

3.2

Food production



Sheep farming in New Zealand – New Zealand is a major exporter of food

Key questions

- What are the main features of an agricultural system?
- What are the causes and effects of food shortages and the possible solutions to this problem?

• Agricultural systems

Individual farms and general types of farming can be seen to operate as a **system**. A farm requires a range of **inputs** such as labour and energy so that the **processes** that take place on the farm, such as ploughing and harvesting, can be carried out. The aim is to produce the best possible **outputs** such as milk, eggs, meat and crops. A profit will only be made if the income from selling the outputs is greater than expenditure on the inputs and processes. Figure 1 is an input-process-output diagram for a wheat farm.

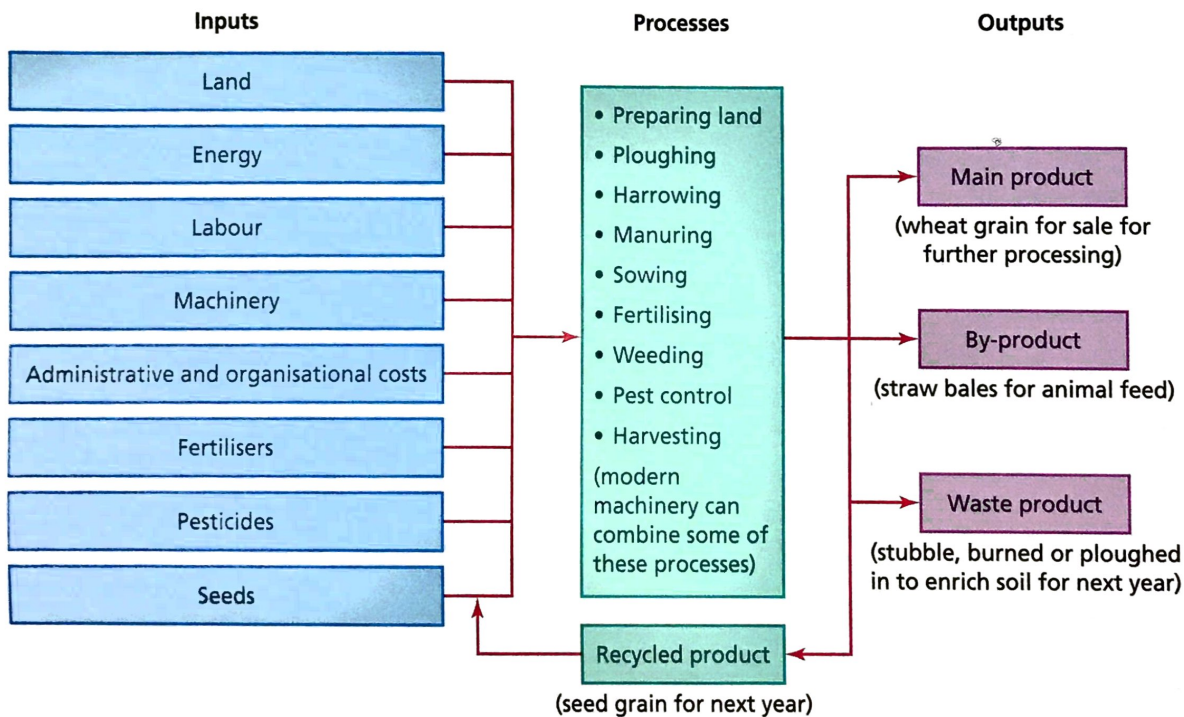


Figure 1 Systems diagram for a wheat farm

Different types of agricultural system can be found within individual countries and around the world. The most basic distinctions are between:

- arable, pastoral and mixed farming
- subsistence and commercial farming
- extensive and intensive farming
- organic and non-organic farming.

Arable, pastoral and mixed farming

Arable farms cultivate crops and are not involved with livestock. An arable farm may concentrate on one crop (monoculture) such as wheat, or may grow a range of different crops. The crops grown on an arable farm may change over time. For example, if the market price of potatoes increases, more

farmers will be attracted to grow this crop. **Pastoral farming** involves keeping livestock such as dairy cattle, beef cattle, sheep and pigs. **Mixed farming** involves cultivating crops and keeping livestock together on a farm. Usually on a mixed farm at least part of the crop production will be used to feed the livestock.



Figure 2 Arable farming in the Nile valley with the pyramids in the background

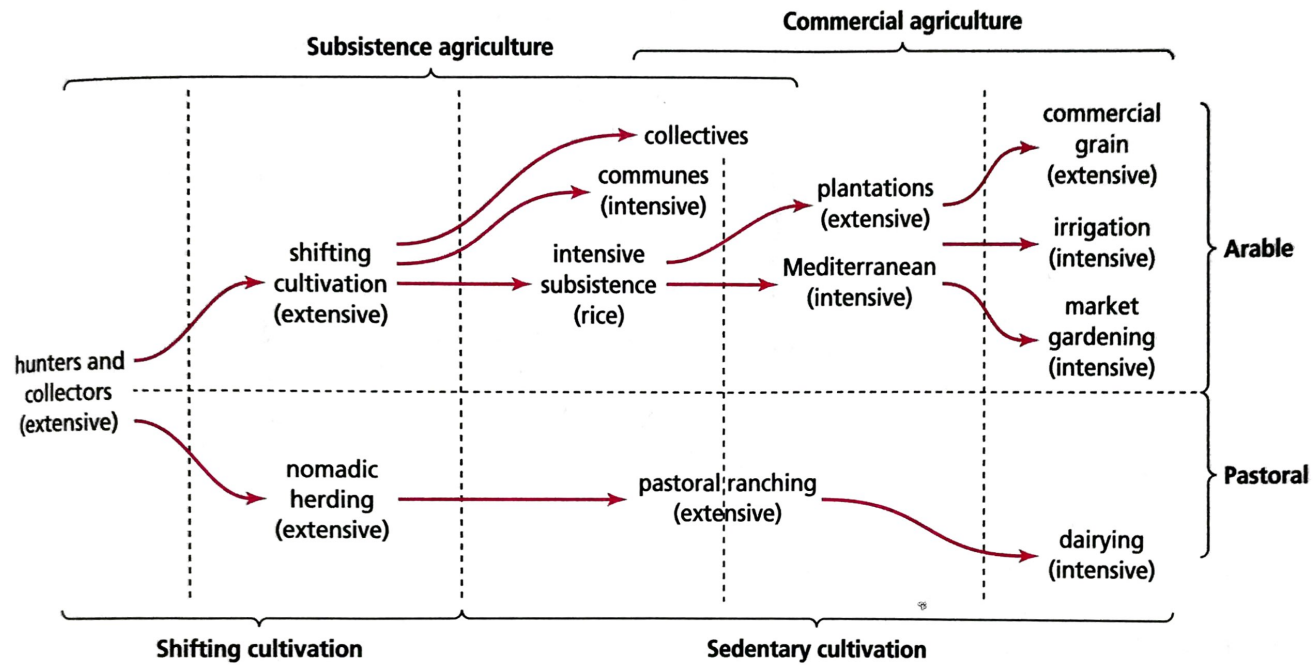


Figure 3 Farming types and levels of development

Subsistence and commercial farming

Subsistence farming is the most basic form of agriculture where the produce is consumed entirely or mainly by the family who work the land or tend the livestock. If a small surplus is produced it may be sold or traded. Examples of subsistence farming are shifting cultivation and nomadic pastoralism (Figure 3). Subsistence farming is generally small scale and labour intensive with little or no technological input.

In contrast, the objective of **commercial farming** is to sell everything that the farm produces. The aim is to maximise yields in order to achieve the highest profits possible. Commercial farming can vary from small scale to very large scale. The very largest farms are often owned by TNCs.



Figure 4 The output of local poultry production in a Moroccan market

Extensive and intensive farming

Extensive farming is where a relatively small amount of agricultural produce is obtained per hectare of land, so such farms tend to cover large areas of land.

Inputs per unit of land are low. Extensive farming can be both arable and pastoral in nature. Examples of extensive farming are sheep farming in Australia and wheat cultivation on the Canadian Prairies. In contrast, **intensive farming** is characterised by high inputs per unit of land to achieve high yields per hectare. Examples of intensive farming include market gardening, dairy farming and horticulture. Intensive farms tend to be relatively small in terms of land area.



Figure 5 Viticulture in the Rioja region of northern Spain

Organic farming

Organic farming does not use manufactured chemicals, so production is without chemical fertilisers, pesticides, insecticides and herbicides. Instead animal and green manures are used along with mineral fertilisers such as fish and bone meal. Organic farming therefore requires a higher input of labour than mainstream farming. Weeding is a major task in this type of farming. Organic farming is less likely to result in soil erosion and is less harmful to the environment in general. For example, there will be no nitrate runoff into streams and much less harm to wildlife.

Organic farming tends not to produce the 'perfect' potato, tomato or carrot. However, because of the increasing popularity of organic produce it commands a substantially higher price than mainstream farm produce.

Activities

- 1 Describe the inputs, processes and outputs for the wheat farm shown in Figure 1.
- 2 a Explain the difference between arable and pastoral farming.
b What is mixed farming?
- 3 Examine the differences between (a) commercial and subsistence farming and (b) intensive and extensive farming.
- 4 Describe the characteristics of organic farming.

● The influence of natural and human inputs on agricultural land use

A wide range of factors combine to influence agricultural land use and practices on farms. These can be placed under the general headings of physical, social/cultural, economic and political factors.

Physical factors

North America, for example, has many different physical environments. This allows a wide variety of crops to be grown and livestock kept. New technology and high levels of investment have steadily extended farming into more difficult environments. Irrigation has enabled farming to flourish in the dry south-west while new varieties of wheat have pushed production northwards in Canada. However, the physical environment remains a big influence on farming. There are certain things that technology and investment can do little to alter. So relief, climate and soils set broad limits as to what can be produced. This leaves the farmer with some choices, even in difficult environments. The farmer's decisions are then influenced by economic, social/cultural and political factors.

Temperature is a critical factor in crop growth as each type of crop requires a minimum growing temperature and a minimum growing season. Latitude, altitude and distance from the sea are the major influences on temperature. Precipitation is equally important. This is not just the annual total but the way it is distributed throughout the year. Long, steady periods of rainwater to infiltrate into the soil are best, making water available for crop growth. In contrast, short heavy downpours can result in surface runoff, leaving less water available for crop growth and soil erosion.

Soil type and fertility have a huge impact on agricultural productivity. Often, areas that have never been cleared for farming were ignored because soil fertility was poor or perceived to be poor. In some regions wind can have a serious impact on farming, for example causing bush fires in some US states such as California. Locally, aspect and the angle of slope may also be important factors in deciding how to use the land.

In Canada, farming is severely restricted by climate. Less than 8 per cent of the total area of the country is farmed. Seventy per cent of Canada lies north of the thermal limit for crop growth.

Water is vital for agriculture. **Irrigation** is an important factor in farming not just in North America

but in many other parts of the world as well. Table 1 compares the main types of irrigation. This is an example of the 'ladder' of agricultural technology, with surface irrigation being the most traditional method and subsurface (drip) irrigation the most advanced technique.

Table 1 Types of irrigation

	Efficiency (%)
Surface – used in over 80% of irrigated fields worldwide	
Furrow Traditional method; cheap to install; labour-intensive; high water losses; susceptible to erosion and salinisation	20–60
Basin Cheap to install and run; needs a lot of water; susceptible to salinisation and waterlogging	50–75
Aerial (using sprinklers) – used in 10–15% of irrigation worldwide	
Costly to install and run; low-pressure sprinklers preferable	60–80
Sub-surface ('drip') – used in 1% of irrigation worldwide	
High capital costs; sophisticated monitoring; very efficient	75–95

Economic factors

Economic factors include transport, markets, capital and technology. The cost of growing different crops or keeping different livestock varies. The market prices for agricultural products will vary also and can change from year to year. The necessary investment in buildings and machinery can mean that some changes in farming activities are very expensive. These would be more difficult to achieve than other, cheaper changes. Thus it is not always easy for farmers to react quickly to changes in consumer demand.

In most countries there has been a trend towards fewer but larger farms. Large farms allow **economies of scale** to operate which reduce the unit costs of production. As more large farms are created, small farms find it increasingly difficult to compete and make a profit. Selling to a larger neighbouring farm may be the only economic solution. The EU is an example of a region where average farm size varies significantly. Those countries with a large average farm size generally have more efficient agricultural sectors than countries with a small average farm size.



Figure 6 Goats feeding from a bowl (because the ground is frozen) in cold central Asia



Figure 7 ... in Morocco

Agricultural technology is the application of techniques to control the growth and harvesting of animal and vegetable products. The development and application of agricultural technology requires investment and thus it is an economic factor. The status of a country's agricultural technology is vital for its food security and other aspects of its quality of life. An important form of aid is the transfer of agricultural technology from more advanced to less advanced countries.

Social/cultural factors

What a particular farm and neighbouring farms have produced in the past can be a significant influence on current farming practices. There is a tendency for farmers to stay with what they know best and often a sense of transgenerational responsibility to maintain family farming tradition. Tradition matters more in some farming regions than others.

Land tenure means the ways in which land is or can be owned. In the past inheritance laws have had a huge impact on the average size of farms. In some countries it has been the custom on the death of a farmer to divide the land equally between all his sons, but rarely between daughters. Also, dowry customs may include the giving of land with a daughter on marriage. The reduction in the size of farms by these processes often reduced them to operating at only a subsistence level.

In most societies women have very unequal access to, and control over, rural land and associated resources. It is now generally accepted that societies with well-recognised property rights are also the ones that thrive best economically and socially.

Political factors

The influence of government on farming has steadily increased in many countries. For example, in the USA the main parts of government farm policy over the past half-century have been:

- Price support loans: loans that tide farmers over until they sell their produce.
- Production controls: these limit how much a farmer can produce of surplus crops.
- Income supplements: these are cash payments to farmers for major crops in years when market prices fail to reach certain levels.

Thus the decisions made by individual farmers are heavily influenced by government policies such as those listed above. An agricultural policy can cover more than one country, as evidenced by the EU's Common Agricultural Policy.

Activities

- 1 List the main physical factors that can influence farming.
- 2 Summarise the information presented in Table 1.
- 3 Why has the size of farms steadily increased in many agricultural regions?
- 4 Briefly state the importance of advances in agricultural technology.
- 5 Give an example of how a social/cultural factor can have an impact on farming.
- 6 How can political factors influence farming?

Interesting note

In terms of agricultural exports the major countries by value of exports in 2011 were the USA, the Netherlands, Germany, France and Brazil.

Case study: An agricultural system – intensive rice production in the Lower Ganges Valley

Location

An important area of intensive subsistence rice cultivation is the lower Ganges valley (Figure 8) in India and Bangladesh. The Ganges basin is India's most extensive and productive agricultural area and its most densely populated. The delta region of the Ganges occupies a large part of Bangladesh, one of the most densely populated countries in the world. Rice contributes over 75 per cent of the diet in many parts of the region. The physical conditions in the lower Ganges valley and delta are very suitable for rice cultivation:

- temperatures of 21 °C and over throughout the year, allowing two crops to be grown annually (rice needs a growing season of only 100 days)
- monsoon rainfall over 2000 mm providing sufficient water for the fields to flood, which is necessary for wet rice cultivation
- rich alluvial soils built up through regular flooding over a long time period during the monsoon season
- an important dry period for harvesting the rice.