TEACHING & LEARNING ACTIVITIES
THE EXPORTING PROCESS
SUPPLY CHAINS: FROM PRODUCER TO CONSUMER

This activity allows students to consider the global, national and local supply chains which exist to create a bar of chocolate.

ACTIVITY 5a: WHAT IS A SUPPLY CHAIN

Read through the Definition: Supply Chain. Based on earlier activities, ask students to define the terms ‘producers’ and ‘consumers’.

Taking the example of a chocolate bar (complete with wrapper), ask students to brainstorm possible examples of each element in the supply chain using the table provided, Elements in the Supply Chain of a Chocolate Bar. Elements might include:

- **Producers**: e.g. farmers and miners;
- **Raw materials**: e.g. cocoa beans, sugar, milk, wood for paper wrappers, aluminium for foil wrappers etc.;
- **Manufacturers**: e.g. chocolate factories, sugar mills and refineries and milk processors;
- **Distributors**: e.g. warehouses, transport companies (delivery trucks);
- **Retailers**: e.g. supermarkets, service stations and vending machines, etc.;
- **Service providers**: e.g. designers, advertisers, market researchers, transport providers etc.;
- **Consumers**: e.g. everyone! manufacturers of other chocolate products, the export market.

ACTIVITY 5b: RESEARCH & JIGSAW

RESEARCH:

Divide the class into four research groups named Sugar, Milk, Cocoa and Product Distribution. Distribute information sheets and question cards Supply Chains (Milk, Sugar, Cocoa, Product Distribution) which detail the supply chains for their ingredient or stage in the process. Ask each research group to work together to extract the key information from the text ready to present to the rest of the class.

When students have completed this activity, hand out the supply chain diagrams to assess their findings and assist in their presentation.

PRESENTATION:

Each research group should give a short presentation detailing the key stages of their supply chain. Their presentation should include:

- The major players (who does it involve?) e.g. not just the farmer but the transport company transporting the milk;
- Key considerations that influence the actions of the major players. e.g. harvesting times, perishable nature of the product, type of transport used (refrigerated tankers);
- Geographic information about the location of the primary producer / site of the manufacturer or distribution centre.

JIGSAW:

Form new groups which contain a specialist from each of the four research groups. Hand out icon sheets to be cut out for use in this activity. Direct the groups to combine their knowledge in order to create a flow diagram representing the full supply chain for a chocolate bar (without wrapper). This diagram should be labelled with key decision factors marked.

After this activity is completed, invite students to use the provided chocolate bar supply chain diagram to assess their own or another group’s illustration of the supply chain.

Discuss students’ responses to the tasks. How would the supply chains of an iPod compare?
**TEACHING & LEARNING ACTIVITIES**

**THE EXPORTING PROCESS**

**SUPPLY CHAINS: FROM PRODUCER TO CONSUMER**

Supply Chain - The Chocolate Bar Supply Chain - Solution

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**SUGAR SUPPLY CHAIN**

- Farmers harvest the sugar cane crop, cutting the stalks into small lengths called billets.
- These billets are loaded into bins and towed by a tractor to an area known as a cane pad and made ready for collection.
- Trucks transport the billets by road to the sugar mill within 16 hours of harvesting.
- Bulk raw sugar is made at the sugar mill and placed in large storage bins for transportation.
- The raw sugar is loaded into a bulk tanker for transportation.
- Sugar is stored in bulk terminals until it is needed for shipment or by sugar refineries.
- Raw sugar is transported from the bulk terminal in a bulk tanker to the refinery, (Jan-May) where it is refined, packaged, and assembled into orders.
- The orders are loaded onto pallets and into trucks, then transported by road to the Port of Melbourne.

**COCOA SUPPLY CHAIN**

- The cocoa pods are collected in large baskets, which workers carry on their heads to curing areas.
- Cocoa pods are harvested from trees. (Oct - Dec)
- At the curing area farmers remove the cocoa beans from their pods and they are fermented and dried.
- The dried, cured cocoa beans are then packed into sacks for transportation.
- The cocoa beans are transported in trucks, by road, to the Ghanaian Port, where they are packed into containers.
- A container ship transports the cocoa beans by sea to the Port of Singapore.
- Trucks transport the cocoa beans from the Port of Singapore to a processing factory.
- Cocoa mass + cocoa butter + cocoa powder are produced at the processing factory.
- The cocoa products are transported in trucks, by road, back to the Port of Singapore.
- A container ship transports the cocoa products by sea to the Port of Melbourne.

**MILK SUPPLY CHAIN**

- Cows at a dairy farm are milked twice a day and the milk is stored in a refrigerated silo for up to 48 hours.
- Milk is pasteurized and homogenized at the processing factory and is stored in refrigerated silos before and after processing.
- A refrigerated tanker transports the milk from the processing factory to the chocolate factory.
- The ingredients are used at the chocolate factory to produce chocolate bars.
- A refrigerated tanker collects milk from the dairy farm every 24 - 48 hours and transports it by road to a processing factory.
- The milk is pasteurized and homogenized at the processing factory and is stored in refrigerated silos before and after processing.
- A refrigerated tanker transports the chocolate bars from the factory to the point of sale.

**SUPPLY CHAIN FINISHES HERE**
ACTIVITY 5
THE EXPORTING PROCESS
SUPPLY CHAINS: FROM PRODUCER TO CONSUMER

5a WHAT IS A SUPPLY CHAIN?

Definition: Supply Chain

A supply chain is the network of producers, manufacturers, distributors and retailers who turn raw materials into finished goods and services delivered to consumers. The supply chain includes the planning, recording and communication needed to make the movement of goods between chain members efficient.

Elements in the Supply Chain of a Chocolate Bar

<table>
<thead>
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<th>Producers</th>
<th>Raw Materials</th>
<th>Manufacturers</th>
<th>Distributors</th>
<th>Retailers</th>
<th>Service Providers</th>
<th>Consumers</th>
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5b RESEARCH AND JIGSAW

RESEARCH:
Read the information on the sheet that refers to your research group (e.g. Milk, sugar, cocoa, or product distribution). Extract key information to present to the class.

PRESENTATION:
Give a short presentation detailing the key stages of your nominated supply chain. Include:
- major players;
- key considerations that influence the actions of major players; and
- geographic information about the location of the primary producer/site of manufacturer or distribution centre.

JIGSAW:
In your new groups (a representative of each supply chain in each group) create a flow diagram or illustration representing the full supply chain of a chocolate bar (no wrapper). Use the icons sheet to cut out icons and arrange in the correct order to form the whole chocolate bar supply chain.
Supply Chain - Milk

The dairy industry is one of Australia's major rural industries, third behind the beef and wheat. Milk is produced and sold as drinking milk but also manufactured to make many dairy products which are consumed within Australia and exported to many world regions.

All Australian states have dairy industries to supply local areas with fresh drinking milk. However, low cost dairy farming, which relies on good pastures and natural water sources, is primarily based in south east Australia where the climate is temperate. The diagram below shows the proportion of milk production within Australia.

Victorian's temperate climate and soil variety are good for dairy farming. The rich pastures allow herds to be fed naturally, keeping Victorian milk production costs relatively low compared with other states. Sometimes though, in times of drought, the supply of grass for grazing may become short and farmers may need to supply alternative food such as grains and hay to supplement the diet.

Seasons affect the production of milk. Milk production is highest in spring when the pastures are at their most lush and reduces in late autumn and winter. However, farmers are able to manage calving and feed supplement so that milk is produced evenly throughout the year.

FROM THE FARM:

Cows are milked twice a day. Modern farms have large milking sheds containing milking machines to collect the cows’ milk through suction cups which the farmer places on each of the cow’s four teats. The machine transports the milk through stainless steel pipes to refrigerated vats or silos that cool and store the milk ready for collection. Milk can be stored in the refrigerated vats for no longer than 48 hours. The milk is collected from the vats every 24 or 48 hours by refrigerated tankers. The milk is stored in refrigerated silos at the factory before being processed.

Samples of milk are taken and analysed before processing begins. Most farmers are paid according to the quality and composition of the milk they produce so it is extremely important that these samples are collected and stored correctly.
At the factory the milk is pasteurised to kill any harmful bacteria. Cream can become separated from the milk whilst being stored and pasteurised so the milk also goes through a process called homogenisation. The milk and cream are blended together again giving the milk its smooth and creamy texture.

The processed milk is once again stored in vats ready to be packaged and transported to shops or collected by refrigerated tankers and taken to manufacturers. Dairy manufacturers make dairy products such as cheese, cream, butter and yoghurt. Other manufacturers use the milk as an ingredient in products such as chocolate. The final dairy products are either made ready for export or assembled into orders and distributed by road or rail to the manufacturers’ customers in Australia.

KEY QUESTIONS

- Why is Victoria one of the best regions in Australia for manufacturers to source their milk supply from?
- What planning, recording and communication do you think need to take place within this supply chain?
- What time restrictions are there in this supply chain?
- What specialised vehicles are used in the transportation of milk?
ACTIVITY 5 - SOLUTION
THE EXPORTING PROCESS
SUPPLY CHAINS: FROM PRODUCER TO CONSUMER

Supply Chain - Milk

Cows at a dairy farm are milked twice a day and the milk is stored in a refrigerated silo for up to 48 hours.

A refrigerated tanker collects milk from the dairy farm every 24-48 hours and transports it by road to a processing factory.

Milk is pasteurised and homogenised at the processing factory and is stored in refrigerated silo's before and after processing.

Milk is packaged and loaded onto pallets and into a refrigerated truck.

It is then transported in trucks by road to supermarkets and retail outlets.

Manufacturers produce dairy and other products from the milk.

These products are loaded on to pallets and into trucks.

Products are then transported on planes for world exports.

A refrigerated tanker transports the milk by road to the manufacturer.

Manufacturers produce dairy and other products from the milk.

These products are loaded on to pallets and into trucks.

Trucks transport the products by road to a warehouse, where orders are assembled.

Products are then transported on planes for world exports.

Trucks transport the products by road, from the processing factory to the manufacturer.

Manufacturer produce dairy and other products from the milk.

These products are loaded on to pallets and into trucks.

These orders are then loaded on to pallets and into trucks.

Or transported by plane for world exports.

These products are then loaded on to pallets and into trucks.

Or transported by plane for world exports.

These orders are then loaded on to pallets and into trucks.
THE SUGAR PRODUCTION PROCESS:

Sugar is grown in many countries around the world. It is produced from sugar cane in countries with warm climates and from sugar beet in cooler climates. Sugar cane grows best in tropical or subtropical areas due to the high temperatures and regular rain supply these climates provide. Australia produces raw sugar from sugar cane grown primarily in Queensland’s subtropical and tropical coastal regions. Sugar cane is also grown in the subtropical north of New South Wales.

HARVESTING THE CROP:

Sugar cane can take between 10 and 16 months to grow before it is ready for harvest between June and December. Harvesting begins by burning the crop to reduce the amount of leaves, weeds and other matter which can make harvesting and milling operations difficult. Farmers use a machine called a harvester to gather the crop. It moves along the rows of sugar cane. As it does so it removes the remaining leafy tops of the cane stalks, cuts the stalks off at ground level and chops the cane into small lengths called billets. The billets are loaded into wire bins towed alongside by a tractor. These field transporters take the harvested sugar cane to collection areas known as cane pads. At the cane pads, the billets are transferred into very large bins ready to be collected and taken to the mill. The sugar mills have to organise collections from each of the cane pads in their catchment area. The mill companies use road transport service providers to co-ordinate this task. This is an important job. Sugar quality and its value reduce over time. Sugar cane should be harvested and delivered to the mill within 16 hours. If the farms are a long way from the mill, rail transport might also be used.

Transport providers often use technology to help them deliver an efficient and effective service. They can use GPS systems to locate the relevant cane pads and have electronic tracking devices on the billet bins to help them track and record the movement of each farmer’s produce.

Farmers often belong to a co-operative which owns or works with the sugar mills. Mills need to process the sugar cane straight away to ensure quality. If too much sugar cane is delivered at one
time and cannot be processed, the sugar will decrease in quality and the farmer will lose money. The mill also needs to make sure that it has enough sugar cane to process to stay open. The mills and the farmers work together to plan their crop and harvest to ensure no sugar cane is wasted and the mill has a sufficient supply. Each farmer within the co-operative is allocated a time within the season to harvest the different sections of their farm to ensure the optimum supply of sugar to the mills.

THE MILLING AND REFINING PROCESS:

On arrival at the mill, the billets are weighed and washed. This weight is recorded so the mill knows how much to pay the farmer. The cane is then fed through a series of mill rollers to extract the sugar juice which is treated to have impurities removed. The sugar juice is heated to evaporate any water leaving a thick syrup called molasses in which raw sugar crystals will form. A machine called a centrifuge separates the raw sugar crystals from the syrup. The raw sugar is tumble-dried and placed in large storage bins and sorted for transport. This bulk sugar is transported to the refineries directly or to bulk terminals by road or rail.

If the sugar is being exported, it is stored in the bulk terminals until it is needed for shipment. Then it is transported via conveyors straight to the wharf and loaded into the ship’s hold.

Although sugarcane is only harvested between June and December the refineries operate all-year-round. They need a constant supply of raw sugar so access supplies from the bulk terminals where it is stockpiled.

When the raw sugar arrives at the refinery the final impurities in the sugar are removed. The sugar is then graded into required sizes and packaged. Orders are assembled and dispatched to the refinery’s customers, including food manufacturers, by road or rail.

QUESTIONS TO CONSIDER

• Why do the farmers and mills have to co-ordinate their harvesting schedule?
• Why is raw sugar stockpiled in the bulk terminals?
• Why do the billet bins have electronic tags?
• Why is efficient transport to the mill so important?
• What information do you think the transport providers need to co-ordinate the collection of billet bins?
Farmers harvest the sugar cane crop, cutting the stalks into small lengths called billets.

These billets are loaded into bins and towed by a tractor to an area known as a cane pad and made ready for collection.

Bulk raw sugar is made at the sugar mill and placed in large storage bins for transport.

The raw sugar is loaded into a bulk tanker for transportation.

Trucks transport the billets by road to the sugar mill within 16 hours of harvesting.

Sugar is stored in bulk terminals until it is needed for shipment or by sugar refiners.

Bulk raw sugar is transported from the bulk terminal in a bulk tanker to the refinery, where it is refined, packaged and assembled into orders.

Sugar is transported by ship for world export.

The raw sugar is transported by ship for world export.

The orders are loaded on to pallets and into trucks.

These pallets are loaded on to lorries and transported to supermarkets and retail outlets or manufacturing factories.
Supply Chain - Cocoa
(Source: Cadbury Australia website www.cadbury.com.au)

Cocoa beans are the key ingredient of chocolate. They are harvested from cocoa trees which grow in humid tropical climates where it rains regularly and temperatures remain even. The cocoa tree naturally grows in South and Central America but has been cultivated to grow in many other countries with appropriate climates. Plantations have been established in areas such as West Africa, the Caribbean and Asia. Cocoa was first planted in Ghana in 1879 and the country is now a major producer of cocoa. Cocoa is grown on small farms where the planting patterns of cocoa trees make mechanisation impractical.

HARVESTING AND SPLITTING COCOA PODS:

Cadbury Schweppes is a major chocolate manufacturer in Australia. According to its website, it uses cocoa beans sourced from Ghana in West Africa as well as Malaysia and Indonesia in Asia.

Cocoa pods are harvested from the cocoa tree twice a year, mainly during October to December. Harvesting cocoa beans is a very labour-intensive process. Every few weeks the ripe pods are cut from the trees. They are collected in large baskets, which workers carry on their heads to the curing area. Here they are piled up ready for splitting and curing. Farmers split open the pods by hand and remove the beans. The beans are then spread out under banana leaves and left to ferment for 5-6 days, being turned regularly.

After fermentation, the beans are dried in the sun. The dried, cured beans are quality inspected and packed into sacks ready for transportation. The beans are bought and transported by a Ghanaian licensed buying company that works with the Ghanaian Cocoa Board to sell cocoa to manufacturers. The beans are transported by road to the sea port where they are packed in containers and prepared for export. Cadbury, for example, has processing factories in Singapore. From the port in Singapore, the cocoa beans are transported by road to the processing factory. Here, the beans are sorted and cleaned ready to be winnowed. The part used to make chocolate called the nib, is roasted and ground in stone mills until a ‘cocoa mass’ is produced. Cocoa mass is used to make cocoa butter and cocoa powder.

The cocoa mass, cocoa butter and cocoa powder products are quality inspected before being transported back to the port for export by ship to manufacturers. Cadbury has factories in Tasmania and New Zealand. The cocoa products are then used to make chocolate.

QUESTIONS TO CONSIDER

• What modes of transport are used in the supply chain of cocoa?
• Why do you think the cocoa is processed in Singapore?
• What planning and organisation do you think is involved in importing cocoa into Australia?
Cocoa pods are harvested from trees (Oct-Dec).

The cocoa pods are collected in large baskets, which workers carry on their heads to curing areas.

At the curing area, farmers remove the cocoa beans from their pods and they are fermented and dried.

The dried, cured cocoa beans are then packed into sacks for transport.

The cocoa beans are transported in trucks by road to the Ghanaian Port, where they are packed into containers.

A container ship transports the cocoa beans by sea to the Port of Singapore.

A container ship transports the cocoa products by sea to the Port of Melbourne.

Trucks transport the cocoa products by road to a manufacturing factory.

Cocoa mass + cocoa butter + cocoa powder are produced at the processing factory.

The cocoa products are transported in trucks by road back to the Port of Singapore.

Trucks transport the products by road to a warehouse where orders are assembled.

A manufacturer loads the cocoa products onto pallets and into trucks.

These orders are then loaded onto pallets and into trucks.

Trucks transport the products by road to supermarkets and retail outlets.

The dried, cured cocoa beans are then packed into sacks for transport.
Supply Chain - Product Distribution

To make chocolate all the key ingredients are brought together at the manufacturer’s chocolate factory. Cadbury, for example, has a chocolate factory in Tasmania where they make Dairy Milk chocolate bars. The key ingredients for chocolate are fresh milk, sugar, and cocoa. Milk would likely be sourced locally to maintain freshness. Most international containerised sea freight enters Australia through the Port of Melbourne where it is processed through Customs and Quarantine before being forwarded on to its final destination. Cocoa, imported by sea from Singapore, and sugar sourced from suppliers within Australia, would be shipped to a Tasmanian port in containers from the Port of Melbourne and then transported by road to the chocolate factory.

The chocolate factory makes chocolate ‘crumb’, a key ingredient of chocolate. The crumb is passed through a pin mill and mixed with cocoa liquor, cocoa butter, emulsifiers and other flavourings. The chocolate is then refined, mixed and beaten (called conching) to develop flavour, and tempered (mixing and cooling the liquid chocolate). Tempered chocolate is poured into bar-shaped moulds, shaken and cooled. The moulded blocks then continue to high speed wrapping plants within the factory. The wrapped chocolate bars are packed and transported in refrigerated containers from the factory to the manufacturer’s distribution centre or made ready for export.

Cadbury’s Central Distribution Centre is located in Melbourne where it has easy links to the port, road and rail networks. The chocolate made in the Tasmanian factory is transported to the sea ports and shipped to the Port of Melbourne before being forwarded on by road to the National Distribution Centre. The National Distribution Centre is where orders are assembled for customers (retailers) throughout Australia and forwarded to destinations by road or rail.

Chocolate products may be delivered directly to retail outlets. Alternatively, for large retail chains in particular, the product may be delivered to large distribution centres where products of different descriptions are stored, sorted and combined into consignments to be delivered to individual stores belonging to the chain.

Cadbury Australia exports confectionery products to a number of countries in the Asia-Pacific region. These countries include New Zealand, Fiji, Papua New Guinea, Indonesia, Malaysia, Singapore, the Philippines, Thailand, Taiwan, Japan and Brunei. Shipments to these countries would depart from the Port of Melbourne.

QUESTIONS TO CONSIDER

• Why might the milk be sourced locally?
• Why do you think the National Distribution Centre is located in Melbourne?
• What planning and organisation do you think is involved in distributing the chocolate bars?
Activity 5 - Solution

The Exporting Process

Supply Chains: From Producer to Consumer

Ingredients (sugar & cocoa) are delivered from suppliers to the Port of Melbourne and loaded into containers.

The ingredients are transported by containership from the Port of Melbourne to the Port of Tasmania.

Trucks transport the ingredients by road from the Port to the chocolate factory.

Milk is transported by refrigerated truck from a local source to the chocolate factory.

The ingredients are used at the chocolate factory to produce chocolate bars.

Chocolate Bars are wrapped, packed and then loaded into a refrigerated truck and transported by road back to the Port of Melbourne.

Chocolate bars are then transported by container ship back to the Port of Melbourne, or transported by container ship for world export.

Orders are assembled at the distribution centre for customers.

Orders are transported by road and rail to supermarkets and retail outlets throughout the country.
A container ship transports the chocolate products to the Port of Melbourne.

The dried, cured cocoa beans are then packed into sacks for transport.

The ingredients are transported by road from the Port to the chocolate factory.

A refrigerated truck transports the chocolate bars from the factory to the Port of Tasmania.

The ingredients are used at the chocolate factory to produce chocolate bars.

Cows at a dairy farm are milked twice a day and the milk is stored in a refrigerated silo for up to 48 hours.

Cocoa pods are harvested from trees. (Oct - Dec)

The orders are loaded onto pallets and into trucks, then transported by road, to the Port of Melbourne.

A container ship transports cocoa products by sea to the Port of Melbourne.

A container ship transports the cocoa beans by sea to the Port of Singapore.

These billets are loaded into bins and towed by a tractor to an area known as cane pads and made ready for collection.

Cocoa mass + cocoa butter + cocoa powder are produced at the processing factory.
ACTIVITY 5
THE EXPORTING PROCESS
SUPPLY CHAINS: FROM PRODUCER TO CONSUMER

Farmers harvest the sugar cane crop, cutting the stalks into small lengths called billets.

The cocoa products are transported in trucks by road back to the Port of Singapore.

Sugar is stored in bulk terminals until it is needed for shipment or by sugar refineries.

A container ship transports ingredients from the Port of Melbourne to the port in Tasmania.

The cocoa beans are transported in trucks by road to the Ghanian Port, where they are packed into containers.

The cocoa pods are collected in large baskets, which workers carry on their head to a curing area.

Trucks transport the cocoa beans from the Port of Singapore to a processing factory.

A refrigerated tanker collects milk from the dairy farm every 24 - 48 hours and transports it to a processing factory.

The products are transported by ship for world export.

Trucks transport the billets by road to the sugar mill within 16 hours of harvesting.

Orders are transported by road and rail to supermarkets and retail outlets throughout the country.

Sugar is stored in bulk terminals until it is needed for shipment or by sugar refineries.
Milk is pasteurised and homogenised at the processing factory and is stored in refrigerated silo’s before and after processing.

A refrigerated tanker transports the milk from the processing factory to the chocolate factory.

Bulk raw sugar is made at the sugar mill and placed in large storage bins for transport.

A refrigerated truck transports the chocolate products to a distribution centre.

Orders are assembled at the distribution centre for customers.

At the curing area farmers remove the cocoa beans from their pods and they are fermented and dried.

The raw sugar is loaded into a bulk tank for transportation.

Raw sugar is transported from the bulk terminal in a bulk tank to the refinery, (Jan - May) where it is refined, packaged and assembled into orders.