more consistent product. Adjusting the air supply to the smouldering wood controls the temperature and smoke density. Only hardwoods should be used because other types of wood produce bitter flavours in smoked foods. As with drying, meats and fish (see FAO Diversification booklet No. 13 *Farm ponds for water, fish and livelihoods*) should be treated using brine or rubbing with salt before smoking to prevent the growth of pathogens. Hot smoked foods have a long shelf-life with minimal packaging in dry climates, but they should be packed in moisture-proof and airtight plastic bags elsewhere to prevent them becoming mouldy.

FIGURE 20 View of twin Chorkhor ovens used for wood-smoking large quantities of fish (Photo: FAO/ 22538)

Fruit preserves and pickles

Jams, jellies and marmalades

Jam is made from fruit pulp or juice with added sugar and sometimes added pectin (a gelling agent) and/or citric acid. Jellies are crystal-clear jams made from juice that is filtered through a fine cloth, instead of using fruit pulp. Marmalades are produced from clear citrus juices and have fine shreds of peel suspended in the gel. The high sugar content and acidity of all preserves prevents mould growth after opening the pack so that it can be used a little at a time.

For fruits that have a low acidity and little natural pectin (for example melon, papaya), citric acid or citrus juice, and powdered or liquid pectin are added. These products are made by boiling fruit pulp/juice with sugar in a stainless steel pan to concentrate the mixture. Other types of metal should not be used because they react with fruit acids. The correct point to stop boiling can be checked using a jam thermometer, by placing a drop of the product in cold water to see if it sets, or by using a hand-held refractometer. However, a refractometer is likely to be too expensive for most small-scale processors. Preserves are hot-filled into glass jars or polypropylene pots using jugs and funnels.

FIGURE 21 Cottage-scale jam making
(Photo by P. Fellows)

Pastes, purees and fruit 'cheeses'

The most common types of pastes and purees are tomato and garlic, which are widely used in domestic cooking and food service outlets in many countries. The high solids content and natural acidity preserve them for several weeks provided they are properly packaged. They can be made at all scales of production, from household- to small-scale by carefully boiling the pulp in a pan with constant stirring to prevent it darkening or burning. An alternative method of making tomato paste is to hang the pulp in a cotton sack and allow the watery juice to leak out. Salt is then mixed in and it is hung again until the weight falls to one third of the original, before a final short boiling to reach the final solids content. This method produces a product that has a natural flavour and uses considerably less fuel than boiling. Fruit 'cheeses' are fruit pulps that are boiled until they set as a solid block when cooled. They can be cut into bars or cubes to eat directly as a snack food or small pieces can be used in confectionery or bakery products.

Pickles and chutneys

There is a wide variety of pickled fruits and vegetables: unfermented pickles are vegetables such as cucumber, cabbage, olive or onion, packed in jars with vinegar, salt and sometimes sugar and pasteurized in a bath of hot water; fermented pickles are made from the same vegetables using lactic acid bacteria to ferment sugars in the food to lactic acid (see also FAO Diversification booklet No. 21 – *Traditional fermented food and beverages for improved livelihoods*). This helps preserve the pickles, although some are also pasteurized. Sweet pickles are made from single fruits or mixtures of fruits and vegetables, and are preserved by the combined action of lactic acid bacteria or added vinegar, sugar and in some cases added spices. Pickles may be packed in small quantities in sealed polythene pouches or in plastic pots. Salted vegetables are made in plastic or steel drums by building up alternate layers of chopped or shredded vegetable (for example cabbage) with layers of salt. The salt draws out water from the vegetables to form concentrated brine, so products can be kept for several months. Washing the vegetables reduces the salt before they are sold and eaten.

Chutneys are thick, jam-like mixtures made from a variety of fruits and vegetables, sugar, spices and sometimes vinegar. The high sugar content and acidity preserves the product. Some products are

boiled to pasteurise them, and others are allowed to ferment so that acids produced by the lactic acid bacteria preserve the products. Some spices such as ginger, mustard, chilli and garlic also have a preservative effect. In the process, ingredients are boiled until thickened and packaged in a similar way to jams.

Sauces

Tomato sauce, chilli sauce and mixed fruit sauces such as 'Worcester' sauce are thick liquids that are made from pulped fruit and/or vegetables. They are boiled together with salt, sugar, vinegar and spices (for example cinnamon, cloves, allspice or cayenne pepper). The acidity, salt and sugar prevent spoilage after the pack is opened. They are produced at any scale from household upwards, by heating the ingredients in stainless steel pans with constant stirring to avoid burning the product, and then packing them in bottles.

FIGURE 22 A range of chilli sauces
(Photo by P. Fellows)

Non-alcoholic beverages

The consumption of juices, especially pineapple, passionfruit and citrus juices, is increasing in urban centres in many countries. Juice can be extracted from fruits in a number of ways, depending on the hardness of the raw material (see FAO Diversification booklet No. 16 – *Fruit products for profits*). Soft fruits, such as melon, strawberry and papaya, can be pressed in a manual or electric fruit press, pulped using a juicer attachment on a food processor, or 'dissolved' by heating them in a steamer.

In larger-scale operations, a pulper-finisher (see Figure 23) pulps the fruit and also separates skins and seeds from the pulp. Citrus fruits are 'reamed' to extract the juice without the bitter pith using manual or electric reamers. Harder fruits, such as pineapple are peeled and then pulped using a powered liquidiser. When a clear juice is required, it is filtered through a fine cloth or stainless steel juice strainer. Juices are then filled into bottles and pasteurized in hot water. They have a shelf-life of several weeks without refrigeration.

FIGURE 23 A pulper-finisher for producing fruit juice
(Photo by P. Fellows)

Squashes are made from fruit juice mixed with sugar syrup and cordials are crystal-clear squashes. Sugar syrup is heated to boiling and mixed with filtered juice in a stainless steel pan, before hot filling into bottles. These drinks are diluted with water and used a little at a time, so they may contain a preservative (usually sodium benzoate) to prevent spoilage after opening. They have a shelf-life of several months at ambient temperatures.

Hygiene, safety and quality

When farming families prepare meals and other processed foods for home consumption, the foods should of course be safe to eat, but any variations in quality are usually acceptable to family members. However, a different situation exists when farmers process foods for sale: the products should have a high quality to compete effectively with other processors, and the quality should be consistent for every batch that is produced. This requires additional skills in quality assurance.

Foods that are acidic are unlikely to carry a risk of food poisoning because pathogenic bacteria are unable to grow in them. These foods include fruits and fruit products such as juices and chutneys, fermented dairy products such as yoghurt, and foods that have added acids such as vinegar in some types of vegetable pickles. Similarly foods that are correctly heated to a sufficiently high temperature for a sufficiently long time are unlikely to cause food poisoning (for example boiled jams, pasteurized milk, bakery products). The main dangers are from low-acid foods (including all animal products, vegetables and moist cereal products such as dough, see Table 7). These may become contaminated by bacteria or moulds before or during preparation. If the foods are inadequately heated during processing, some pathogenic bacteria may survive the process and risk causing food poisoning.

In other foods, some types of bacteria and moulds can release poisons into the food that are not destroyed by heating and result in food poisoning. This can be a particular problem with cereals, nuts and legumes that are contaminated by moulds, or spices contaminated by pathogenic bacteria, as a result of poor post-harvest handling and storage. Any product that uses water as an ingredient also has the potential to cause food poisoning if the quality of the local water supplies is unsatisfactory.

TABLE 7 **Risk of foodborne diseases from different types of foods**

High	Medium/Low
Cooked food to be eaten cold	Bakery products without fillings
Dairy cream, raw milk	Dried foods
Leafy salad vegetables (e.g. lettuce)	Fried food
Uncooked dough	Fruits and fruit products
Pastries/pies filled with meat, fish or vegetables, especially when eaten cold	Pickles and chutneys
Raw meat and fish, meat products such as sausages	Salty foods - e.g. cured and smoked meats and fish

In other foods, some types of bacteria and moulds can release poisons into the food that are not destroyed by heating and result in food poisoning. This can be a particular problem with cereals, nuts and legumes that are contaminated by moulds, or spices contaminated by pathogenic bacteria, as a result of poor post-harvest handling and storage. Any product that uses water as an ingredient also has the potential to cause food poisoning if the quality of water supplies is unsatisfactory.

Other hazards include contamination of foods by metal or glass fragments, pesticide residues or other contaminating chemicals, by dirt and dust, or by hair, feathers and excreta from rodents or birds and insects or their body parts. Foods can also become contaminated if the farmer has poor personal hygiene or does not practice hygienic food production.

The location where processing takes place is also important: places that have accumulations of rubbish that attract insects, rodents or birds; lack of clean water for washing hands and equipment; or insufficient facilities to dispose of waste food in a hygienic way each contribute to an increased risk of contamination of foods. Education and training are key factors in ensuring good personal hygiene (washing hands, clean clothes, etc.) and keeping the food production unit clean and tidy.

One aim of processing is to reduce, or if possible eliminate, these hazards

to make foods safe to eat. The principle factors that are used to preserve foods and reduce hazards from micro-organisms are shown in Table 8. These factors may be thought of as a series of fences (or hurdles) that micro-organisms have to 'jump' in order to survive a process. The more hurdles there are and the higher the hurdles, the more difficult it is for micro-organisms to survive processing. For example, in making pasteurized milk the hurdles are: low temperature storage of milk before processing; heating the milk to a high enough temperature for a long enough time; and packaging the pasteurized milk to prevent it becoming contaminated. A more complex series of hurdles exist in jam making: the temperature and time of boiling; the high sugar content and low moisture content; the acidity of the jam; and the packaging are each hurdles to microbial growth. Similarly in smoked meats, the hurdles are the use of salt (which kills bacteria) before smoking; the time and temperature of smoking; the amount of smoke that is deposited on the meat (another antimicrobial chemical); and the low moisture content after smoking.

TABLE 8 **Factors that preserve foods and reduce hazards from micro-organisms**

Factor	Examples of types of processes
Heating to destroy enzymes and micro-organisms	Boiling, blanching, roasting, grilling, pasteurization, baking, smoking
Removing water from the food	Drying, concentrating by boiling, filtering, pressing
Removing heat from the food	Cooling, chilling, freezing
Increasing acidity of foods	Fermentation, adding citric acid or vinegar
Using chemicals to prevent enzyme and microbial activity	Salting, syruping, smoking, adding chemical preservatives such as sodium metabisulphite or sodium benzoate
Excluding air, light, moisture, micro-organisms and pests	Packaging

Non-microbial hazards are reduced by properly sorting and inspecting foods before and during processing. One of the most cost-effective ways to ensure the quality of foods is to make sure that farmers are properly trained to sort and inspect raw materials before they are processed.

Good sanitation is essential to prevent contamination of products, and equipment should be thoroughly cleaned after each day's production. No wastes should be left in the processing room overnight. All wastes should be disposed of in a way that does not damage the local environment. Solid wastes should be removed from the building at regular intervals, and either buried or turned into animal feed or compost; and liquid wastes should be disposed of in soak-aways that do not risk polluting local water supplies.

The safety of foods is assured by farmers carefully inspecting and sorting their raw materials, the use of strict hygiene and correct processing conditions, and adequate packaging. This may require training in each of these aspects by advisors and support organizations. Examples of training include how to ensure product safety, hygiene and quality using simplified and appropriately targeted versions of 'Good Practices' approaches, including Good Agricultural Practices (GAP), Good Handling Practices (GHP), Good Manufacturing Practices (GMP) and Hazard Analysis and Critical Control Point (HACCP) systems (see the *Selected further reading* section of the booklet for further information).

Sustainable strategies for the processing enterprise

Whichever types of food smallholder farmers select for processing, there should be sustainable strategies that enable the enterprise to earn income over and above its costs and if possible to grow and become more successful. The most important components of strategies for sustainable livelihoods in food processing are those that enable a process to be set up, such as provision of knowledge about equipment and packaging; availability of credit; those that help generate sales and income using market appraisals; and those that ensure the enterprise operates successfully and profitably, including skill development in management, finance, marketing and quality assurance and keeping records.

Market appraisal

Conducting regular market appraisals helps to make an enterprise less prone to failure. Smallholders who are in direct contact with customers, be they final customers in rural markets as well as retailers for example, are more proactive and not reactive to changes in markets or consumers' preferences. They can obtain information from customers regarding, for example, the quality of products, whether the amounts sold in a pack meet customers' requirements, which products are bought most often, and how the quality and price compare to competitors' products. They can also use this contact with customers to assess new products by asking customers to taste them and give their opinions on what they think about them and what price they might be willing to pay. Farmers can also use this contact to find out who else could be targeted as potential new customers.

Products: safety, hygiene and quality

An important element for a sustainable strategy for this livelihood activity is quality. All products must be safe to eat, and not risk injuring or poisoning consumers. They should also have the quality that meets consumer expectations and standards. This means that everything, from growing the food, through handling and transport, to storage of ingredients, preparation and processing of the foods, and packaging them, should have an

emphasis on maintaining the quality and safety of the products.

Product packaging

Farmers should regularly review the type of packaging they use to ensure that it is effective and has the lowest cost. Packaging is needed to transport foods to sellers and also to promote the foods. Distribution packages need to be sturdy, easily handled and they should prevent the food becoming contaminated or damaged during transport. Wooden, plastic or cardboard boxes are commonly used as transport containers. Retail containers that are used to display the foods should be attractively designed to compare well with those of competitors.

The choice of which materials to use for retail packaging (for example glass, plastic, paper, etc.) depends on the properties of the foods, the availability of packaging materials at a local level and their cost. Packaging for liquid foods is most commonly re-used glass jars and bottles that can be collected and washed at low cost. Dried and baked products may be sold in simple paper wraps or polythene bags to keep them clean. Farmers should also take account of the minimum quantities per order and the reliability of the supplier if they consider a new source of packaging materials. The information on labels such as the producer's name, weight of food inside, the ingredients used, as well as expiry date of the product is a legal requirement in most countries. Advisors can support small-scale farmers by providing information on appropriate materials to be used for the particular type of food, as well as possible suppliers of packaging and the local legal requirements.

Access to markets

Small-scale farmers need to be able to access customers such as retailers who can sell their products. They are likely to know their own areas or local towns and are therefore able to judge for themselves which are the best retailers to select to sell their products. However, they may require assistance from advisers if they expand the enterprise to cover locations further afield.

Access can be hindered by problems caused by poor road infrastructure or lack of public transport, lack of communications technology, or insufficient funds or access to credit. Policy constraints that hinder trade may require interventions to provide a stable business environment, facilitate rural-urban linkages, cut red tape or make it easer to obtain licences, etc. Small-scale farmers require support

from advisors to provide information and advice about local municipal legislation, and finding their way through bureaucratic procedures regarding health certificates, licences or permits and so forth.

Access to credit

Small-scale farmers who do not have sufficient readily available cash to buy equipment and materials or to prepare a processing room to the necessary hygienic standards are likely to require credit when getting started. They may also require credit to get them over periods of cash shortages during operation of the enterprise. The credit options that may be available are often limited, especially if farmers lack the collateral that is required by formal lenders.

Small-scale farmers first option is to contact family members or friends to borrow money informally, possibly in return for a share in the business. If, as is likely to be the case, these people also have limited funds, the farmer's next option is to apply to one or more micro-finance initiatives that are operated by local or international NGOs. These organizations may have lending conditions that are more favourable to farmers, including the interest rates that are charged, payback periods and other conditions that are placed on the loan. Alternatively, they could join together with a number of other farming families to set up a community savings scheme with assistance from advisers. The next option for many farmers is the formal credit sector, including development banks and rural banks. These institutions are likely to require a feasibility study to provide evidence of the business potential and security of loan repayments before they are willing to support the venture. However, their generally higher interest rate makes it more difficult to set up and operate a profitable enterprise, or extend the time until a business can become profitable. The final option for small-scale farmers is traders and middlemen that operate as unofficial moneylenders in many rural areas. Generally, they make funds available when they are required and without collateral, but they often charge exorbitant interest rates that can result in permanent indebtedness by farmers, and for this reason these should be the last option that is explored.

Management, marketing and selling

Good organization of the enterprise in terms of production, processing

and marketing is another important element of a sustainable strategy. To be successful, smallholder processing enterprises need to have well-developed linkages, relationships and networks that assist with the operation and development of the business.

Advisers can assist small-scale farmers in developing these networks using their own contacts with government and private sector institutions. These include chambers of commerce and manufacturing associations that arrange meetings, trade fairs, workshops or seminars. Advisers can also provide linkages to professionals to arrange technical assistance for product testing by laboratory services, or legal and accounting support. Advisers with backgrounds in management, marketing and economics can deliver appropriately designed training courses to improve marketing, business management and financial management, in ways that are easily understood by farmers. Other advisers can train farmers in hygiene and food handling, correct processing and packaging techniques needed to produce high quality processed foods, and appropriate quality assurance techniques.

Managing production planning

Farmers need to plan their production to find for example:

- What type and size of equipment they need to meet market demand.
- The levels of stocks they should hold (for example raw materials, ingredients, equipment spares, packaging and finished products).
- How many people they need and what skill levels are required.
- The amount of fuel or electricity required for the process.How much money they need to start the enterprise.

Farmers should use production planning techniques to identify any potential 'bottle-necks' in a process and continually modify the plans if necessary to ensure that all parts of a process have the capacity to meet market demand for their product(s).

Raw material and ingredient supplies

It is important that smallholder processors have all raw materials and ingredients in place to meet production requirements. Orders from customers need to be used to decide the volume of processing and to be able to calculate the weights of raw materials and ingredients that will be needed (see Box 3).

BOX 3 **Obtaining raw materials and ingredients**

A small-scale chutney processor uses tomatoes, sugar, chillies, garlic and salt as ingredients. Because of their short shelf-life, tomatoes are brought daily from the fields, whereas chillies and garlic are harvested fortnightly. Stocks of salt and sugar are replenished monthly. The farmer may use a chart to work out the ingredients needed for a week's production as follows:

Week N°	Raw materials & ingredients for chutney (kg)				
Day	Tomatoes	Sugar	Chillies	Garlic	Salt
Monday	35	-	1	0.25	50
Tuesday	35	-	-	-	-
Wednesday	35	-	-	-	-
Thursday	35	200	-	-	-
Friday	35	-	-	-	-
Harvest/buy	175	200	1	0.25	50
Stock	-	110	0.2	0.85	1
Total	175	310	1.2	1.1	51

Source: Adapted from FAO. 2005. Business management for small-scale agro-processors, by P. Fellows & A. Röttger, Agricultural Management, Marketing and Finance Working Document No. 7, Rome

Farmers should also take account of losses during processing (for example, from spoiled raw materials that are thrown away during sorting, from accidental spillage, etc.) (see Table 9 on next page) and ensure that they have additional materials to take these losses into account.

All products increase in value during processing and any losses that arise towards the end of the process are much more serious financially. Farmers should reduce losses as much as possible by using only good quality raw materials and training workers or family members to reduce wastage (for example reducing damage to soft fruits and vegetables caused by poor handling during harvest and transport to the processing unit). Farmers should make sure that all raw materials are correctly handled and stored (for example cool crops after harvest and store them in a cool place; remove any damaged pieces to prevent them infecting the others; avoid over-filling crates to prevent crushing the food when they are stacked). Likewise, handling meat, fish and milk should be done carefully and hygienically to avoid the risk of introducing food poisoning bacteria to these raw materials.

TABLE 9 **Typical losses in different types of food processing**

Stage in a process	Typical losses (%)			
	Oil extraction	Fruit & vegetable processing	Cereal processing	Fish, meat & dairy processing
Sorting raw materials	5 - 30	15 - 30	5 - 30	5 - 20
Preparation	-	5 - 30	-	10 - 30
Processing	10 - 15	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	0 - 10
Distribution	0 - 5	0 - 5	0 - 5	0 - 5

Part of a sustainable strategy for processing is the frequency with which smallholder farmers bring raw materials from the fields, and this depends on how stable they are: cereals have a long storage life, whereas fresh fruits and vegetables have a much shorter storage life. Animal products must be processed immediately to prevent spoilage. Depending on the particular area, there may be a single harvest season each year for oilseeds, nuts, cereals, legumes, root crops and some fruits and vegetables, and these may be stored for many months. Most short storage life crops (especially soft fruits) are brought from the fields daily during the harvest season to minimise spoilage before processing. Fish, meat and milk are usually available throughout the year, although there may be changes in the amounts produced during a dry season, but farmers do not have the same problems of seasonality that crop processors need to plan for.

It is possible for farmers to part-process and store seasonal crops for later production, by drying or removing water using concentrated sugar syrups or brine, or by storing foods with a chemical preservative. Part-processing makes the raw materials available throughout a larger part of the year, but it has a number of disadvantages:There is a longer time before the farmer receives an income from the crops, and money spent on part-processing is tied up for longer periods before products are sold.

- Larger buildings, and hence higher start-up costs, are needed to store the part-processed products and there is a higher expenditure on drums or other containers.
- The farmer requires good skills to manage the stock and production planning is more complex.
- There is a risk of spoilage and financial losses if the part-processed products are incorrectly stored.

Intermediate storage is therefore a more expensive and higher risk option, and only more experienced smallholder processors practise it. An alternative strategy is for farmers to process a succession of crops throughout the year. This is a favoured option for many farmers, but it too carries risks: production planning is complex because different ingredients, labels, etc., need to be ordered in advance; there may be frequent changes to production methods that workers have to understand; and sufficient products have to 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.

Marketing and selling

Selling is the action of exchanging the processed food for money, whereas marketing is making potential customers aware of the benefits of the particular product. Marketing therefore paves the way for selling. Farmers should think about what is special about their product and the service they can offer to customers, which is summarised as a 'marketing mix' (see Figure 24 on the next page). Using the information from a market assessment, farmers can identify groups of people who are likely to provide the greatest sales, and if necessary refine their product and its production to meet the needs of customers and consumers. The marketing plan also involves developing an attractive package, negotiating with retailers, distributors or other buyers, and designing and distributing promotional materials.

Farmers have five potential types of markets that they can consider supplying:

1. *The local community:* consumers who are neighbours and other members of the village.
2. *Local villages:* in many rural areas, people from neighbouring villages meet in weekly markets and farmers can rent a stall in the marketplace, set up

Product High quality Attractive appearance of the food or packaging Available in the amounts required	**Promotion** Free samples Events, fairs and shows Posters Special promotions In-shop poster displays
Place Long opening hours Clean with good decoration Popular location Fast and friendly service	**Price** Low price Special offers

FIGURE 24 Examples of components of a 'marketing mix'

roadside stalls, or rent a shop in a neighbouring village.

3. *Rural towns:* these have larger daily markets that attract people from a wider area and have a larger range of income groups who are potential customers in shops or markets. There may also be sales to small hotels, bus stations, cafes, etc.
4. *Large towns / capital city:* these have people with higher disposable incomes and therefore large numbers of potential consumers. Urban residents may also be more willing to try out new or different foods.
5. *Export markets:* some types of processed foods are suitable for export. However, this is not an option for an individual farmer because of the administrative and legal complexities of exporting. Export by well-organized farmers' producer/marketing associations may require assistance, either from local agents or from advisers in business development agencies. Sales of processed foods such as dried fruits, nuts, cooking oils, shea butter and jams to Fair Trade organizations (see *Sources of further information and support*) are also possible for farmers' groups. These organizations assist communities to establish village development programmes to use the income from sales to fund improvements to community facilities.

Farmers also can consider other markets such as demand from cafés, restaurants, hotels and guest houses. Another option is to consider supplying larger-scale food processors with processed foods that they use as ingredients (for example honey, cream or jam used by bakeries or fruit juices used by wine-makers).

BOX 4 **Tips for small-scale processors to increase sales in local markets**

- Produce products that have an attractive appearance and packaging, with a catchy brand name that people will remember and/or display them in an attractive manner if they are not packaged.
- Make sure that products have the same quality every day.
- Make sure that the same weight of product is filled into each pack.
- Emphasise in the promotions that the products are produced hygienically.
- Try to increase production to benefit from economies of scale, and pass on lower prices to customers.
- Create a reputation for high quality products and value for money.

Small-scale farmer processors need to make sure that consumers try their products to evaluate their quality and value for money. Advertising and promotion aim to ensure that consumers trust the brand of food, and build up loyalty to it. This is done by larger food companies, and small-scale farmers have to do the same thing, but with more limited budgets. This could for example be as simple as a hand-coloured poster to advertise the food in a rural shop or a painted signboard outside the production unit.

Consumers require processed foods to be good value for money, to be of quality and meet their expectations and not harm them in any way. Consumers may also be concerned about processed foods from small-scale farmers having low or variable quality or poor hygiene in on-farm processing. These should be addressed by careful processing and attractive packaging - so that the quality 'speaks for itself' - and also building up strong relationships with retailers and other buyers so that they promote farmers' foods to consumers.

Recordkeeping

In household- and cottage-scale operations as well as some small-scale processing businesses, farmers keep all 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 farmer falls ill, no one else can know what is happening in the business. Financial management for a sustainable enterprise requires records, but keeping records for their own sake

is useless: they should be used to monitor and control a business. Smallholder processing enterprises at all scales of operation need to keep financial records to know how much income there is from sales, and how much has been spent - and for what purpose. The benefits of keeping records include:

- Being able to reduce costs, know how much profit/loss is being made.
- Detecting fraud or theft among employees.
- Conforming to tax laws.
- Know which customers owe money and how much.

Sustainable business enterprise

Whatever level of investment is chosen for a food processing enterprise, from a household-scale to small-scale, it has to be economically viable i.e. earn a profit. This means that income earned needs to be greater than the costs, not only in the short term but also in the long term. If high quality foods are produced and sold, customers have greater trust, which results in repeat sales as well as word-of-mouth promotion to other potential customers. This can generate increased sales and income for the small-scale farmer. However, it is important that the farmer reinvests some of the profits in the enterprise to enable it to grow.

Support services to promote processing as a livelihood activity

Rural isolation and lack of education may each contribute to small-scale farmers' poorly developed knowledge and skills in how enterprises operate. When starting to diversify into food processing as a source of income, they may be unable to compete effectively or operate a sustainable business without additional support and training. They may also lack the technical skills and knowledge to produce foods hygienically, safely and with the quality demanded by consumers and retail buyers.

This section describes the areas of support that are likely to be needed by small-scale farmers when they establish a food processing enterprise. It is important to stress that advisers and support organizations have a responsibility to carefully evaluate the assistance that they provide to ensure that it is effective in meeting the needs of the individual farmers and communities that are being assisted. They should only advise and assist, and not attempt to make the decisions for farmers and communities.

Public policy and institutional role

National and local governments have a central role in supporting food processing enterprise development by fostering an enabling environment that encourages trade, creates new enterprise opportunities, reduces bureaucratic procedures such as business registration, and facilitates inspection of food premises or food quality certification. Technical support services may be provided by government institutions, such as technical colleges, universities, bureaux of standards, departments in Ministries of Agriculture, Health or Commerce/Trade and Industry and their related extension services.

In order to access services offered by public institutions, small-scale farmers require proximity to such services. Because of the difficulties and costs faced by farmers in travelling from rural areas, this means that support services should have decentralised access points that farmers can use in rural areas. These need not be permanent offices, but there should be regular and well-

advertised visits to an area by staff from the institution concerned.

A key role for governments is the provision of infrastructure such as roads, clean water supplies and telecommunications. At local government and municipal levels, providing clean water supplies ensures improved hygiene and safety in food production, and a reliable and well-maintained road system enables increased trade and economic development of an area. Governments can also use tax breaks and other measures to encourage small-scale enterprise development and also support agencies and public-private partnerships that provide assistance to small-scale entrepreneurs in for example technical and business training.

Another role for government is to create legislation and regulatory environments that support food enterprises, such as food quality regulations that can be met by small-scale processors in an affordable way. By providing support such as training and technical advice, government agencies can encourage more enterprises to register in the formal sector in order to receive the support. At a local level, government and private sector institutions, including chambers of commerce, manufacturing associations, etc., can help create and foster linkages for small-scale food processors by for example, arranging meetings, trade fairs, workshops and seminars.

Local government and municipal authorities have a role in providing advice and support to farmers and food processors: a local administration has good knowledge of the particular characteristics of the markets in its geographical area and the local context in which food processors operate; it is also likely to be more accessible to farmers than national institutions. With appropriate guidance and training, local authorities can have an important part to play in national programmes of support to enable small-scale farmers to diversify into food processing. The main areas of national and local government policy and institutional support that are likely to be available to farmers engaged in food processing are described below.

Quality and safety regulations

Most countries have national legislation to ensure that food processing premises are registered; that hygienic processing operations take place in these premises; to control the composition and safety of some foods to prevent fraud and risk of injury to consumers;

and to ensure that food processing staff work in a safe environment. Staff who handles food may also be required to undergo an annual or biannual health check to make sure that they do not carry any diseases that could be transmitted to consumers via the foods.

In some countries regulations are aggressively enforced by local inspectors, with fines or imprisonment for serious contraventions, whereas in other countries enforcement officers take the view that with proper advice and training they can correct any problems without resort to the law. This more enlightened policy approach results in better relationships between processors and officials, reduces the incidence of 'hidden' companies that try to evade detection by authorities, and reduces the incidence of corruption. It is also likely to result in more cottage- and small-scale processing enterprises registering as formal enterprises, especially if the local authorities offer subsidised training, information or technical support that is only available to registered food businesses. There is also a role for public institutions to devise or adapt quality assurance methods to make them affordable and easily adopted by small-scale processors.

Licensing, legal matters and bureaucratic procedures

There are various options that farmers can choose from when setting up an enterprise and advisors should use their experience to offer choices of enterprise management structures that meet farmers' needs. Advisers should also consult with an accountant or solicitor on behalf of farmers to see whether professional advice is needed on the best type of enterprise to establish. Once a business is established, advisors can assist farmers to follow the correct procedures to register the business and deal with licensing and legal matters. If required they may also provide information and experience of established group structures that have been successful elsewhere and help to establish farmers' groups or small-scale processing associations (see Case Study 4). Advisers should also be aware of schemes operated by national or local governments to encourage small enterprise development, such as Small Business Advisory Services, which may offer support to new farmers' enterprises, and pass this information on to farmers. Before new enterprises can sell foods they may need to be inspected, and advisers can provide information about regulations on food hygiene, food composition, labelling and other legislation and advise on how to prepare production units for inspection.

CASE STUDY 4 **Assistance to small-scale food processing enterprises from a support agency**

Since 2004, the Women Entrepreneurship Development (WED) programme in food processing has operated as an independent unit within the Small Industries Development Organization (SIDO) in the United Republic of Tanzania. The programme has the objective of promoting productive employment and gender equality, within the focus on poverty alleviation and sustainable livelihoods. The impact of this programme has reached all 21 regions of the Tanzanian mainland and the islands and current programme activities include:

1. *Food processing and entrepreneurship development courses including Training of Trainers courses.* WED has modern facilities for training entrepreneurs and trainers in food processing methods and technologies, food quality and safety, complemented by business and entrepreneurship skills for managing enterprises. The distinctive features of the training are a combination of entrepreneurship and technical skills offered by experienced trainers with reputable credentials. Training is tailor-made according to the needs of course participants, using participatory training techniques and sharing experiences through learning by doing. Trained entrepreneurs are equipped to start their own food processing enterprises supported by advisory services.
2. *Consultancy for the small-scale food industry.* WED offers services to food processing entrepreneurs in surfing the Internet, local and international technology suppliers, compiling and offering information on food processing technologies.
3. *Provision of information on food industry markets.* Finding market information on the Internet, using local and international publications, newsletters, bulletins, booklets, etc. Preparation of feasibility and other technical studies for micro-, small- and medium-scale enterprises (MSMEs). Business cash-flow preparation and proposal writing.
4. *Organizing open days and trade fairs for MSMEs to promote products made by women entrepreneurs.* The programme organizes open days/exhibition for enterprises in food processing, packaging and related industries. Exhibitions provide a forum for interactions with consumers, policy-makers, financiers and other stakeholders; in addition to promoting manufactured products. Participating exhibitors obtain good contacts including orders from supermarkets and hotels. The programme also facilitates participation in national and sub-regional trade fairs (for example Nairobi and Kampala international trade fairs).
5. *Sourcing and sale of food processing equipment and other inputs such as packaging materials.*
6. *Facilities for food processing trials and product testing.* These include fruit, vegetable and meat processing, pasta making, baking, mixing, milling flour and grinding spices, and oil processing. The unit also has a quality control laboratory and water treatment plant and can be used by micro-scale entrepreneurs wishing to expand their businesses.
7. *Networking and advocacy.*

CASE STUDY 4 **Assistance to small-scale food processing enterprises from a support agency** *(Cont.)*

WED has trained 118 trainers to date who are working in all regions of the United Republic of Tanzania and Zanzibar, with all 21 regions having 1 to 2 trainers, some located in the rural areas. In summary:

- 2 400 entrepreneurs have been trained in short courses (from 2 days to 2 months), of which 585 are 1 to 2 month courses.
- Over 70 percent of trainees are in business.
- Assets of the women in business range from US$670 to US$16 200
- 1 700 jobs have been created by both long and short course participants.
- Value added to processed foods compared to raw materials from farms is over 200 percent.
- Most of the enterprises produce quality products, which are sold in different supermarkets in the country competing with imported food products.
- Formation of a Tanzanian Food Processors Association operating independently from the programme and with over 200 paid up members is another positive impact of the programme.

Source: Adapted from the Small Industries Development Organization, United Republic of Tanzania (Available at http://www.sido.go.tz/Web/Index.aspx)

Access to investment funding

Where farmers require investment funding to establish a food processing venture, assistance from advisers can include information on sources of credit, financial services, the types of credit available from formal banking systems and whether they are eligible to apply for a loan. Advisers can also help them to present their requirements for a loan to formal lending agencies using the feasibility study. Where bank loans are not appropriate, advisers can provide information on other credit options that may be available to them, including micro-finance initiatives run by NGOs, credit from equipment suppliers, or setting up community savings schemes.

Financial services

In most countries, governments hand over provision of financial services to the private sector, but there are opportunities for national and local governments to support and publicise micro-finance initiatives run by commercial companies or NGOs. They can also assist business start-ups with a number of other financial incentives, such as the examples in Table 10.

TABLE 10 **Examples of financial support for small food processing business start-ups**

Type of support	Notes
Time- limited tax breaks	For example reduced business tax or reduced utility costs for the first three years.
Business start-up grants	Either direct grants that are given out for training, recruitment or capital investment projects, which may require a 50 percent contribution by the company, or repayable grants, which are repayable out of future revenues (but are written off if the company fails).
Soft loans	Where the terms and conditions of repayment are more generous than under commercial financial arrangements (e.g. lower interest rates or no interest payments, or repayment over a longer period).
Equity finance using public funds	Used to finance a capital sum and take a share in the enterprise. When the value of the firm increases the stake is returned. Unlike private venture capital, the expectations and requirements of the finance are less demanding.
Free or subsidised consultancy	Used to assist start-up businesses that lack particular skills, which may be provided by public institutions or contracted private consultants.
Use of public buildings with low or zero rental	Access for small-scale processors to publicly owned buildings or facilities that they need to produce particular products.
Grants	Funding for the transfer of improved technologies and new best practice initiatives to small-scale enterprises through business support networks.
Cost-sharing	Establishing schemes for shared-cost product or process development where the costs are shared between several businesses that also share the improvements.

Technical training services

There is a need for small-scale processors to have ongoing technical training, both to improve processing and quality assurance and to develop new products. Government technical institutions, including technical colleges, universities and agricultural, food, and engineering research institutes, are each capable of providing training and outreach services to cottage- and small-

scale food processors. This may be subsidised by governments, but it should not be free - processors should contribute towards the cost, either directly through a course fee, or indirectly through a subscription to a processors' association that organizes the training.

The emphasis of the training should not be the theoretical classroom-based learning that is used in institutions, but it should be a practical 'learning-by-doing' approach that allows farmers to be shown how to do a particular activity and then be given sufficient time to practice it. This requires a reorientation of attitudes by many academic staff and a willingness to learn new training techniques. Also training should take place at the premises of a farmer's processing enterprise or in a farmers' association centre, rather than in a venue that is not representative of the conditions under which farmers work, such as a college. Trainers can also organise 'field visits' to observe other small-scale processing enterprises in other areas. Further details of training methods for small-scale food processors are given in Battcock *et al.*,1998. *Training in food processing: successful approaches*, in the *Selected further reading* section.

Business skills training

The development of entrepreneurial skills and knowledge in areas such as bookkeeping, production planning, cash flow management and marketing are all necessary to sustain a food processing business over time. Staff at business colleges or ministry field workers who have appropriate knowledge and experience in farm management, agribusiness management, marketing, finance and economics can deliver such training, but again it should be focussed on real-life problems rather than taking a theoretical approach, and it should be conducted away from an academic environment that can be intimidating to small-scale farmers. The *Selected further reading* section of this booklet includes references to business training materials that are suitable for small-scale enterprises.

Technology and equipment transfer

Government-funded institutions, including university food science and technology departments, food research institutes and engineering colleges each have a role in developing and transferring food processing technologies that are appropriate in scale and complexity for small-scale operations. Staff at

these institutions should also be aware of locally available technologies and machinery, know import agents who can supply equipment, and be able to research other suppliers via the Internet. This requires an 'outward-looking' approach by institutional staff to understand the needs of small-scale food processors and the actual market situation regarding equipment supply, in order to be able to work with them to find appropriate technological solutions.

Promoting farmer/processor associations

Government extension services from Ministries of Agriculture, Trade and Industry or Economic Development can promote the formation of associations for farmers who wish to undertake food processing. This requires a commitment by field staff, managerial support for the extension workers, and adequate funding to allow the field staff to regularly visit the associations, support meetings and train association members to properly manage the association.

Promoting and encouraging farmers' organizations and small-scale processing associations can contribute to supporting food enterprises. Associations can represent farmers in meetings where issues are discussed with public authorities. Likewise government institutions can communicate more efficiently and effectively with large numbers of small-scale farmers through associations to provide for example, information on new regulations or services offered by the institutions. Associations are also a more efficient way to deliver training. Advisors can initiate and encourage the formation of associations by providing the initial contacts, arranging meetings, and providing information on rules and legal status for the association and examples of other associations that operate successfully.

Role of private sector, national and international organizations/ non-governmental organizations

Local NGOs that have expertise in food processing, other 'third sector' organizations such as manufacturers associations or farmers' groups, and international development organizations that work in the country, including UN-based organizations such as FAO, each have a role to support government initiatives for small-scale food processing enterprise development. These organizations can often be more effective than national government ministries because their work priorities are to focus locally, to assess needs and design development programmes that meet the needs,

and raise funds to support the development work. They can be very effective in delivering services such as training in processing and quality management, improved business management, and provision of technical information and technical support, often in collaboration with staff from government-funded institutions.

Other aspects that advisors can address to promote and support food processing enterprises to improve livelihoods include:

- Provide information to farmers on demand and existing supply in processed food markets, how the sector functions, and the potential of the sector for small-scale food processors.
- Provide information on suppliers of equipment, packaging materials and ingredients.
- Help farmers obtain cost estimates to construct or modify building facilities for food processing operations.
- Provide information about regulations on food hygiene, food composition, labelling and other legislation. Regularly update farmers on changes in laws and/or the enactment of new laws.
- Advise and support small-scale farmers to conduct feasibility studies, to cost the business operation and estimate incomes and profitability.
- Advise on how marketing or access to markets can be improved.
- Provide support and training or provide information on who can deliver training in appropriate food handling, processing, packaging, quality assurance, storage and distribution of foods.
- Promote food processing associations or farmers' groups.

Challenges

The various and different constraints faced by farmers can be grouped into those that are 'the responsibility' of farmer/processors themselves, which they have some degree of control over, known as 'internal' constraints; and those that the farmer/processor has little or no control over, known as 'external' constraints. These are summarised in Tables 11 and 12 respectively

TABLE 11 **Examples of internal constraints on farmers**

Internal constraints on farmers	
Raw Material supply	Gluts during harvest time and lack of storage and part-processing facilities make continuous processing difficult.
	Lack of trust between farmers, or the lack of organizations to enable them to work together, result in insufficient volumes of crops to meet processing requirements. Planting incorrect varieties for processing.
Quality	Lack of knowledge and skills cause farmers to harvest crops when they are immature, cause damage to crops as a result of poor post-harvest handling, and they do not sort crops into different quality grades.
	Farmers are unable to afford facilities that would reduce damage and maintain the quality of their crops.
	Other problems meeting quality standards required by consumers, include lack of access to appropriate seeds, pest management or crop storage techniques/equipment; lack of technical skills in processing. Each of these restricts farmers' ability to meet quality requirements and reduces their income.
Financial	Lack of resources as a result of insufficient income to farmers from their crops. Reasons for this include delayed payments from buyers; lack of access to credit; high interest charges for informal loans by rural money-lenders or middlemen.
	Farmers' lack of access to capital means they are unable to afford post-harvest technologies to store crops or buy processing equipment. The need for income as soon as possible during the harvest and high levels of theft from fields in some countries, cause farmers to harvest and sell crops before full maturity, resulting in lower income.

TABLE 11 **Examples of internal constraints on farmers** *(Cont.)*

Internal constraints on farmers	
Financial	Lack of access to capital for expansion into food processing; high costs of capital in relation to expected production and processing margins, each reduce farmers' income.
Business management	Farmers' lack of skills or knowledge of the way in which commercial enterprises operate. This includes limited knowledge of business opportunities and realities; underdeveloped planning and business management skills; poor marketing knowledge and selling skills; little recognition of opportunities for product diversification.
Market access	Poor negotiating and selling skills; lack of trusting relationships and formalized agreements with buyers.

Source: Adapted from FAO. 2003. Strengthening farm-agribusiness linkages with small-scale farmers: Case studies in Latin America and the Caribbean, by P. Santacoloma, Agricultural Management, Marketing and Finance Occasional Paper No. 4 , Rome

TABLE 12 **Examples of external constraints on farmers and processors**

External constraints on farmers and processors	
Adverse macroeconomic conditions	Business rules and regulations that are inconsistent and not transparent hinder business development. Economic development stifled in countries with high taxes, poor tax administration and high levels of corruption.
	Poor monetary policies reflected in high interest rates, leading to high cost of finance and/or limited access to credit. Loans unaffordable where high inflation/high interest rates exist.
	Exchange rate devaluation leads to high costs of imported inputs. Reduced government expenditure on agriculture and insufficient margins in the farming sector.
Market constraints	Limited purchasing power by consumers results in low demand for processed foods, which limits profitability of processors.
	Small numbers of processing businesses do not support local manufacturers/suppliers of processing equipment, packaging and ingredients, which slows development of agribusinesses.

TABLE 12 **Examples of external constraints on farmers and processors** *(Cont.)*

External constraints on farmers and processors	
Market constraints	Trade liberalization policies increase competition from imported foods.
Lack of institutional support	Lack of coherent agricultural and business/industrial development strategies or problems with implementation.
	Under-funded education sector, with institutions having insufficient understanding of farmers' and processors' needs, and lacking resources and commercial awareness to implement practical support.
	Government policies that do not coordinate agricultural education, research and development with agricultural or industrial development policies, or conflict with them.
	Poor coordination and cooperation between government institutions and the private sector; breakdown of governmental extension services/absence of direct farm business support services. Extension services inadequately resourced; extension agents that lack marketing/business skills or organizational skills required to help farmers' organizations.
	Poor infrastructure (road, water, electricity, communications) and/or erratic supply and high cost of public utilities.
Limited availability of inputs	High cost of some raw materials and ingredients increases overhead costs and reduces processing margins. Inputs may be imported and local suppliers cannot compete on price and quality.
	Insufficient availability and high prices of seeds, farm machinery, fertilizer/chemicals, etc.; lack of local/affordable supplies of ingredients, packaging materials and equipment, all increase processing costs.
	Inadequate equipment production by local workshops and inadequate knowledge by workshops of hygienic and safe equipment design.

TABLE 12 **Examples of external constraints on farmers and processors** *(Cont.)*

External constraints on farmers and processors	
Restricted market information	Little or no publicly published information on markets, prices, trends, key market players. High cost/limited access to commercial market research services.

Source: Adapted from FAO. 2003. Strengthening farm-agribusiness linkages with small-scale farmers: Case studies in Latin America and the Caribbean , by P. Santacoloma, Agricultural Management, Marketing and Finance Occasional Paper No. 4 , Rome

Local perspectives on processed foods

In some countries, processed foods have a poor image and reputation with the general public as a result of unscrupulous food processors who deliberately adulterate foods (for example adding brick dust to chilli powder or papaya seeds to black peppercorns, diluting milk or fruit juices with added water, etc.). There may also be issues over poor or variable food quality as a result of inadequate processing skills and understanding of the process, or poor production control and quality assurance.

In other cases there are examples of simple fraud by some processors who under-fill packs of food or misrepresent a food by claiming that it is a more expensive type than it actually is. It is the role of local government inspectors to protect consumers against these malpractices, but small-scale processors associations can also enforce codes of conduct on their members, and both government and non-government training and support agencies can ensure that processors are properly trained to produce safe, wholesome foods that are accurately labelled.

Seasonal processing and raw material quality

Gluts of raw materials during harvest time are common for some crops and lack of storage or part-processing facilities makes it difficult for processors to operate continuously throughout a large part of the year. This restricts their ability to meet buyers' requirements and it reduces their income. Also lack of trust between farmers to work together and a lack of farmers' or processors' organizations that could coordinate raw material supplies results in insufficient volumes of crops to

meet the demand by processors. Additionally, the quality of crops may be compromised because of farmers' lack of knowledge and skills, which cause damage to crops from poor post-harvest handling and not sorting crops into different quality grades.

Lack of skills and knowledge of the way in which commercial enterprises operate is also a significant constraint on development of on-farm processing enterprises. Inefficient production leads to high costs of raw materials, and other inputs that are needed to add value to raw materials are often imported because local suppliers cannot compete on price and quality, each of which reduces the profitability of processing. These constraints can be addressed by investment in post-harvest facilities, establishment of producer cooperatives or similar organizations, and training and support to improve farmers' business skills.

Repair and maintenance of equipment

Most equipment used in household-scale processing does not require any specialised maintenance, and utensils, boiling pans, tanks etc., and lasts for many years before they need repairs. The only equipment that is likely to require maintenance are cutting blades that need sharpening, and this can be easily done on-farm without external inputs. Mechanized food processing equipment that is used at larger scales of operation requires engineering support for routine maintenance and repairs.

Lack of engineering skills and facilities in rural areas can be a serious constraint on production because of delays in getting spare parts or skilled technicians from urban areas to maintain and repair equipment. These are particular constraints when imported equipment is purchased, and long delays in obtaining spares or repairs can prevent orders being completed. This severely affects both an enterprise's income and its reputation with buyers. Regular maintenance is required to ensure that equipment operates safely, and some processors may be unwilling to carry it out because of the high costs. These constraints can be addressed by conducting a comprehensive feasibility study that should highlight any problems in engineering workshop backup and support, by farmers setting aside a maintenance budget, by buying locally manufactured equipment so that service engineers are available, or by ordering sufficient spare parts and having local engineers trained to service imported equipment.

Infrastructure and services

Farmers should design their food processing operations to take account of the infrastructure services that are available on site. The most important are access to safe water and all-year access roads, and for some processes access to electricity and fuels. Good telecommunications, usually with mobile phones, is also a service that benefits business development. Two constraints caused by inadequate infrastructure/service provision are where a household-scale enterprise wishes to expand production and move from manual to powered equipment, but electricity is not available; and secondly where services such as mains water or electricity are provided but are unreliable. In each situation, the farmer has to resort to their own investment to provide water or power supplies, which may be unaffordable or put substantial strain on business finances. Lobbying of local or national service providers by development agencies or farmers' associations to improve the infrastructure in a particular area is an alternative, but a much slower option to investment in improved facilities.

Quality and safety management

The lack of direct contact with consumers means that farmers are often not aware of their quality requirements and as a result do not produce foods to the standards of hygiene or quality that are required. The main constraints that lead to inadequate food quality and safety are poor quality raw materials that risk causing food poisoning; inadequate skills and knowledge by processors in how to process and package foods, lack of knowledge or inadequate attention to personal hygiene and cleaning of equipment and processing facilities; and storage of processed foods in conditions that could cause them to become spoiled or risk food poisoning. Each of these constraints can be addressed by training and support from advisors and support organizations.

Competition

Depending on the type of foods being processed by small-scale farmers and the geographical and socio-economic markets in which the foods are sold, there can be significant competition from other food processors. They may have an advantage over small-scale farmers who begin a food processing enterprise because of better linkages in the supply chain, better relationships with buyers, and greater experience of both market requirements and processing methods to achieve high quality products.

Farmers should assess the number of competitors and their activities as part of the feasibility study and, with assistance from advisers, decide where to position their product(s) in the market and the level of sales that they expect to take from competitors. Some competitors may use underhand practices to win customers, make false allegations about other processors, or use substandard cheaper ingredients to increase their profits. However, if farmers compete effectively and honestly by developing good relationships with customers, treating them honestly and delivering what is promised on time; as well as identifying competitors' strengths and weaknesses and using this information to stay 'one step ahead' of them, they are likely to continue the business and make it grow. Training programmes by support agencies that are part of a food processing development programme for farmers entering food processing should include confidence-building techniques and marketing skills as well as the technical skills needed to produce high quality processed foods. The support and training should also foster improved linkages between farm-based processors, their suppliers, and buyers of their products.

Gender issues

Women often have an important role in processing operations, but in some countries and societies their roles can be marginalised as a result of social constraints, poorer access to credit facilities particularly if they do not own collateral in land or housing, and poorer access to training. Women also have family responsibilities that may limit their time to engage in business. Advisers should take these factors into consideration when offering support to farming families to set up a processing enterprise.

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Food and Agriculture Organization (FAO). Publications, Viale delle Terme di Caracalla, 00153 Rome, Italy, Tel: 39(06)5705.1, Fax: 39(06)5705.4593, E-mail: fao@fao.org., Web: www.fao.org. A CD-ROM of current titles is available by post.

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Enterprise Development (IFP/SEED), Tel: 41 22 799 6862, Fax: 41.22.799.7978, E-mail: ifp-sed@ilo.org, Web: www.ilo.org/global/What_we_do/Publications/ILOBookstore/lang--en/index.htm.

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www.4.fao.org/faobib

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International Network for the Availability of Scientific Publications.
www.inasp.org.uk

FAO World Agricultural Information Centre (WAICENT).
www.fao.org/waicent

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Notes

Notes

Small-scale food processing can create diversified incomes and employment for farmers in rural villages. Processing brings many different benefits to communities: it allows foods to be preserved and stored as a reserve against times of shortage; it helps to avoid the effects of lowered prices when seasonal gluts occur at harvest time; it creates special foods for cultural or religious occasions, thus reinforcing social and cultural identity; and it enables farmers to add value to crops and animal products that diversify and increase sources of income.

The booklet is focused on promoting processing enterprises as a successful diversification enterprise for small-scale farmers. It is intended for advisers, government officials, community leaders and development agency staff, who work with small-scale farmers in low- and middle-income countries.

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