

TECHNICAL REPORTS

Setting up a food-processing unit

Part 1: Selecting the best location

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This is the first of a series of articles on the decisions that face small-scale processors when starting a new business or when expanding to a larger building. The article focuses on the factors that should be taken into account when selecting the correct location for a food factory. Subsequent articles will examine the design and layout of food production units and the materials that are needed to construct food processing buildings and equipment.

THE DECISION ON ABOUT WHERE to locate a small-scale food processing unit is influenced by a number of factors, which are summarized in Table 1.

Table 1. Aspects to take into account when choosing a production site

Aspect	Considerations
Raw materials	Journey time/maximum distance to travel for raw materials. Value, shelf life, losses, or wastage during transport to processing site
Transport	Cost/km or cost/tonne/km for raw materials, fuels, and packaging materials delivered to the site. Delivery of products (especially for chilled transport) to customers. Relative costs of own vehicle vs. contract hauliers
Land	Availability and size of plot, cost/ha
Building construction/alteration	Cost of local building materials, transport costs, availability, skills, and cost of local labour for construction
Utilities	Availability of mains utility services and cost of connections to electricity and water/drainage supplies. Annual costs for electricity, water, and effluent treatment. Cost of alternatives (generator and fuel, construction of borehole, water treatment, and waste disposal facilities). Mobile phone reception or availability of landlines
Security	Costs to protect building and cost of security guards in relation to the level of risk in the locality
Equipment maintenance	Available local engineering skills. Cost of engineering service contract vs. cost/convenience of local workshop facilities or on-site workshop
Staff	Skills and wage levels of local residents. Travel for employees, quality of road access/distance and cost of travel to work, and availability of public transport. Social, medical, educational, and retail facilities available locally for staff

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Bulky raw materials are often processed close to their source of production

Proximity to raw material supply

To reduce transport costs, foods that are produced from bulky raw materials are more likely to be processed close to their source of production. This is especially the case for fresh raw materials that have a short shelf life (e.g. fresh meat, milk, fish, and some types of fruit and vegetable). For these foods, long journeys, delays, or rough roads can result in unacceptable levels of damage or spoilage and significant financial losses if the raw materials have a high value. Also, if a significant part of the raw material is discarded during processing (e.g. animal bones or peelings from fruits or root crops) a location close to their source reduces the cost of transporting materials that are subsequently discarded. If raw materials have a longer shelf life or are not easily damaged during transport (e.g. grains, oilseeds, flours, or nuts) processors may choose to locate the production unit away from the crop production area.

Cost of the building

In most countries, the costs of renting or buying a building and the cost of land for a new-build are lower in rural areas than at urban sites. However, the costs of transporting building materials and processing equipment to a rural site are higher; skilled labour to convert or build a production unit to the required hygienic standards may not be available in rural areas, thus incurring additional costs in transport and lodgings to bring construction workers from nearby towns.

Availability of utility services

Where the availability and quality of utility supplies in rural areas are inadequate for food processing, processors must make additional investments in five areas. First, provide potable water by drilling a borehole and installing water treatment facilities. Water is used in all small-scale food processing for a variety of purposes: to wash raw materials, wash equipment and processing rooms, in blanching, cooling or cooking foods, or directly as an ingredient in the product. It can come from different sources depending on the location: in urban areas there is usually a public mains supply, and in some countries supplies are treated and tested to ensure that they meet potable drinking water standards. In others there is no testing by the authorities, or the quality and reliability of treatment may be in doubt. In rural areas, if there is no mains supply there may be a private well or borehole, or surface water. Water from boreholes, springs, and wells is generally safer than surface water from rivers or lakes and is the preferred option for processing. Rainwater collection is feasible

Water from boreholes and wells is generally safer than surface water

if there is a sufficiently large storage capacity, but construction of underground storage tanks is expensive and there are usually other lower cost options for securing an adequate water supply. Second, either pay for a connection to the mains electricity grid or install a generator and pay the cost of transporting and storing fuel to operate it. Third, select a fuel that is suitable for the intended process and available at the lowest cost. The main sources of energy, in addition to electricity, for heating foods are:

- gas (natural gas or bottled liquid petroleum gas (LPG) or biogas);
- liquid fuel oil (diesel or kerosene (paraffin));
- solid fuels (anthracite, coal, wood, charcoal, or bagasse for sugar boiling).

The relative price and availability are the main factors that are taken into account, but other factors that determine which one is chosen are shown in Table 2.

Fourth, ensure telecommunications are adequate to communicate with customers and suppliers. Where there is limited coverage of landlines and obtaining a connection is expensive and time-consuming, ownership of mobile phones (cell phones) can improve telecommunications. Coverage of mobile phone reception may be less reliable in rural areas than closer to towns. Fifth, provide waste disposal facilities for solid and/or liquid wastes, depending on the type of process. In urban areas, municipal authorities may collect solid wastes and allow liquid effluents to be disposed of via the mains drainage, sometimes with additional charges. If on-site treatment

Ensure telecommunications are adequate to communicate with customers and suppliers

Table 2. Advantages and limitations of different energy sources for food processing

	<i>Electricity</i>	<i>Gas</i>	<i>Liquid fuel oils</i>	<i>Solid fuels</i>
Cost per kJ of energy	High	Low/Moderate	Low	Low
Energy per unit mass/volume of fuel (kJ/kg × 1,000)	–	1.17–4.78	8.6–9.3	5.26–6.7 (coal) 3.8–5.26 (wood)
Heat transfer equipment cost	Low	Low	High	High
Efficiency of heating ¹	High	Moderate/High	Moderate/Low	Low
Flexibility of use	High	High	Low	Low
Fire/explosion hazard	Low	High	Low	Low
Risk of contaminating food	Low	Low	High	High
Labour and handling costs	Low	Low (mains gas) Moderate (LPG)	Moderate	High

Note: ¹ Efficiency = amount of energy used for heating divided by amount of energy supplied

facilities are required, the cost of land and stricter environmental laws in urban areas may make this an expensive option. There is often no mains drainage in rural areas, but suitable sites for treatment of liquid effluents and composting sites for solid wastes are more likely to be available at lower cost.

Sources of contamination

Make sure that neighbouring buildings are not a source of contamination

All sites for food production units should be away from swampy areas or refuse dumps to avoid contamination by flying insects or rodents. Care is needed when selecting a plot of land or an existing building, especially in urban industrial areas that have mixed types of business, to make sure that neighbouring buildings are not a potential source of air- or water-borne contamination (e.g. a fertilizer plant, sewage treatment works etc.). When building a new facility or taking over an existing building, it is also necessary to check whether any previous occupants of the site had operations that could have polluted it. In some types of processing, an outside covered area or a separate building is needed for operations that could contaminate foods. For example, washing reused bottles should be done away from processing rooms so that any glass splinters from breakages cannot contaminate products. Similarly, operations that create potential contaminants, such as smoke from ovens or smoking kilns, or dust from milling flours, spices, or sugar, should take place away from the main processing area.

Security

In general, rural areas are more secure than urban and peri-urban centres and have a lower requirement for burglar-proofing windows and doors, burglar alarms, perimeter walls, exterior security lighting, and the cost of employing security guards and night watchmen.

Ease of access and distribution of products

Distance and time for distribution are critical factors in maintaining product quality

Depending on the shelf life of the products and the location of customers, the distance and time needed for distribution are critical factors in maintaining product quality up to the point of sale. Access is also required by delivery vehicles to bring in raw materials and packaging and long journeys clearly add to these costs. The availability and cost of transport, the quality of access roads to rural sites and the reliability of hauliers are each important considerations. Processors may choose to locate a processing unit close to an urban centre or in a suburban area that has good transport links; or they may invest in their own vehicles to ensure more reliable deliveries;

or they may rely on buyers providing transport for distribution. The quality of the access road is important; in some countries rural roads are only accessible during the dry season and in other areas rural roads are not gritted against ice and snow in winter. Loss of access can significantly affect production targets, causing stoppages due to shortages of materials or staff not attending work. A consideration for all types of processing is the ease with which employees can access the production site and the distance that staff are required to travel to get to work. Depending on the level of skills in a local population, processors in rural areas may be able to employ nearby villagers as process workers. If this is not feasible and staff have to travel from a nearby town, the distance and availability of public transport when it is required (especially if multiple shift work is necessary) are each important considerations. Processors may then need to provide transport for staff, with its additional costs. If staff from outside an area are employed, the availability and quality of local schools, shops, entertainment, and medical facilities for their families can be an important consideration for them to relocate.

Processors may
need to provide
transport for staff

Closeness to engineering facilities

Most processing equipment requires periodic maintenance and occasional repairs and, depending on the level of complexity of the equipment, it may be important to have a nearby engineering workshop. This favours a location close to an urban centre as a remote site increases the costs of repair services, spare parts, and other supplies. Because of the lower costs of rural locations, however, it may be less expensive to use an urban-based engineer to periodically visit a production site using a service contract.

A remote site
increases the costs
of equipment
repairs

Other location factors

If a processing unit is built on a hillside, it may be possible to take advantage of gravity to move foods through pipework, on rails or in 'flumes' (troughs of flowing water that carry foods), thereby reducing the need for pumps and motors and reducing energy consumption. Similarly a multiple storey building can be used to allow foods to descend by gravity through different processing stages on each floor.

Government incentives

In some countries, economic development grants may be offered to new businesses by local, regional, or national governments to encourage them to set up a food-processing enterprise in a specified area. In others, governments have set up special 'food parks' that

Food parks have the
required facilities
and environment
for food-processing

have the required utilities, facilities, and a clean environment to locate food-processing businesses. Support can also include tax breaks, reduced utility costs, or rent-free periods to help a new business become established (although many of these incentives may only be available to larger-scale operations). There may also be special trade or economic zone concessions, particularly if there is a possibility of generating foreign exchange from exports. Details of the available assistance can be obtained from the relevant ministry (e.g. ministry of trade, commerce, export development or industry) or local government department (e.g. department for economic development).