In some circumstances, artificial drying is the only practical solution. In the simplest form, a wood fire is lit in a chamber below the drying platform and the combustion gases are conducted away in a flue that continues beneath the drying platform before becoming a vertical chimney. Convection and radiation from the fire chamber and flue heat the drying platform. A better system is to use a heat exchanger to create warm dry air that is then passed through the bed of cocoa beans. A well maintained installation will in all cases help reduce the risk of combustion products coming into contact with the drying cocoa, and hence the risk of contaminating the cocoa with smoky notes.

Artificial drying can affect the cocoa quality in two ways. First, the beans may be dried too quickly resulting in very acidic beans. This is caused by the shell becoming hard and locking or trapping the volatile organic acids inside the bean. Acidity can be reduced by using lower air temperatures or an overnight rest period to allow the moisture in the beans to equilibrate. The reduction in drying capacity or throughput is compensated by lower fuel costs resulting from more efficient drying. The second, more serious, problem with artificial drying is that smoke may find its way onto the beans. This problem is most commonly linked to the use of wood fires, and is liable to produce an unpleasant harsh, smoke or tar taste, which cannot be removed from the resulting chocolate by processing. While it is comparatively easy to design a drier in which the smoke is kept away from the cocoa, it is not so easy to maintain one in this state. After a drier has been operated for a number of years, the risk of smoke reaching the cocoa beans too often becomes a reality. This is one of the reasons why cocoas from some areas are in less demand and consequently command lower prices.

Cocoa beans can sometimes be seen drying on the roadsides in areas where farmers do not have sufficient drying facilities. This is to be avoided as it contributes to the contamination of the cocoa beans with chemical residues from the tarmac and vehicle exhausts.

Care is also required not to over-dry the beans. Beans dried to below 6% moisture become quite brittle and are easily damaged in subsequent handling, generating losses. During or after drying the beans, it is necessary to carry out a hand sorting or mechanical sieving/winnowing process to remove debris, clumped and broken beans. The beans are then bagged and may be stored for a short period prior to sale (see Figure 2.13).

2.4 The cocoa supply chain

Cocoa beans have to get from the many small farmers, who are often in remote areas of developing countries, to the cocoa processing factories that may be located in temperate countries. They can pass through a number of intermediaries, each of whom plays an important role. This section describes the steps in the chain, the impact on quality and how the price is determined. The next section

Figure 2.13 Dried cocoa is weighed and bagged. Reproduced with permission of Ivan Kashinsky.

looks at the cocoa value chain and the issue of farmer poverty. The price of cocoa is given in US$ or GB£ per tonne and is determined in the open markets of New York and London. The evolution of prices, production and consumption (demand or "grindings") is given in Figure 2.14. From this graph one can note that production and consumption are closely balanced and have grown steadily at the same rate. However, prices are more volatile and are influenced by production, consumption, stock levels, political, social and economic factors and speculator activity.

2.4.1 Internal market

Typically, the farmer sells his cocoa to a co-operative or a trader (first level collector). The important points for a farmer are the price received (% of world market price) and the level of service provided (location and frequency of collection, availability of "free" credit, technical support etc.). The cocoa will then be taken and sold to a larger trader or collector in the nearest main town. From here the cocoa will go to the port and into the warehouse of an exporter or shipper.

2.4.2 International cocoa markets

Producers (cocoa growers, co-operatives, government marketing boards and exporters) need to be able to sell their cocoa at the best price. The size and timing of the crop vary from season to season and this can affect the price. The users of cocoa (processors, grinders, and chocolate manufacturers) require a regular