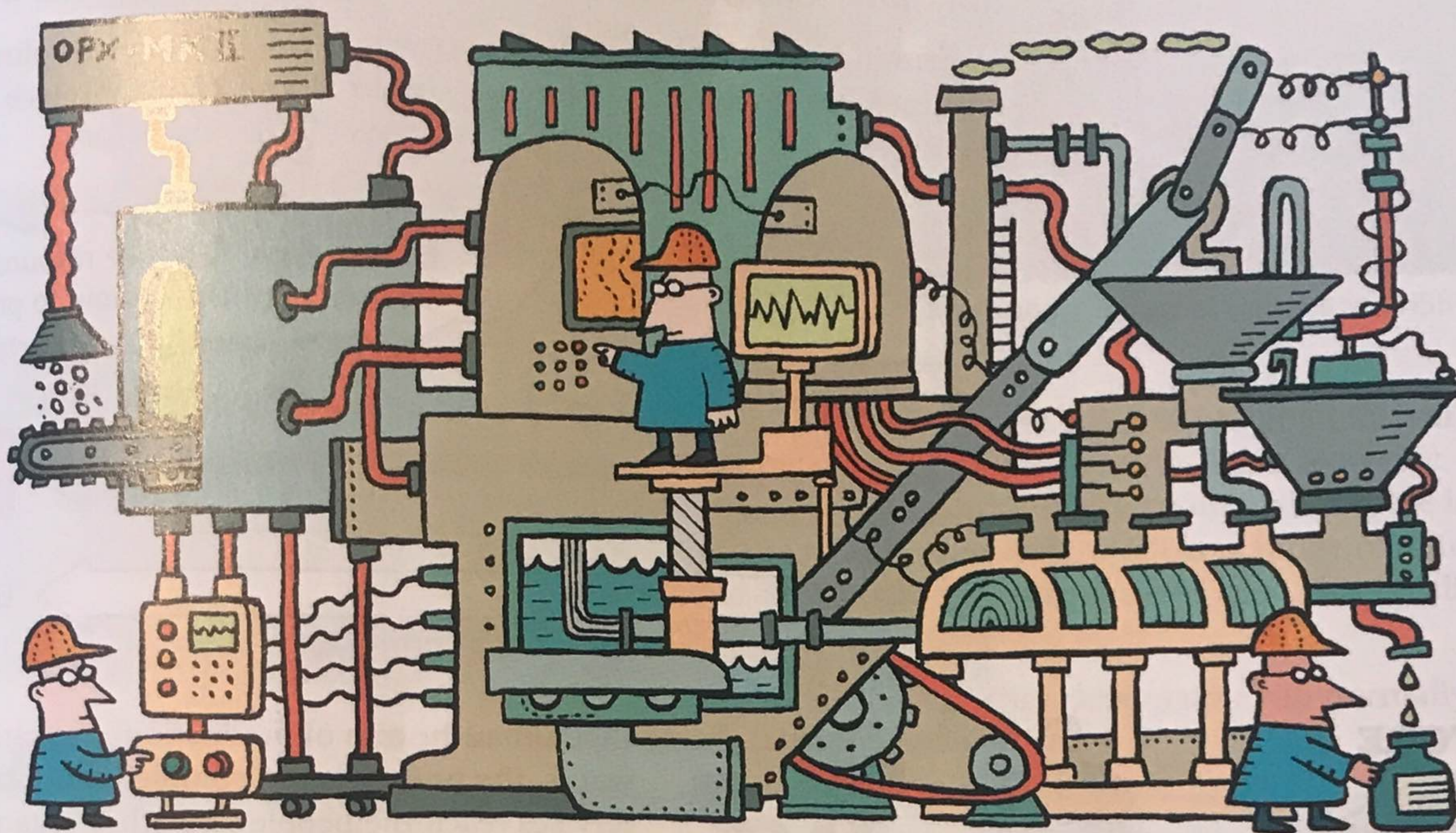


# Firms and production

## Firm's costs, revenue and objectives



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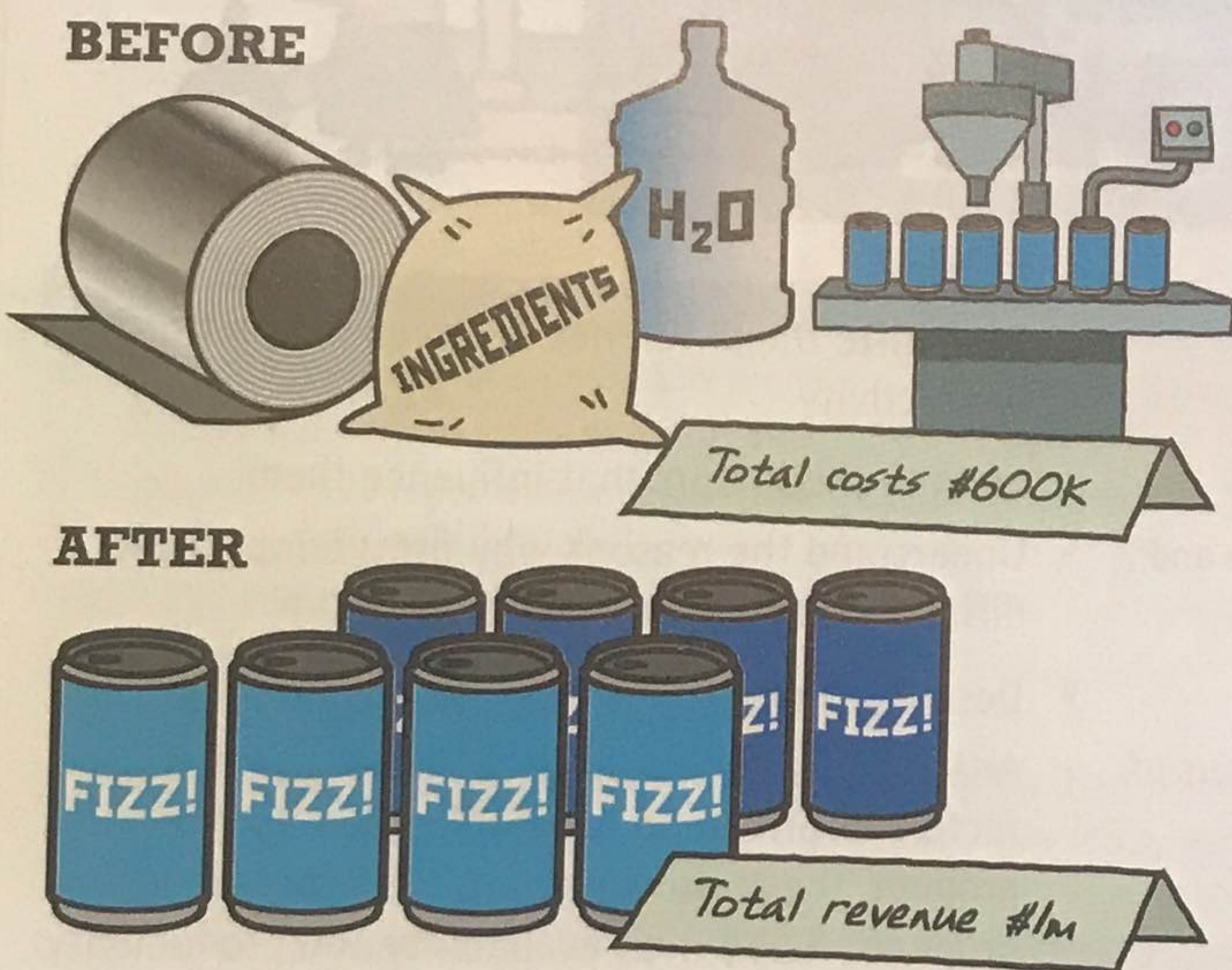
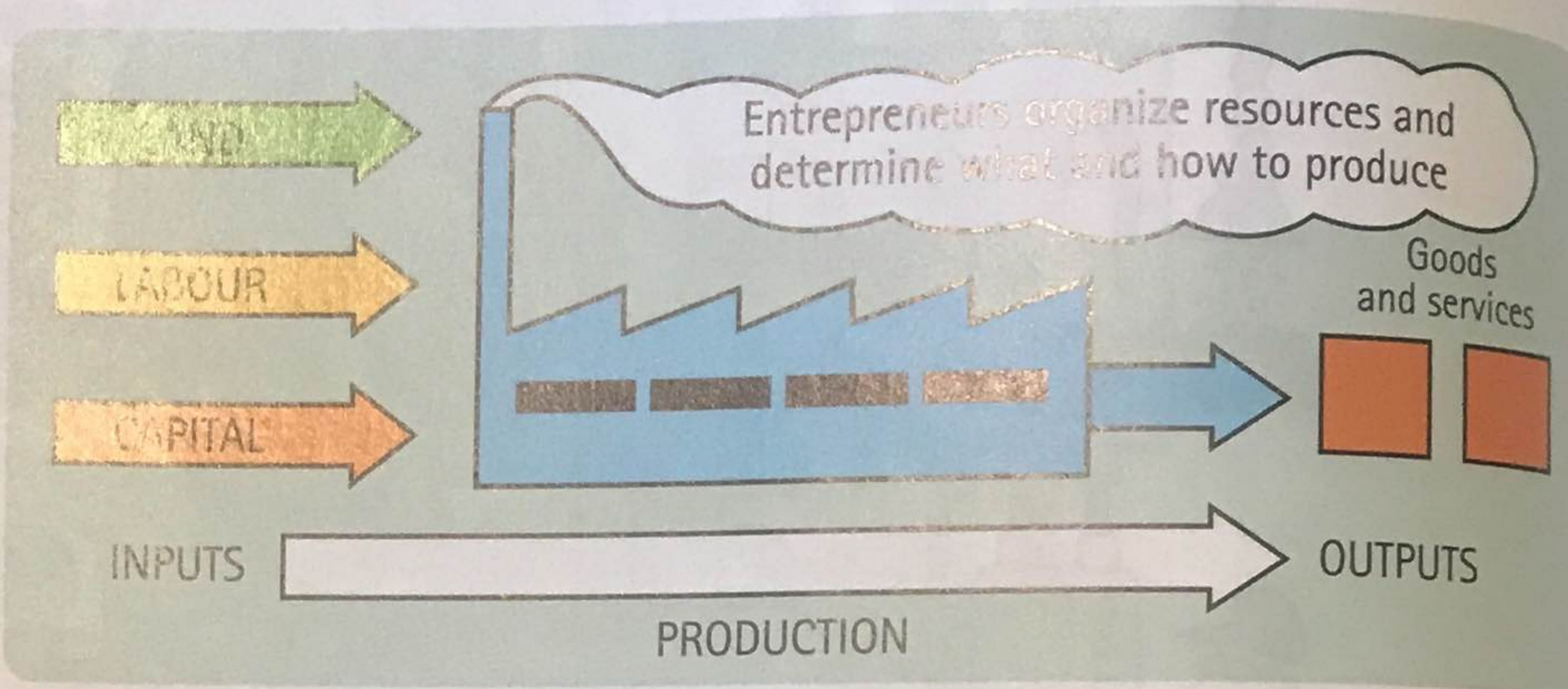
## SECTION 3.6.1

### How production adds value to resources

## Production and productivity

Goods and services are produced to satisfy consumer wants. The **production** of goods and services is organized by entrepreneurs in firms. A firm combines the factors of production land, labour and capital (**inputs**) to make goods and services (**outputs**). Goods and services are produced to satisfy consumer wants. > 1.1

A firm may own one or more plants where resources are employed and productive activity is carried out. A **plant** is simply a workplace and includes premises such as a warehouse, retail outlet, office or factory.



▲ How production adds value to resources

Given that the aim of production is to satisfy consumer wants, the process is not complete until the goods and services reach the people and other organizations who want them. Warehouses and shops that sell goods and services to consumers, as well as all those people and machines involved in transportation, insurance and many other tasks, are all part of the production process.

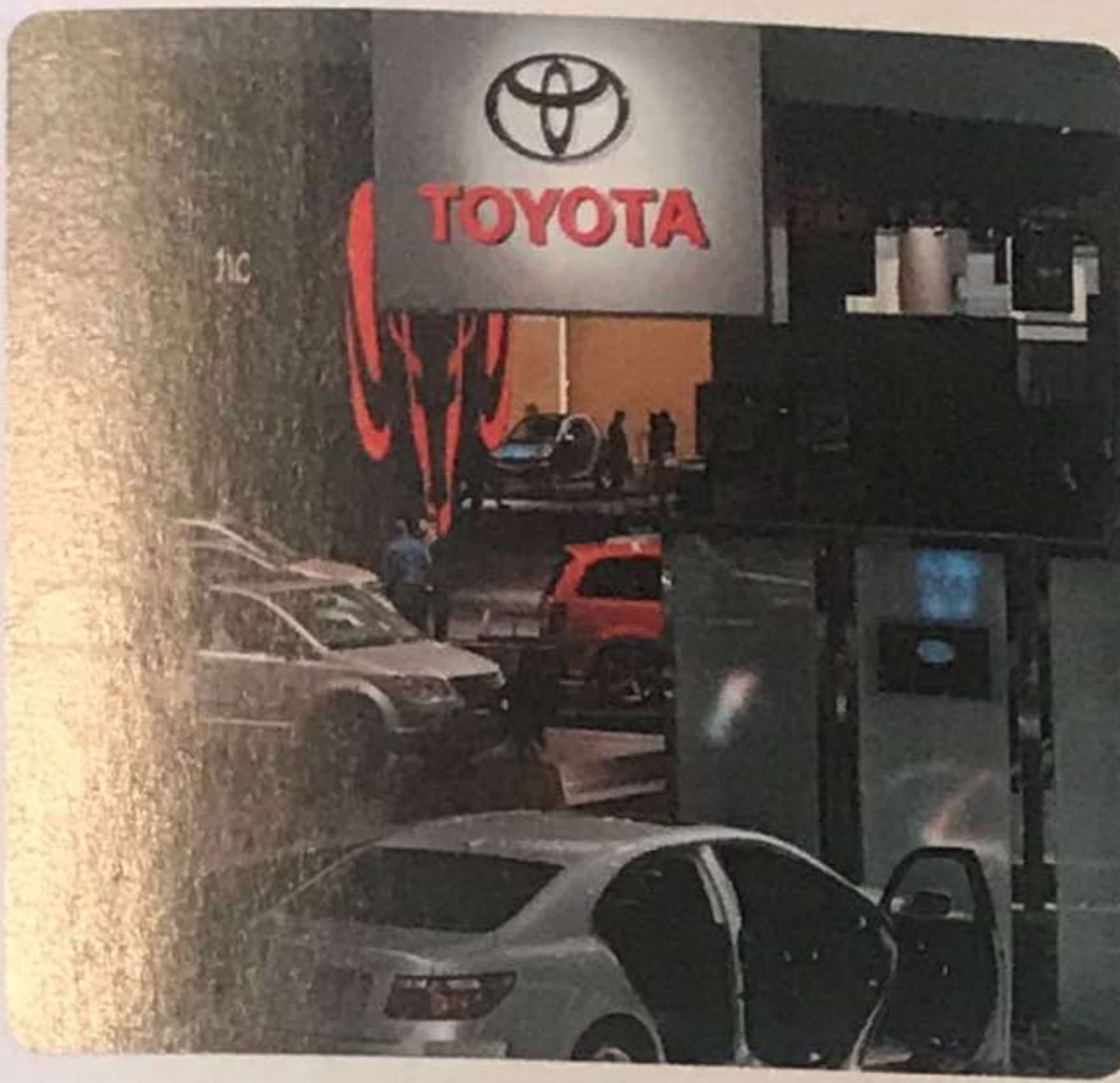
By combining resource inputs to produce outputs consumers want and are willing and able to buy, productive activity adds value to those resources. For example, a firm that produces 1 million cans of fizzy drink which are sold for \$1 each but cost only \$600,000 to produce has added \$400,000 to the value of the resources used in their production, including labour, water, aluminium, machinery, vehicles and electricity.

Value added in production is the difference between the market price paid for a product by a consumer and the cost of the natural and man-made materials, components, tools and equipment used to make it. Value added is therefore equal to the wages paid to workers who have been employed to produce the product and the profit received by the owners of the firm that organized its production.

### Specialization in production by firms

Imagine you set up a firm and try to produce lots of different products to sell, from light bulbs and garden tools, to designer clothes and bus services. You are unlikely to be successful at all these activities. This is because you and the people you employ would be trying to do too many things at the same time.

It would be far more sensible for you and your employees to concentrate on producing what they are best at. This is called **specialization**. > 3.1



The Toyota Motor Corporation specializes in making cars, buses and commercial vehicles and HSBC specializes in providing financial services

Specialization means a firm can make the best possible use of all the skills and resources it has and therefore add much more value to them. However, a firm that specializes in the production of just one product could fail if there is a fall in demand for its product. Some firms therefore produce a range of different products in case consumer demand for any one of them falls. This is called **diversification**.

Because firms specialize in particular activities, production will normally involve a **chain of productive activity**.

### ACTIVITY 3.22

#### Dough!

The jumble of cartoons and numbered descriptions that follow on the next page together describe how bread is produced. Match each picture to a description. Write down the descriptions to form a chain of the productive activities involved in bread production, right through to final sale to consumers. Some descriptions may be used more than once.



- 1 Wheat, water, yeast and other ingredients are mixed together to produce dough
- 2 Coal and oil are used to power electricity stations for use by firms and households
- 3 Farms plant seeds to grow wheat
- 4 Supermarkets and other shops sell bread to consumers
- 5 Road haulage service providers transport harvested wheat and finished breads
- 6 Consumers buy bread
- 7 Wheat is harvested
- 8 Insurance firms provide insurance to protect firms from risk of damage or theft
- 9 Dough is poured into baking trays and placed in ovens to cook
- 10 Sealed packets for the bread are produced and labelled in printing machines
- 11 Consumers make sandwiches or toast to consume
- 12 Finished loaves of bread are sealed in plastic packaging
- 13 Commercial banks provide loans and payment services to firms
- 14 Food inspectors check the quality and hygiene of the breads and the bakery

2 Investigate and list the chain of productive activities involved in the production and sale of the following products:

- ▶ a new computer game
- ▶ fresh orange juice
- ▶ sweets
- ▶ washing powders
- ▶ hairdressing
- ▶ a good or service of your choice

Each chain of productive activity will link together many different firms, industries and industrial sectors – from firms in the primary sector producing natural resources such as coal, corn and oil, to manufacturing firms that use raw materials to make component parts and finished goods and services for consumers, and finally to those tertiary sector businesses that operate warehouses, transport services and shops to distribute and sell products to customers. ▶ **2.1**

### What is factor productivity?




**Productivity** measures the amount of output (goods and services) that can be produced from a given amount of input (land, labour and capital resources).

For example, a business that uses 10 units of resources to produce 40 units of output per week is twice as productive as a business that uses 10 units of the same resources to produce just 20 units of output per week.

The aim of any business will be to combine its resources in the most efficient way. That is, it will aim to produce as much output as it can with the least amount of resources it can, and therefore at the lowest cost possible.

For example, farms in Pakistan obtain 33 million tonnes of milk from 20 million milking animals, compared with over 37 million tonnes obtained by Chinese farms from 15 million animals and 84 million tonnes of milk produced in the USA by 9.1 million cows.

How productivity in dairy farming differs around the world

Pakistan	China	USA
		
20m	15m	9.1m
33m	37m	84m
1.65 tonnes per cow	2.47 tonnes per cow	9.23 tonnes per cow

Although the combined farms in Pakistan are the fourth largest producer of milk in the world after farms in India, the USA and China, the productivity of milking animals in Pakistan is clearly much lower than that of US or Chinese cows.

Low milk yields increase the cost of production of milk. For example, US farmers feed one cow to obtain the same quantity of milk that a Pakistani farmer obtains by feeding 4.5 cows.

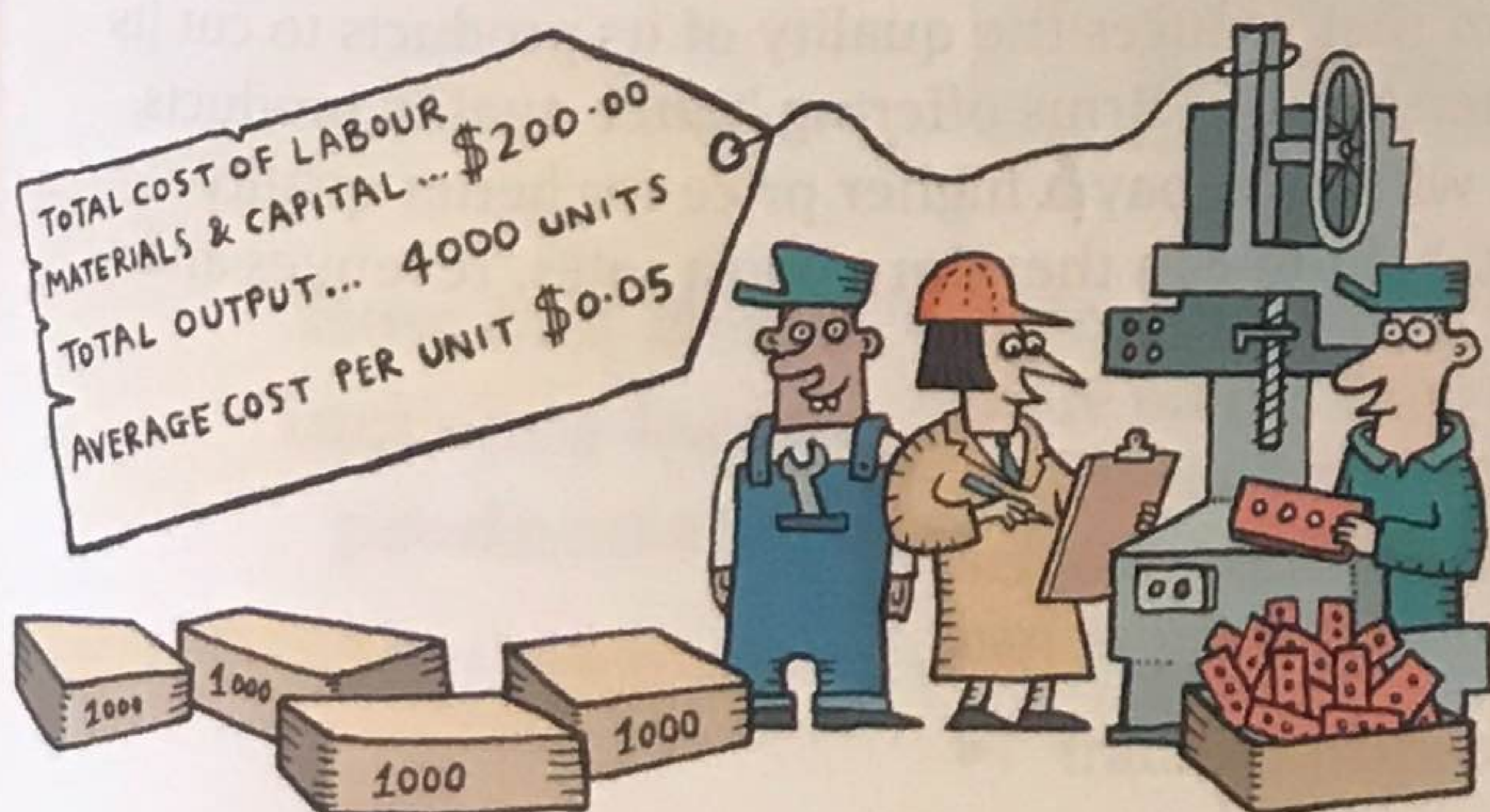
According to livestock experts, milk yields of dairy herds in Pakistan could be increased by around 600 litres per animal by providing them with adequate clean drinking water. Feeding them a balanced diet and improving hygiene could lead to an increase of another 600 litres of milk per animal.

Productivity therefore measures how efficiently resources are being used in production.

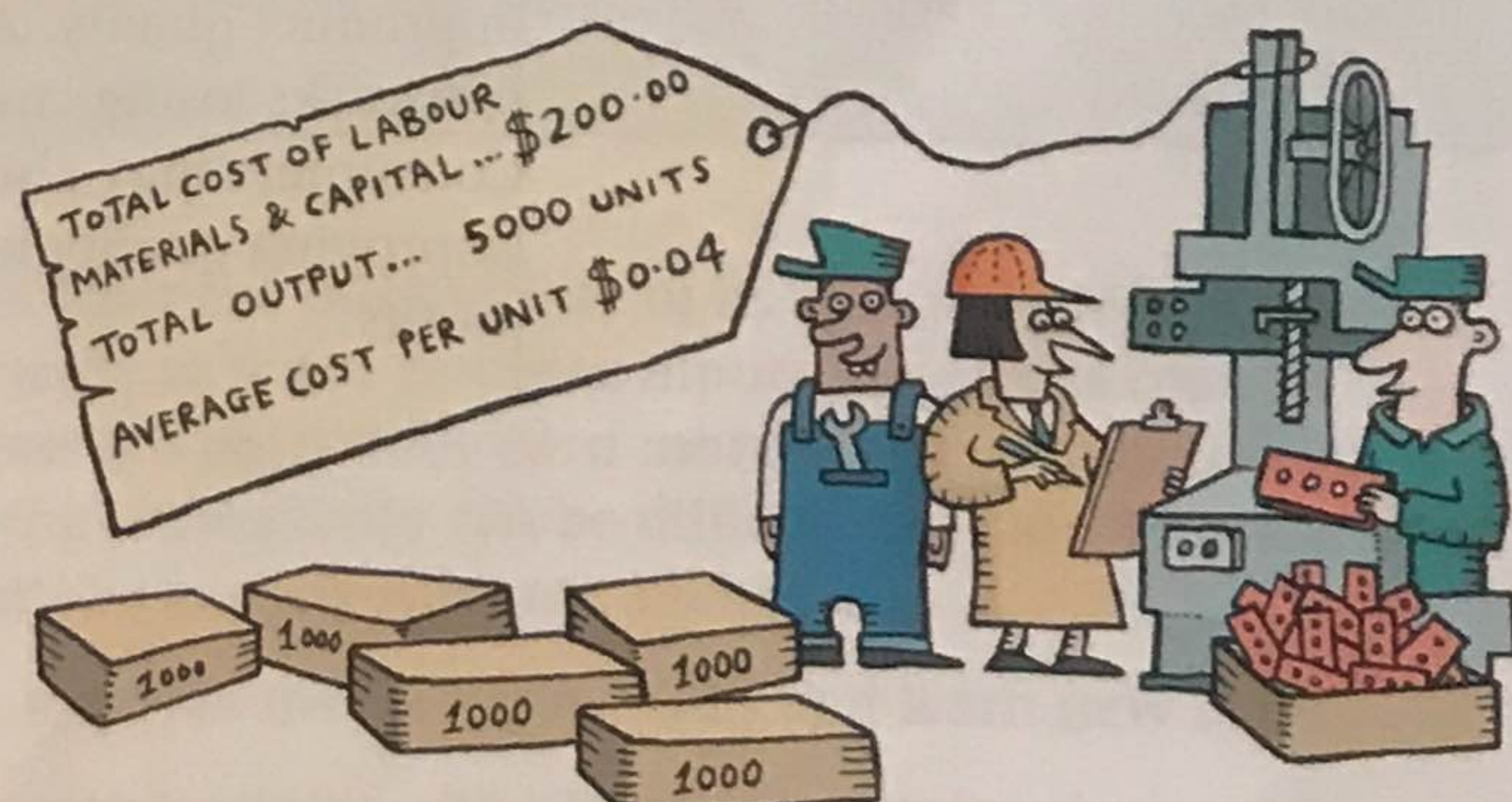
In general, productivity in a firm or entire economy will have increased if:

- more output or revenue is produced from the same amount of resources
- the same output or revenue can be produced using fewer resources.

Resources cost money to buy or hire. For example, materials must be purchased from suppliers, wages must be paid to hire labour, machinery and equipment must be purchased outright or leased, and premises must be rented. Therefore, if the same amount of labour, land and capital can produce more output for the same total cost, then the cost of producing each unit of output (or average cost) will have fallen. Increasing the productivity of resources can therefore reduce production costs, make a firm more competitive, and increase profits.



▲ Productive



▲ More productive

A firm that fails to increase the productivity of its resources or factors of production at the same pace or at a faster rate than rival firms will have higher production costs and therefore lower profits than its competitors.

## Measuring productivity

**Labour productivity** is the most common measure of factor productivity. It is calculated by dividing total output over a given period of time, for example a day, week or month, by the number of workers employed. This gives a measure of the average productivity per worker per period.

$$\text{Average product of labour} = \frac{\text{total output per period}}{\text{number of employees}}$$

The average productivity of labour is a useful measure of how efficient workers are and how efficiently they use other resources. For example, if a company employs 10 workers who produce 200 plant pots each day, the average product per employee per day is 20 pots. If daily output is able to rise to 220 pots per day without employing additional workers then productivity will have increased to 22 pots per worker per day.

Productivity in business organizations producing services can be more difficult to measure. For example, a hair salon could measure the number of customers or hair treatments per day per employee, but not all employees in the salon will be hairdressers. Some may be office staff and cleaners. So how can we measure their productivity?

A better measure of overall productivity is the average revenue per worker per period.

$$\text{Average revenue product of labour} = \frac{\text{total revenue per period}}{\text{number of employees}}$$

Productivity is also difficult to measure in organizations that do not produce a physical output or earn revenue, for example government-funded hospitals or schools, government departments or a police force. Other performance measures, such as time spent waiting for an operation, meeting deadlines, numbers of students passing qualifications and numbers of arrests, will often be used instead.

Another problem with productivity measures is that they take no account of the quality of work. Increasing productivity should also include improvements in product quality. A firm that reduces the quality of its products to cut its costs risks losing customers to rival firms offering better quality products. Consumers may also be willing to pay a higher price for better quality. Improving quality in production can therefore boost sales, revenues and profits.

### ACTIVITY 3.23

#### Passport to success

Manteau Designs Ltd is a small private limited company that manufactures luxury passport holders. The company started four years ago with just five production workers. Since then it has successfully expanded its sales, output and workforce.

Productivity at the factory has also increased over time as workers have become more experienced in the production of passport holders. The increase in workforce to 20 full-time production workers has also meant that the machinery and equipment installed at the factory is now fully employed throughout each working day.

With sales continuing to grow, the company's owners are thinking of expanding output further over the next year. They are considering two options.

**Option 1:** Employ five more workers, costing the business an additional \$100,000 in wages each year to be funded from revenues.

**Option 2:** Use retained profits to finance the purchase and installation of new, more advanced machinery costing \$300,000. The new machinery should remain productive for 10 years.

Year	Total output achieved (* forecast)	No. of workers	Average annual labour productivity
1	100,000	5	
2	210,000	10	
3	330,000	15	
4	460,000	20	
5	570,000*	25 (Option 1)	
5	540,000*	20 (Option 2 using new machinery)	

- 1 Calculate the average output of each worker each year to complete the table.
- 2 Do you think the company is right to consider increasing the workforce by employing five more workers?
- 3 Should the company install new machinery instead of employing five more workers? Justify your answer.
- 4 Suggest other ways the company may be able to improve the productivity of its workforce.

#### How can firms increase factor productivity?

A firm that is able to increase the productivity of its resources will produce more output from the same or fewer resource inputs, reduce its costs of production and therefore can potentially earn more profit from each item it sells. However, improving productivity can be difficult and slow to achieve. It can require multiple actions and investments, including:

- training workers to improve their existing skills and learn new skills
- rewarding increased productivity with performance-related pay and bonus payments

- encouraging employees to buy shares in their organization – improved productivity will help to raise profits and pay higher dividends on shares
- increasing job satisfaction, for example by improving the working environment, making jobs more varied, introducing more team working, involving workers in business decision making and giving regular feedback on performance
- replacing old plant and machinery with new, more efficient machines and tools for workers to use
- introducing new production processes and working practices designed to continually reduce waste, increase speed, improve quality and raise output in all areas of a firm. This is known as **lean production**.

Many of the above initiatives will tend to raise the cost of employing labour in the short run. However, if productivity improves, the average cost of producing each unit of output will fall and profits will tend to rise. Lower costs can be passed on to consumers as lower prices in an attempt to increase consumer demand and generate more sales revenues. If consumer demand expands, then the demand for labour may also increase.

## SECTION 3.6.2

### Labour-intensive and capital-intensive production

## SECTION 3.6.3

### Demand for factors of production

#### Different production methods require different factor combinations

Production requires factor inputs to produce goods and services. Firms will therefore attempt to combine land, labour and capital in the most productive and efficient way possible to maximize their outputs and minimize their costs.

For example, many modern firms employ **capital-intensive production** methods that require far more capital input than labour. Capital-intensive production processes are often partially or fully automated. They aim to mass-produce similar or identical products faster and cheaper than workers could by hand. However, total costs may initially be high because specialized machinery and other capital equipment can be expensive to hire or purchase.

In contrast, **labour-intensive production** is common in many service industries and also in the agricultural sector where capital-intensive methods are not feasible. For example, many hospitals, hotels, restaurants, supermarkets and other retailers employ large workforces because they provide personalized services. Similarly, many delicate fruits and vegetables are carefully hand-picked on farms to avoid bruising or damaging the crops. Some goods may also be handmade by workers using handheld tools to produce more personalized or customized items.

For products that can be produced using either capital or labour-intensive methods, firms will therefore choose the production method that offers them the greatest overall advantage in terms of efficiency and profitability.



▲ Labour-intensive

#### Advantages of

- ✓ Products ca
- ✓ Mass produ
- each unit of production
- ✓ Wages and
- ✓ There is less labour or f
- ✓ Automate
- every day;
- ✓ Programm
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- may be m

#### Disadvantages

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- ✗ Training
- operate
- ✗ It may be
- demand
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- ✗ Technolo
- machine
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- ✗ Breakdo
- ✗ It is not
- consum





▲ Labour-intensive production



▲ Capital-intensive production

#### Advantages of capital-intensive production

- ✓ Products can be mass-produced if the market size is large;
- ✓ Mass production will reduce the average cost of producing each unit compared to slower, more labour-intensive production methods;
- ✓ Wages and other labour employment costs are far lower;
- ✓ There is less risk of disruption to production from shortages of labour or from industrial disputes;
- ✓ Automated production can be continuous, 24 hours a day and every day;
- ✓ Programmed equipment cannot lose skill or concentration. As a result there is less risk of human error and product quality may be more uniform than with hand-produced products.

#### Advantages of labour-intensive production

- ✓ Consumers may pay a premium price for handmade and more personalized products;
- ✓ Labour costs can be kept low if workers are unskilled or hired on temporary contracts, for example, to pick crops during summer months;
- ✓ There is a lower risk of losses due to machinery breakdowns or power cuts halting production;
- ✓ Workers may take more pride in their work and produce better quality products than they would if they were simply operating machinery or carrying out repetitive tasks in an automated production process;
- ✓ Labour can be used more flexibly than installed and therefore immobile machinery;
- ✓ Product quality is easier to observe, monitor and change at each stage of the production process.

#### Disadvantages of capital-intensive production

- ✗ Machinery and other capital equipment can be very expensive to buy or hire;
- ✗ Maintenance costs can also be high and may increase over time as equipment wears out;
- ✗ Training costs may be high if workers need to be trained to operate complex equipment;
- ✗ It may be difficult to change production, for example if consumer demand or technology changes, once a firm has installed a significant amount of machinery and other equipment;
- ✗ Technological advance is increasing the rate at which machines and other equipment need to be replaced to remain competitive with new firms installing the latest equipment;
- ✗ Breakdowns and power cuts will hold up production;
- ✗ It is not suitable for many service industries or in markets where consumers want more personalised or custom-made products.

#### Disadvantages of labour-intensive production

- ✗ Wages and other employment costs can be high;
- ✗ Firms may find it difficult to find and hire workers with the skills they need and may have to pay higher wages to attract skilled labour;
- ✗ Disputes with trade unions and workers can result in industrial actions which can disrupt production;
- ✗ Workers may need to be retrained in new skills and production methods as consumer demand changes;
- ✗ The average cost of producing each item will be much higher than in firms using more capital-intensive methods to mass-produce the same or similar products;
- ✗ Labour-intensive methods are best suited to small-scale production or the production of individual or personalized products.

## What determines the demand for factors of production?

Firms that choose to employ capital-intensive production methods will demand more capital inputs than labour compared to labour-intensive firms. But how much capital and how much labour will each type of firm demand? How much land and other natural resources will they require? What affects their demand for these different factors of production?

### 1 Consumer demand for their products

The more goods and services consumers want and are willing and able to buy, the more factors of production firms will need to produce them. That is, their demand for factors of production is a **derived demand**. The demand for land, labour and capital by firms depends on there being sufficient demand from consumers for the goods and services they produce. It follows that an increase in demand for their products will result in an increase in factor demand while a fall in demand will reduce factor demand.

### 2 Factor prices

As consumer demand for their products increases, will firms hire more capital or more labour to increase production? This will depend on their relative factor prices.

Just like the demand for all other goods and services, the demand for factors of production by firms will depend on their market prices. The higher their prices the more costly it will be to produce goods and services and, therefore, the less profitable production becomes. For example, as wage rates increase, the demand for labour will tend to contract. Similarly, if the cost of buying or hiring capital equipment increases then demand for capital will also tend to contract. However, if capital is relatively cheap, then firms may cut their workforces and employ more machinery and other capital equipment instead.

### 3 Factor availability

Factor availability will affect both the price and quantity supplied of different factors of production. For example, the supply of workers with highly specialized skills is low relative to demand for them. As a result, the wages they can command tend to be very high. ▶ **3.3.2**

Shortages of skilled labour can disrupt production. Firms will therefore compete with each other to attract skilled labour with offers of higher wages and better working conditions. Alternatively, firms may have to hire less experienced workers and provide them with training in the skills they require but this can take time and be expensive especially if those workers leave to take higher paid jobs elsewhere once they have been trained. As a result, some firms may be forced to adopt more capital-intensive production methods instead to reduce their labour requirements.

In much the same way, firms will often have to compete with each other to buy or rent a limited supply of premises in the most advantageous locations. Many firms are also having to modify their products and production methods as many of the natural resources they use run out and become more difficult and more expensive to obtain. ▶ **1.1.1**

### 4 Factor productivity

A profit-maximizing firm will only employ additional land, labour or capital if it is profitable to do so. For example, a worker that costs \$100 each day in

Table lan

Number of workers

4

5

6

7

8

9

Table lamp production

Number of workers	Total output per week	Extra output per worker per week	Value of extra output (quantity × price)
4	300	–	–
5	350	50	\$500
6	390	40	\$400
7	430	30	\$300
8	440	20	\$200
9	450	10	\$100

wages to employ who only adds \$90 to the value of output each day will not be worth employing. However, it will be profitable to employ a worker costing \$100 who adds \$120 to output. The demand for labour as well as all other factors of production therefore depends on how productive they are.

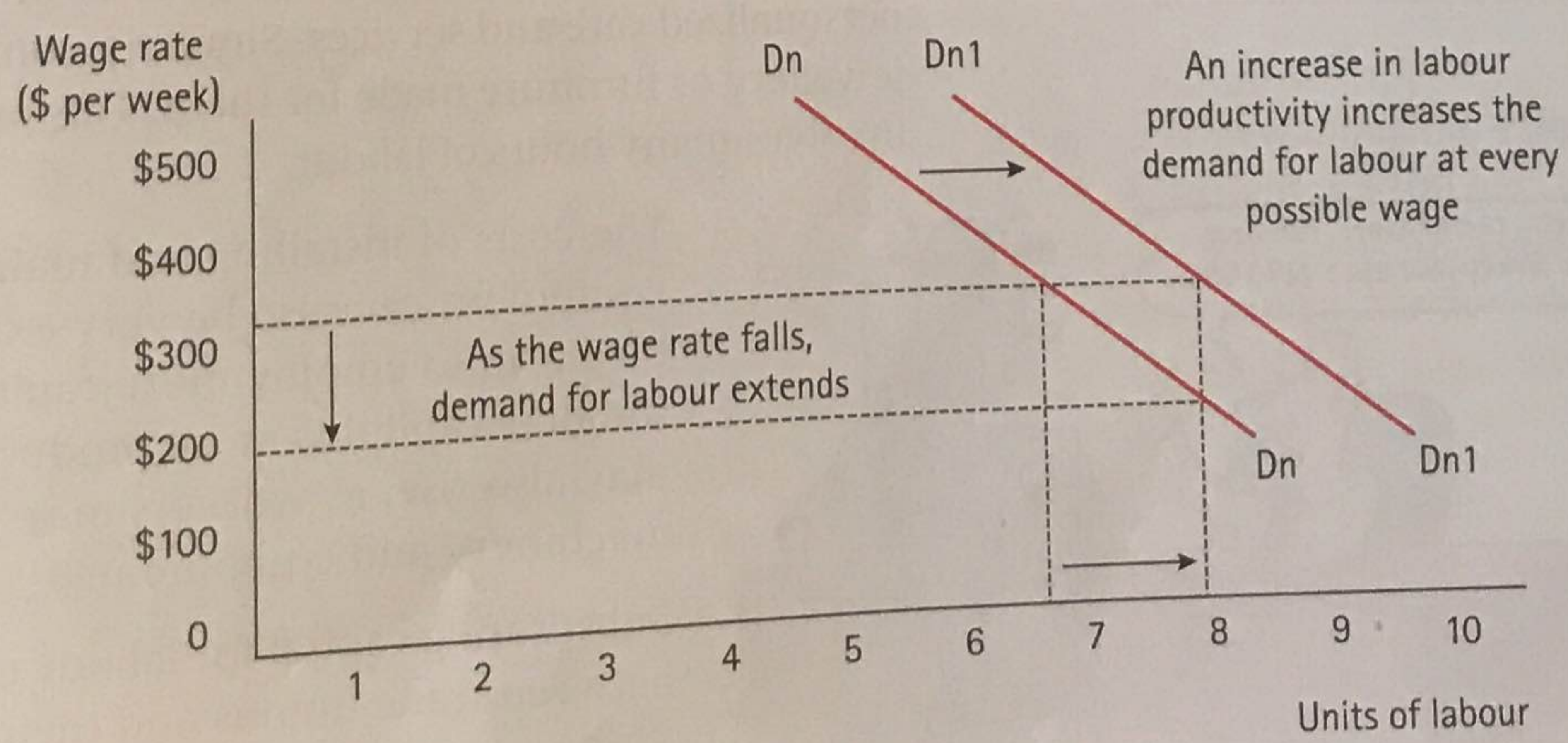
Imagine a firm producing table lamps. Each lamp sells for \$10. At present, four units of labour (that is, four employees) are employed producing a total output of 300 lamps each week. The firm wants to increase output but doesn't know how many extra workers it should employ. To help the firm decide, it estimates the amount of output each additional worker is likely to produce.

The firm has estimated that adding a fifth worker would raise total output by 50 lamps each week. When these extra lamps are sold, the firm's revenue will increase by \$500. The revenue productivity of the fifth worker is therefore \$500 per week.

If the wage rate is \$300 per week, it is worth employing the fifth worker as well as a sixth worker. A seventh worker will add \$300 to the value of total output each week, and costs \$300 in wages to employ. In a profit-maximizing firm this worker is worth employing because each one of the extra lamps produced will be adding to profit. However, if the firm attempted to employ an eighth worker it would gain only \$200 in extra output but lose \$300 in extra wage costs. Profits would fall by \$100. The only way the firm would extend its demand for labour to eight workers would be if wages fell to \$200 each week. The firm's demand curve for labour therefore slopes downwards. ► 3.2

Alternatively, our table lamp manufacturer could attempt to increase the productivity of all its workers. It estimates that if it trains new and existing employees in more productive techniques each worker could produce a further 10 lamps worth an additional \$100 each week.

Demand for table lamp makers



So now, a fifth worker would increase output by 60 lamps each week, worth \$600 in extra revenue. A sixth worker would increase output by another 50 lamps, worth \$500 in revenue, and so on. This has the impact of shifting the demand curve for labour to the right at every possible wage rate (from  $D_n$  to  $D_{n+1}$  in the diagram above). If the weekly wage rate remains at \$300 per employee, then clearly it is now worth employing up to eight workers, since the eighth worker will now add as much to revenue as he or she will cost to employ.

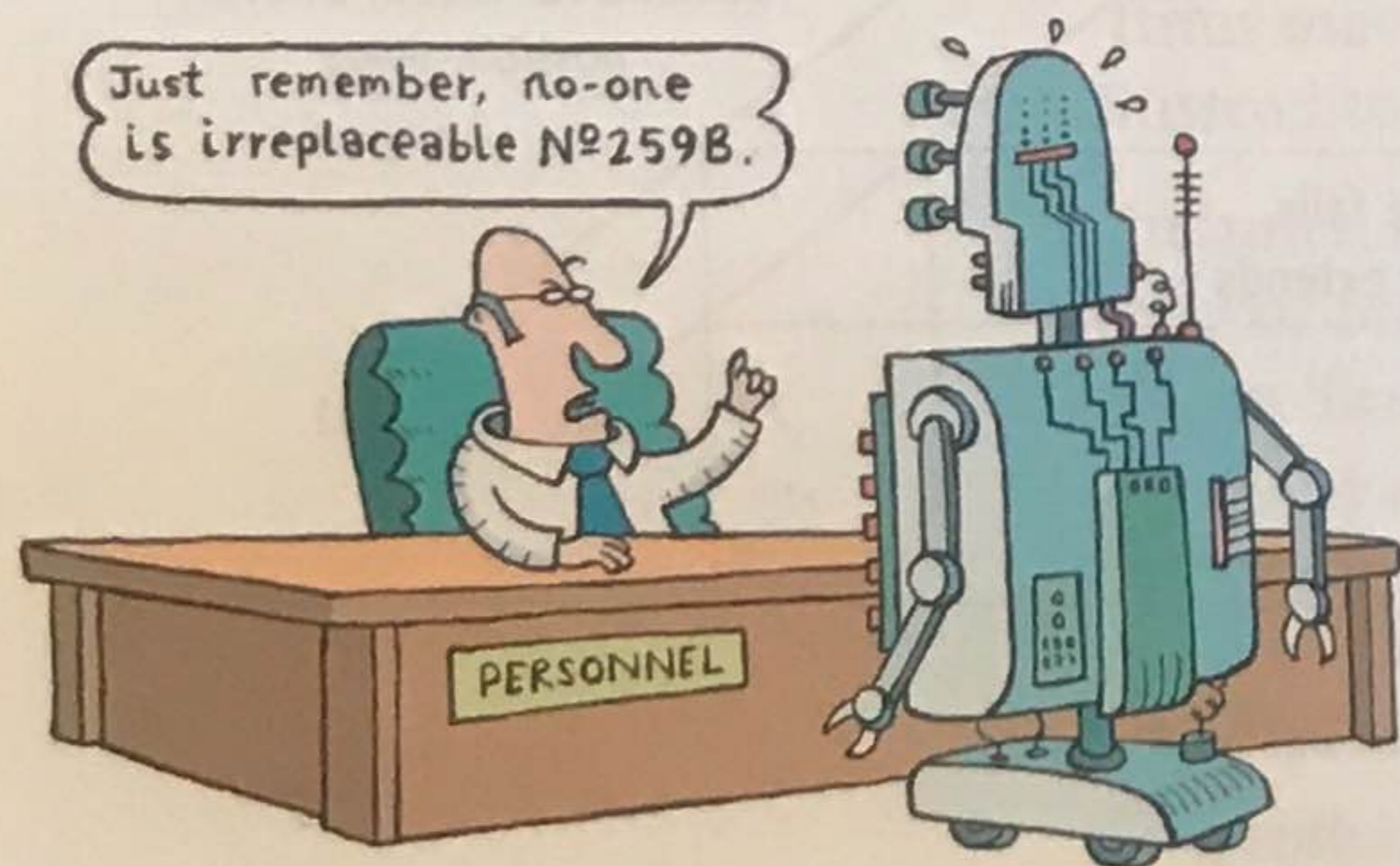
Exactly the same will apply to a decision to increase the amount of capital employed in the table lamp firm if it could employ computerized machinery to make the lamps instead of extra workers. If the productivity of capital rises, and/or the cost of capital falls, firms will tend to expand their demand for capital.

A firm will want to combine its resources in the most efficient way to maximize overall productivity for the minimum of costs. It will therefore compare the costs and productivity of labour with capital and will tend to employ more of the most productive factor. It follows that if wages rise or the productivity of capital rises, a firm will tend to replace labour with more capital. This is known as **factor substitution**.

### Factor substitution

Factor substitution involves replacing labour in a production process with new capital equipment and machinery. The substitution of labour with capital has occurred in many modern industries in many countries. Technological advance has greatly lowered the cost of new equipment and machinery and has increased their productivity relative to labour. For example, the work of once skilled typesetters and compositors in the printing industry has now been replaced by desktop publishing software on computers operated by writers and journalists. Intelligent robots controlled by computer have taken over human tasks in manufacturing processes such as car assembly and food packaging. This is known as **computer aided manufacture (CAM)**.

However, labour and capital are not perfect substitutes. The ability of a firm to substitute capital for labour will very much depend on the type of product and the production process used. For example, automated mass production processes are used to produce many thousands or millions of very similar products, such as newspapers, cars, paints and computer disks. However, machines cannot replicate the work of a doctor, solicitor, hairdresser or other workers providing personalized care and services. Similarly, some consumers want personalized jewellery or furniture made for them. This production is usually by hand, and involves many hours of labour.



The costs of installing and maintaining new machinery and other equipment can also be very expensive and will affect the decision by a firm to employ more capital at the expense of labour, even if the new capital is more productive. Short-term production costs may also rise, as workers may need to be retrained to use new machinery and equipment.

Substituting capital for labour may also cause bitter labour disputes between trade unions and their employers over possible job losses. Strikes by workers and redundancy payments for those forced to leave can be very expensive for a firm. ► **3.4.3**