Social and Spiritual Development
Social Science

Unit 3: Transition and Change

Module 3.6 Technological Change

Student Support Material

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Unit outline

Unit 3 **Transition and Change**	**3.1**	**Skills for Investigating Change (Core)**
	3.2	**Independence (Core)**
	3.3	**PNG History – an Overview (Optional)**
	3.4	**Power, Control and Change (Optional)**
	3.5	**PNG at War (Optional)**
	3.6	**Technological Change (Optional)**
	3.7	**Pre-history and Archaeology (Optional)**

Icons

 Read or research

 Write or summarise

 Activity or discussion

Table of contents

Module 3.6 – Technological Change

During the past two centuries, societies in Papua New Guinea have been exposed to increasingly sophisticated technologies. These have had a major impact on communities, individuals and the country as a whole.

Objectives

During the study of this module students will:

- Acquire knowledge about technological developments in PNG and the world
- Investigate the impact of technological change at all levels of society
- Investigate the nature of technological change in particular environments
- Compare changes in PNG with elsewhere in the world
- Understand the concepts of technology, change, progress, development etc

Section 1: Services

Topic 1: Power

Batteries

Small cell batteries are used to run torches, radios, watches, and pocket calculators. Large electric batteries are used to start car engines and drive larger machines.

Small batteries are usually of a kind called primary cells. The electricity comes from chemicals sealed inside them. They can be used continuously for a few days before the chemicals are used up. Once the battery is 'flat', it has to be thrown away.

Figure 1: High voltage power supply lines. Source: N. Lauer.

Electricity supply

Batteries cannot store enough energy to keep appliances such as stoves, lights, washing machines supplied with electricity. When you plug in a fan the power can come from a generator kilometres away. At the power station, electricity from the generator passes along thick cables to a transformer. Power is carried across country by overhead transmission lines. The voltage is stepped down in stages as the power is distributed to towns and villages.

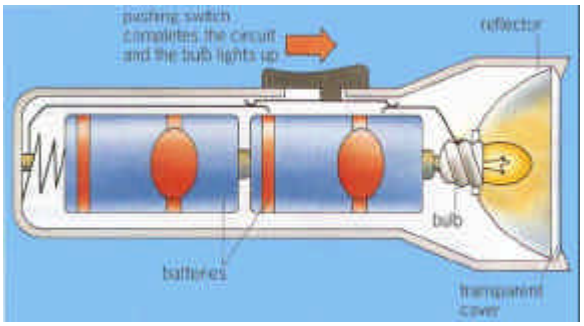

Figure 2: Cross-sectio of a torch. Source: Ultimate Visual Dictionary of Science.

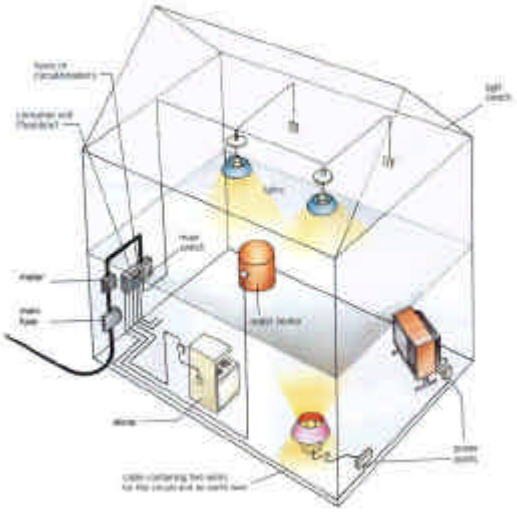

Figure 3: Electrical wiring in a house. Source: Ultimate Visual Dictionary of Science.

Frequent, longer, blackouts likely: Elcom

By Thomas Kilala

THE PNG Electricity Commission has warned that blackouts might become more frequent and last for longer periods, given the poor state of its equipment and the lack of funds for maintenance or repairs.

Elcom's acting chief executive general manager, Joe Bariamu, sounded the warning yesterday while explaining the reasons for the repeated and extended blackouts that occurred at the weekend and on Sunday night.

"Automatic restart equipment on some of the generators require major maintenance to restore them to efficient operational status. This can only be done as and when Elcom's financial and cash flow constraints permit," Mr Bariamu said.

"Unfortunately, the concerns that Elcom has expressed over recent months regarding the potential for serious system faults causing loss of supply due to lack of maintenance and replacement of old equipment were ignored.

"Elcom is not happy that this situation is occurring but without adequate tariffs, there is little that can be done."

The National 10 July 2001

Solar power

Light and heat from the sun pour down on the Earth all the time. When this energy is turned into electricity or used as heat it is known as solar power. The equipment needed to turn the sun's energy into useful power is expensive but it costs less to run and maintain than an ordinary power station. By 1900 many houses in the hotter parts of the USA had solar water-heaters In remote parts of some developing countries, solar cells provide electricity to pump water for drinking and growing crops and to power machines and other equipment.

Water power

Water always flows from a higher point to a lower point. This movement can be used as a source of energy. It can be the gentle flow of a river, or water falling from a great height such as a waterfall or from a dam. The never-ending movement of waves at sea and tides can also be harnessed to provide energy.

Topic 2: Water

Water is essential to all life on earth. Although we can survive many weeks without food, without water we would die in a few days. When large numbers of people settle in an area water supply becomes a major problem. Water is then needed for domestic, industrial and agricultural use. The commonest way of storing water is by damming flowing rivers and streams. Each town or city relies on large dams to provide water. Water is also stored in rainwater tanks and underground, where wells and bores are used to bring it to the surface.

Water pollution has become an important environmental concern. Sources of pollution include rubbish disposal, industrial waste, pesticides, sewage, and oil spills.

Water supply

Unless you get water from a well, the water supplied to your home comes through pipes in the ground. This water may have made a journey of many kilometres to reach your taps. We take water from lakes, rivers and underground to supply our homes. We also build dams across rivers in deep valleys so that large reservoirs of water build up behind the dams. These reservoirs normally provide a constant supply of water all the year round.

Water is then piped to water works to be purified. Although rain is pure water, germs and dirt get into the water as it flows over or soaks into the ground. At the water works, chemicals are added to the water to kill the germs and remove the dirt. The water is also filtered by passing it through beds of sand to trap dirt and germs.
The pure water next goes to water tanks or water towers to be stored. These are often built above cities and towns so that water flows down by gravity to homes, schools, factories and offices.

WATER DISRUPTION NOTICE

The Executive Chairman of Eda Ranu, Mr. Jamie Maxtone-Graham wishes to advise residents of the National Capital District that the city will be experiencing low water pressure during the next couple of weeks due to the following reasons:

- Low level of water at Laloki river affecting pumping, due to the dry season in the Central Province;
- One (1) pump at the Bomana pumping station not working, undergoing maintenance and
- there is currently some renovation work carried out at the Pumping station to install some new pumps. The renovation is expected to completed in three weeks times.

As precautionary measures are asked to **store water for consumption.**

Eda Ranu apologises for the inconvenience caused and we ask for your cooperation and support.

For further information contact our Hotline on 312 2100

EDA RANU
OUR WATER

Figure 4: Newspaper notice placed by Eda Ranu.

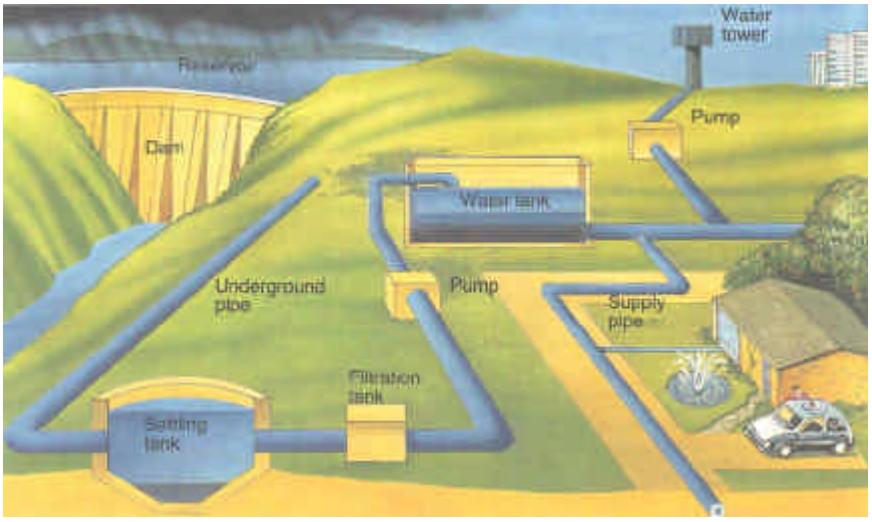

Figure 5: Water supply system. Source: Heinemann Children's Encyclopedia.

Drains and sewers

Rainwater drains carry rainwater from gutters to soak away in the ground. Kitchens, bathrooms and toilets also produce wastewater or sewage that, unlike rainwater, is impure and dangerous to health. It is therefore carried away from buildings by separate drains to be purified. House drains normally connect to sewers, which are large pipes and tunnels under the streets. These carry the waste to sewage disposal plants.

The sewage first goes to a tank where heavy sand and grit settle out. The impure water is then treated by passing air through it and adding bacteria, which break down the harmful substances in the water. It is finally purified by filtering and the pure water discharged into a lake or river or into the sea. The sludge that is left behind can be used as a fertilizer in farming.

Many homes in the country are not connected to sewers. Instead wastewater flows to a septic tank, in which it is slowly purified. The pure water formed soaks away in the ground.

☞ 3.6 Activity 1

Identify equipment in your local area which is powered by batteries.

Draw a solar panel and describe how it works.

Visit a village/house that uses solar panels. What are they used for?

What is a hydro-electric power station? How is it used to produce power?

What difference has electricity made to people's lives? Why do problems with the power supply upset people so much?

Why do electricity sub-stations have warnings posted on them? What is the warning?

How does Elcom know how much to charge you for power?

Describe or sketch traditional methods of collecting and storing water.

Where does the water at your college come from and how is it supplied?

What impact can poor water supplies (scarce or polluted) have on the community?

Section 2: Construction

Topic 3: Building construction

The construction of the homes and buildings in which people live and work has been a major industry ever since early human beings first made huts of sticks, mud, or rocks. Methods of building construction have been constantly improved since those first crude structures. The world's largest office building, the Pentagon in Arlington, Virginia, U.S.A., has 344,243 square metres of office and other space. The Petronas Towers, in Kuala Lumpur, Malaysia, the world's tallest buildings, are 452 metres high. India's Taj Mahal required 20,000 workers and took from 1632 until 1653 to complete. Modern skyscrapers can be built within a year or two. Prefabricated buildings, with their various parts made in factories by assembly-line methods, can be built in a day or two, but are rarely as durable as traditionally made buildings.

Concrete

Concrete is one of the most useful materials for construction. This is because it is produced as a liquid that can be poured into position. It then sets hard. Concrete slabs and panels can be moulded in all kinds of shapes for building. Often, they are precast - first made in a factory and then taken to the site. Concrete is made by mixing stones, sand and cement with water and stirring vigorously.

The ancient Romans developed cement and concrete similar to the kinds used today. Their cement had such great durability that some of their buildings, roads, and bridges still exist. To make cement, the Romans mixed slaked lime (lime to which water has been added) with a volcanic ash called pozzuolana. The ash produced a hydraulic cement that hardened under water. People lost the art of making cement after the fall of the Roman Empire in the A.D. 400's. In 1756, John Smeaton, a British engineer, again found how to make hydraulic cement by using Blue Lias lime with a clay content and pozzuolana from Italy.

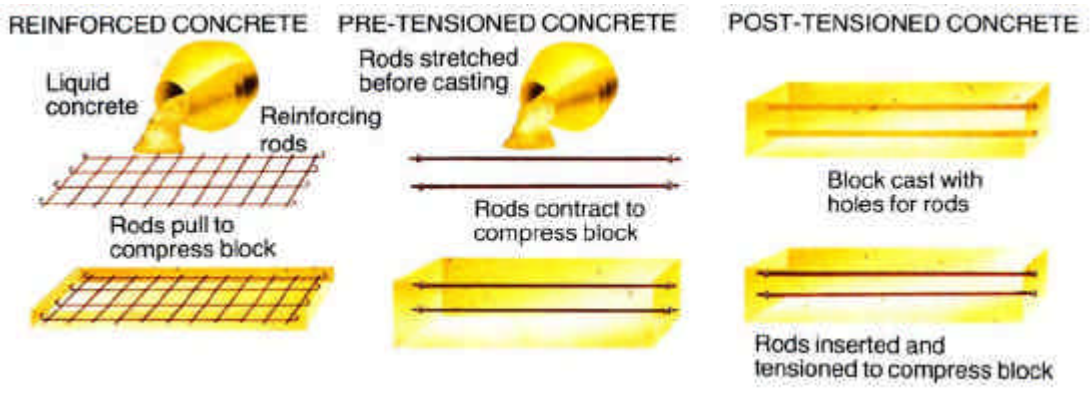

Figure 6: Types of concrete. Concrete is made stronger by placing rods inside. These act to compress or squeeze the concrete in the structure, which gives it strength. To make reinforced concrete, liquid concrete is poured over frameworks of reinforcing rods. Concrete blocks may contain rods that are tensioned to compress them either before or after casting the blocks. Source: Heinemann Children's Encyclopedia.

Nearly all skyscrapers and factories and many homes stand on concrete foundations. These buildings may also have concrete frames, walls, floors, and roofs. Concrete is used to build dams to store water and bridges to span rivers. Cars and trucks travel on concrete roads, and aeroplanes land on concrete runways. Concrete tunnels run through mountains and under rivers. Concrete pipe distributes water, carries away sewage, drains farmland, and protects underground telephone wires and electric-power lines. Reinforced concrete is also used extensively in the huge structures used to produce oil from under the sea. Concrete resists seawater much better then steel or other metals, which corrode when exposed to the sea.

Ceramics and glass

Among the most common materials that we use to make things are ceramics. Ceramics include pottery and porcelain, which we use for tableware like plates, cups and saucers. Glass is also a ceramic. Ceramics are made from cheap, common materials found in the ground - pottery from clay and glass from sand. They can easily be shaped into objects. Glass is also useful because it is transparent. Ceramics are formed by heating. Ceramic objects made of soft clay are hardened in a furnace. Glass is heated to soften it for shaping and it hardens as it cools.

Glass is one of the most useful materials in the world, yet few products are made of such inexpensive raw materials. Glass is made chiefly from silica sand (silica, or silicon dioxide), soda ash (sodium carbonate), and limestone (calcium carbonate).

Glass-ceramics are strong materials that are made by heating glass to rearrange its atoms into regular patterns called crystals. These crystalline materials can withstand high temperatures, sudden changes in temperature and chemical attack. They are used in a wide variety of products, including heat-resistant cookware, turbine engines, chemical and electronic equipment, and nose cones of guided missiles.

Glass has countless uses and can take many different forms. It can be spun finer than a spider web. Glass can also be moulded into a telescope lens or mirror weighing many tons. It can be stronger than steel, or more flimsy than paper. Most glass is transparent but can also be coloured to any desired shade. Besides being useful, glass is also ornamental. Ever since people learned how to make glass, they have used it as an art material.

Pottery is produced by shaping damp, soft clay and other ingredients, either by hand - often using a potter's wheel - or by machines using moulds. The shaped piece of clay is then allowed to dry before being fired or baked in a kiln or oven. The great heat fuses the particles of clay together so that the clay becomes hard.

There are three main kinds of pottery: porcelain, stoneware and earthenware. Porcelain, or china, is the finest pottery. Delicate and almost glass-like, it is used for the best tableware. Stoneware is a strong, hard kind of pottery used to make ovenware, storage pots and pipes. It is non-porous, meaning that it does not absorb water. Earthenware is porous and is therefore often glazed (given a waterproof coating). Ornamental pots and mugs are often made of earthenware. Pottery may be painted before or after firing.

Topic 4: Textiles

In our daily lives we use a great variety of fabrics. They clothe us and, as sheets and blankets, keep us warm at night. Curtains and carpets decorate our homes. The different materials that we use are called textiles.

Prehistoric people had no textiles. They clothed themselves in the skins and furs of animals. Later people learned to spin wool and make fabrics by hand, using simple tools. Nowadays, machines spin, weave and knit textiles and manufacture clothing. However, many people like to knit wool and make their own clothes.

Natural fibres

Nature provides us with several different fibres that we can use to make textiles. They come from animals and plants. Cotton is the most widely-used of all fibres. It comes from the ripe seed boll (pod) of the cotton plant, which grows in warm climates. Other plant fibres include jute and flax which is used to make linen cloth. Wool from sheep is the best-known animal fibre. It comes from the fleece that is sheared from a sheep every summer. Other animal fibres include mohair, which comes from angora goats, and camel hair. Silk, the finest natural fibre, is produced by a caterpillar called the silkworm. It spins a cocoon of fine thread around itself. The cocoon can be unravelled to obtain one long thread.

Artificial fibres

Many of the fibres in our textiles are not found in nature. They are artificial, and are made in factories. Some artificial fibres are made from natural substances, particularly cellulose, which comes from wood pulp, cotton and other plants. The cellulose is dissolved in certain chemicals. Then the solution is pumped through a spinneret, which has tiny holes. The thin streams of cellulose solution harden immediately into cellulose fibres. This kind of artificial fibre is called rayon. Similar fibres are made of cellulose compounds. Fibres called synthetic fibres are made entirely from chemicals. They are really kinds of plastics formed into long threads using a spinneret. Synthetic fibres include nylon, polyester and acrylic fibres. They are stronger than natural fibres and rayon, and clothes made of synthetic fabrics are easier to clean.

Dyeing and printing

Most fibres are a yellowish colour, while people like fabrics to be either pure white or coloured. Fabrics are made white by bleaching them with chemicals. This is also done before dyeing and printing, which colours the fabrics with pure shades and patterns.

In dyeing, the fabric is passed through a hot solution of dye. Most dyes are not natural colours but synthetic substances made from chemicals. This is because synthetic dyes come in a wide range of shades that do not wash out or fade.

Dyeing colours the whole fabric. Printing produces a coloured pattern on the fabric by applying different dyes to various parts of the fabric. The pattern may be on several rollers to which the dyes are applied. The fabric passes through the rollers to be printed.

Topic 5: Plastics

Plastics do not occur naturally and must be manufactured. Most plastics are made from chemicals found in oil, although a few come from wood, coal and natural gas. Common types of plastics include polythene, polystyrene, PVC and nylon.

Plastics do not rot like wood, or rust like iron and steel. They are light in weight and can be made in almost any shape or colour. Most do not allow electricity to pass through them so they can be used for covering wires, plugs and other electrical items.

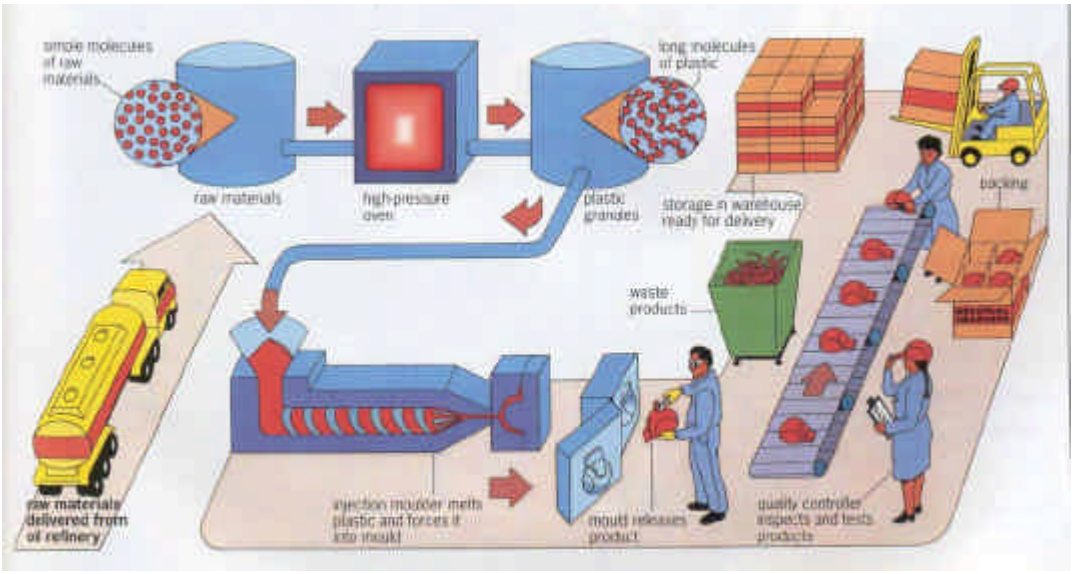

Figure 7: Plastic manufacturing. Source: Ultimate Visual Dictionary of Science.

Some plastics are hard, others are soft and stretchy. Many are transparent. Some can be filled with tiny gas bubbles to make plastic foam. Some can be draw into fine fibres and woven into cloth, and some can be used to make paint and glues.

☞ 3.6 Activity 2

Research one specialist glass from the following eg laminated glass, tempered glass, optical fibres, fibreglass, or optical glass. Explain with diagrams how it is made and provide examples of its use.

List the natural fibres used in PNG to make bilums, cloth, mats etc. Select one and describe the process used to prepare the fibre for use.

Identify and describe some of the traditional dyes used in PNG

How have modern products been adapted for use in traditional crafts?

Silk-screen printing is a process widely adopted throughout PNG. Ask your Ex Arts lecturer to show you how it is done. Practise for yourself.

Plastic does not break down easily. What problems does this cause for the environment?

Identify all the items you use or see in a day that are made from plastic.

Section 3: Equipment

Topic 6: Keeping time

People have used timekeepers for thousands of years. Shadow sticks have been used since 3500BC. Ancient Egyptians used water clocks to tell the time. Other measuring techniques included burning candles and sand-glasses.

The first mechanical clocks were made in the 14th century. They did not have hands or a dial but made an alarm ring every hour. These striking clocks were put in public places in large cities. Pocket watches became possible after the invention of the mainspring about 1500. Wrist watches, made mainly in France and Switzerland, started to become popular around 1900.

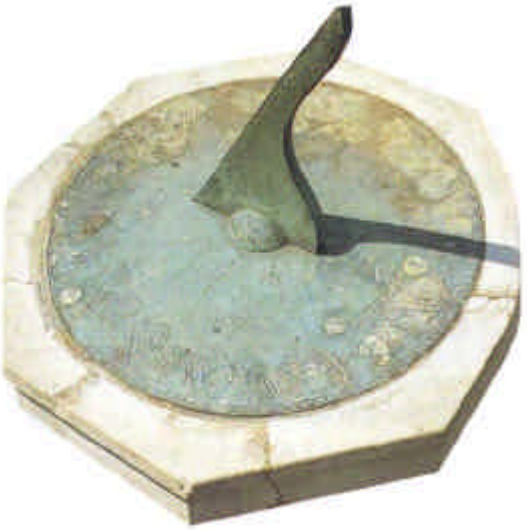

Figure 8: Sundial. Source: Ultimate Visual Dictionary of Science.

Mechanical clocks get their power from a weight that slowly falls or a spring that has to be wound up from time to time. The first electric clock was invented in 1843.

Today many clocks and watches use the natural vibrations, 100000 times per second, in a quartz crystal to keep time and their power comes from batteries. Even a small watch can be like a tiny computer, with a built-in alarm and stop-watch and the time shown by a digital electronic display.

Topic 7: Household equipment and appliances

Life in houses in cities and towns is much easier and convenient now than it is in villages and remote areas. In the past water might have come from a shared well or nearby creek. The toilet was just a hole in the ground, food cooked over an open fire and candles provided lighting. Household chores were all done by hand and could take much of the day.

Most modern houses are connected to mains electricity, drains, sewerage, water and probably a gas supply as well. These are called services. Certain basic equipment is built into a house – taps, sink, bath/shower, toilet. Other equipment usually found in a house includes stoves, washing machines and refrigerators.

☞ 3.6 Activity 3

Find out how your ancestors kept time in the village

Construct a sundial, shadow stick or water clock

Experiment with different size candles (mark evenly spaced lines on them) to see how regularly they burn i.e. how many minutes/hours per section.

Compare the services and equipment used by the college with those used in a remote village

Make a list of all the equipment/appliances used by your family that were not available in PNG 50 years ago.

Whose lives have been affected most by household technology? Is home maintenance easier or harder now?

Observe and list all the places in your local area which use calculators for quantities and prices. Pick three different examples and describe how they are used.

Section 4: Transport

Topic 8: Road

Most vehicles that travel over land move on wheels. The first were carts with solid wooden wheels invented in ancient Mesopotamia in about 3200 BC. They probably developed from the use of logs to roll heavy objects along the ground. Wheels with spokes were invented about a thousand years later. They were used in chariots for fighting and racing. As spoked wheels were lighter, greater speed was possible.

Later, the Romans developed a four-wheel wagon in which the front wheels could be turned for steering.

The Romans also built find roads that enabled wagons to make good progress. However, after the Roman Empire collapsed, the Roman roads were allowed to decay. By the Middle Ages, roads were so poor that wagons could hardly use them. Most land transport was by horseback and there were few passenger carriages. In the 1600s rich people used sedan chairs, which were small carriages carried by two servants. Later, stagecoaches pulled by teams of horses carried people and goods from place to place and horse-drawn buses began to appear in cities.

Road transport improved greatly in the 1800s as faster transport was needed following the Industrial Revolution. Good roads were built and cars and buses powered first by steam engines and then by petrol engines appeared. Rubber tyres, at first solid and then inflatable, aided travel. Few early motorcars had roofs to shelter their passengers, but closed bodies were common by 1930. Since then, improvements have made cars simpler and safer to drive.

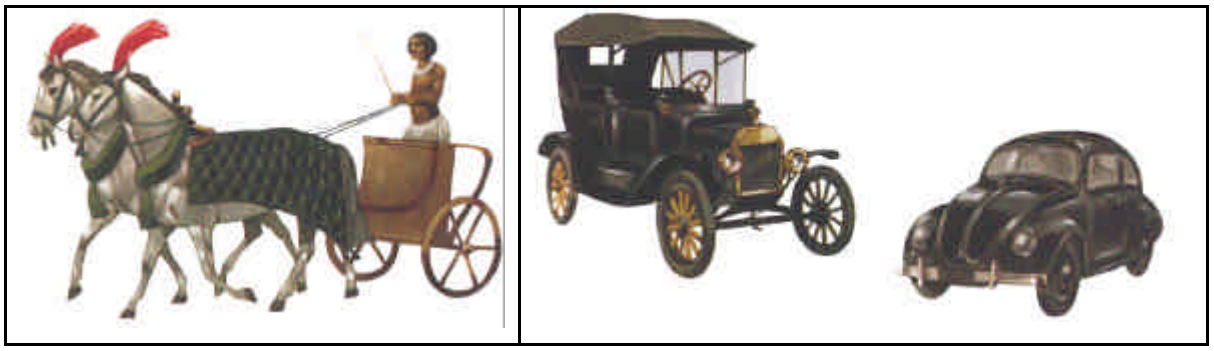

Figure 9: Different forms of transport. Source: Heinemann Children's Encyclopedia.

Nowadays most countries are criss-crossed with road and rail networks and there are more than 400 million cars in the world.

Trucks (lorries) are large vehicles used for carrying goods by road. They first appeared in the late 1890s and were powered by steam or electricity. Reliable diesel engines became available in the 1920s. Trucks are often built with the same basic cab and chassis (frame) but different bodies are bolted on depending on the load to be carried. Special trucks can tip, carry liquids in a tank or keep food refrigerated. Most trucks are owned by haulage companies and hired

out with their drivers. Many trucks carry their loads in containers which can be lifted straight on or off ships and railway trucks for ease of handling.

Figure 10: Road construction. Source: Heinemann Children's Encyclopedia.

Roads and bridges

The first roads were narrow twisting bumpy tracks used by people and pack animals. Hard smooth roads were needed once the wheel had been invented. The first paved roads were built in Mesopotamia (now Iraq) about 2200BC. Two thousand years later, the Romans built hard straight roads all over Europe and North Africa for their soldiers. Roman roads were paved with stone and sloped to either side to let rainwater drain away. In the 18th century, John McAdam invented a new road surface made of a layer of egg size stones covered by smaller stones which were gradually ground together by the pounding of horses and carriages. These roads were no good for rubber-tyred vehicles so modern road surfaces of tar or concrete were developed.

Bridges can carry roads, railways or footways. Most are fixed but some can be raised or swung round. With all bridges, the problem for engineers is to design and build structures which will not sag or crack under the weight they have to carry. The earliest bridges were tree trunks resting between the banks of a stream.

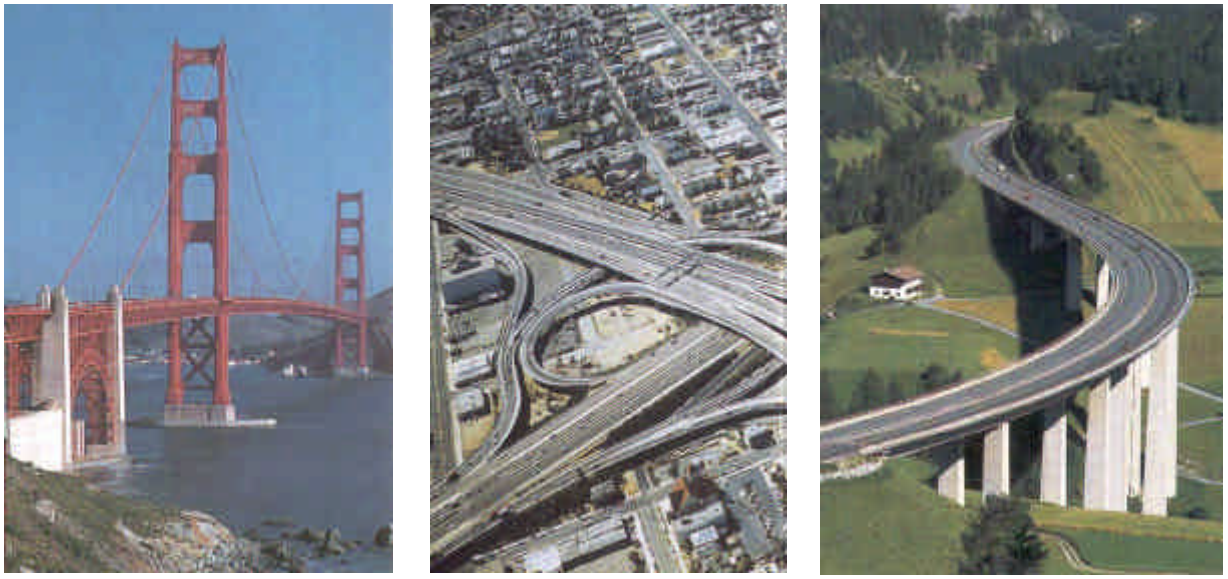

Figure 11: Road bridges. Source: Heinemann Children's Encyclopedia.

Road safety

As there are millions of vehicles on the roads of most countries, it is not surprising that there are many accidents. To prevent as many accidents as possible, governments make laws that people must obey when driving or riding vehicles. They also provide warnings of possible dangers as well as signs, lights and police for traffic control. There are also laws and controls for pedestrians using roads.

Topic 9: Air

Passenger flying developed after World War 1. By the late 1930s, people could travel between Europe and the Far East aboard large flying boats which took off and landed on water. The first jet aircraft flew in 1939, but jet airliners only entered service in 1952. Today nearly all long-distance or international travel is by jet. Already more than 700 million passengers throughout the world travel by air every year and the number could double in ten years. Helicopters are used to carry people and equipment to and from inaccessible places. They fly crews and equipment to oil rigs and mines. They carry soldiers quickly around battlefields and work as gunships. They are ideal for rescue work because they can hover.

Topic 10: Sea

The very first boats were made by prehistoric people many thousands of years ago. They were simply logs on which people could sit and float down a river. Then it was found that logs could be lashed together to make a raft that could carry several people. Primitive rafts were also made by tying bundles of reeds together. It is possible that long ago people may have crossed oceans on rafts made of logs or reeds.

Hollow boats can carry several people. The first were probably dugout canoes made by hollowing out logs. This kind of vessel is still used today in parts of Africa and in some of the islands of the Pacific Ocean. A solid log may be fixed alongside the canoe to make it seaworthy.

Boat building progressed in ancient times as people constructed boats with frames. They covered the frames with animal skins, bark or wickerwork smeared with gum to make it watertight. These boats were built as long canoes and round coracles that could easily be paddled. They are still used in some parts of the world.

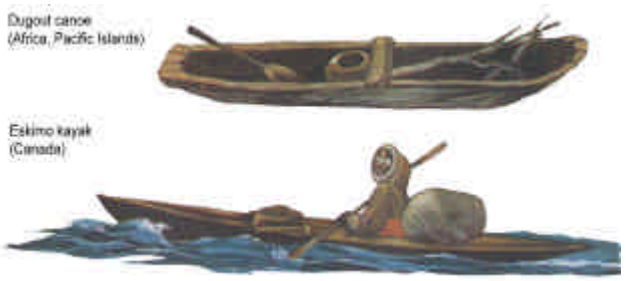

Figure 12: Types of water transport. Source: Heinemann Children's Encyclopedia.

People have travelled the seas for thousands of years. Places on the coast where there is shelter from the open sea, or natural harbours, have been established as ports. Ships carry nearly all the freight that has to travel overseas. Some, like supertankers, are designed to carry one type of cargo. Others carry containers which are packed with goods before they reach the docks and can fit straight on the back of a truck.

Transport in PNG

Traditional transport
Source: Colonial Intrusion Papua New Guinea (

Outrigger canoes

Poreporena Highway Port Moresby

Figure 13: Transport in PNG.

The transport and communications system of PNG has been shaped by the country's complicated geography. Air, sea and river are the main links, with road networks only in certain areas. Although there are almost 25000 kilometres of roads, most of the rainforests and mountainous regions are inaccessible except by air or on foot. The national capital, Port Moresby, has no road link to the rest of the country.

The history of PNG is linked with sea transport. Many of the country's first inhabitants came here by sea, traded with one another by sea and built a range of vessels such as the lakatoi. European navigators, traders and whalers sailed into the same waters thousands of years later.

Aviation has a long and eventual history in PNG. It began in 1921 and was vitally linked to the economic development of the country within a decade. Gold was discovered in the Wau-Bulolo area in the early 1930's, but the industry could not have developed without aircraft. In 1932 Guinea Airways actually carried more freight than all the aircraft in England, France and the United States combined. The aviation industry revolutionised transport in PNG, opening up the country for large-scale communications for the first time. Airstrips were laid all around the nation and light planes carried people and goods to areas previously labelled as some of the most remote in the world. In 1973, two years before independence, the national carrier, Air Niugini, was formed.

☞ 3.6 Activity 4

Why isn't PNG criss-crossed with road and rail networks.

Research the founding and operation of one airline or helicopter company in PNG.

Describe and map traditional transport routes eg Kula ring.

Survey how often fellow students travel long distances by air rather than road or sea (or how people return to their place at the end of the year – distances, means of transport, length of journey).

Research the costs of setting up and operating A PMV service.

Research the cost of owning and running a private vehicle such as a Toyota Hilux.

Why is most freight transported by sea rather than air?

Trace the stages/steps involved in shipping a container of household goods from your home to the UK.

People in many Asian countries use bicycles and motorbikes as the main form of transport. Why hasn't that happened in PNG?

Interview a truck driver. What problems do they experience transporting goods in PNG?

Survey of vehicle use eg number of PMVs, number of utes, number of cars, number of occupants, number and types orf trucks passing a particular spot over a period of time.

Sketch and label main operating parts of canoe, banana boat and coastal boat.

Identify main ports and natural harbours in PNG. Name some and state where the name came from.

Sketch different types of boats used by PNG communities in earlier times.

Name and draw some famous bridges. Describe/drawsome bridges you have used.

Use the library to research the construction of ancient roads eg Rome.

Describe how modern roads are built, including the machinery used – wall chart of steps. Compare this with making of village tracks.

A whole system of rules and regulations has developed since the advent of roads. Describe some of these, their impact on society and the costs.

Draw and explain the meaning of five road signs.

Interview people about their first experience of flying.

Section 5: Communication

Topic 11: Communication processes

Words, numbers and alphabets

The main way in which we communicate with each other is by using words, either by speaking and listening or by reading and Writing. Words allow us to give and receive information, ideas and orders. A language also contains numbers to represent quantities. There are about 5000 languages in all. Many people learn one or more other languages than the language they learn as children. This happens especially if their own language is not widely spoken.

Most languages are written with letters of an alphabet. English and most other European languages use the same alphabet as the ROMANS. However, the letters may represent different sounds in different languages. In Spanish, for example, C may be pronounced TH and V as B. Other languages have different alphabets. Russian is written in the Cyrillic alphabet, which includes some Greek letters. Hebrew and Arabic are written from right to left.

Figure 14: Different alphabets. Source: Heinemann Children's Encyclopedia.

Writing

People began to write about 7000 years ago. At first, they used simple pictures to represent objects such as bows and arrows, possibly just to indicate possessions. Then people put pictures together to represent something more complicated, like a sentence. Each picture could stand for a word, so that a phrase like 'A man hunts deer' could simply be written as pictures of a man, an arrow and a deer. This kind of picture writing developed about 5000 years ago and was used in ancient Babylonia and ancient Egypt. The Egyptians had picture symbols called hieroglyphics, which included figures of birds and people. In Babylonia, the symbols were patterns of wedge-shaped strokes called cuneiform script that looked less like pictures. Hieroglyphics and cuneiform script died out long ago. However, similar picture writing still exists in the characters used in Chinese and Japanese writing.

The next step in the development of writing was to use symbols that represented the sounds of words rather than their meanings. We use this idea in puzzles, for example in representing the word 'carpet' by pictures of a motorcar and a pet animal. Then finally the alphabet was invented in about 1500 BC by the PHOENICIANS, who lived in the eastern Mediterranean. They used a set of symbols or letters to represent the basic sounds of a language. The sound of 'o' was given by a circle, a symbol that we still use for this sound today.

People first wrote by carving symbols in stone and by making marks in clay tablets. Later a form of paper was made from papyrus reeds. Although few people were able to read, the development of writing was vital to the rise of civilization.

Signs

Speaking and writing a language is not the only way of communicating with other people. It is often necessary to give information to people such as foreign travellers who cannot understand the language of a country. There are also handicapped persons who cannot use a spoken or written language.

Signs enable people to communicate where they cannot use language in the usual way. International signs, for example at airports and hotels, give us information in a simple form that can be understood by almost everyone. Signs on products and packages tell us without words how to use the product and handle the package. People who cannot hear or speak often use a sign language. With their hands they make signs that represent words.

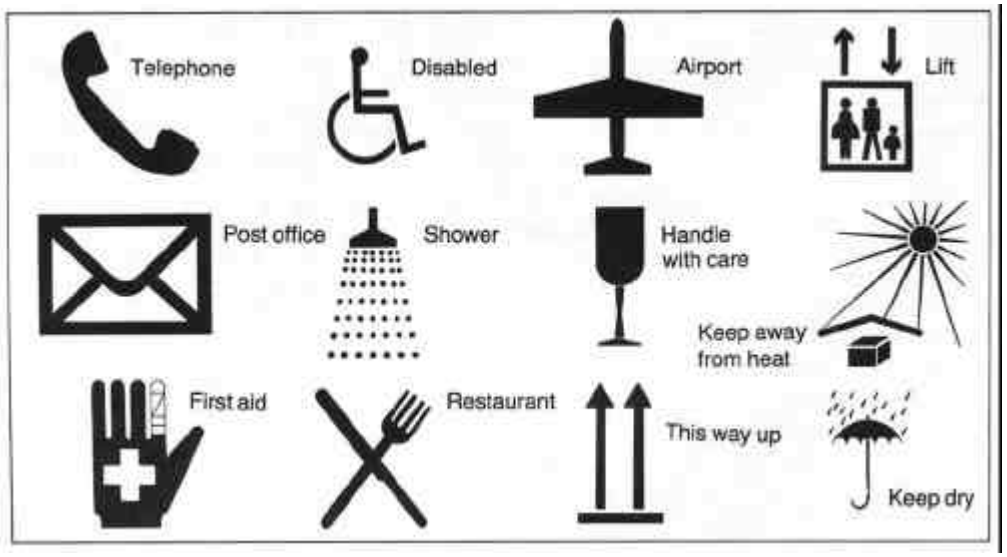

Figure 15: Signs and symbols. Source: Heinemann Children's Encyclopedia.

Printing

Printing is a way of making many identical copies from one original. For every page in a book, every stamp, poster, cereal packet or plane ticket there was one original. Printing was known in China, Japan and other parts of Asia long before it was used in Western countries. The first books were made in China using hand-carved characters and design on a flat block of wood. The Chinese also invented paper. About 1450 Johann Gutenburg of Germany invented movable metal type which could be used again and again. He cast individual letters and held them on a type mould. Mechanical typesetting was introduced by 1900 and photo-typesetting systems which produce type on film instead of metal first appeared in the 1950s

Paper is made from plant fibres matted together to form a sheet. For hundreds of years fibres were obtained from pulped cotton and linen rags, but during the 19th century, it was discovered that paper could be made from wood pulp. Now most of the wood pulp comes from conifers such as pines, spruces and firs. Millions of trees are cut down each year to make

Photocopiers

A photocopier is a machine that can make a copy of a page of a book or a similar document quickly. The copy is usually made on an ordinary piece of paper and is in black-and-white. Although pictures may not be very clear, a photocopy is good enough to read. Some photocopiers can make copies of different sizes from the original, and there are machines that produce copies in colour.

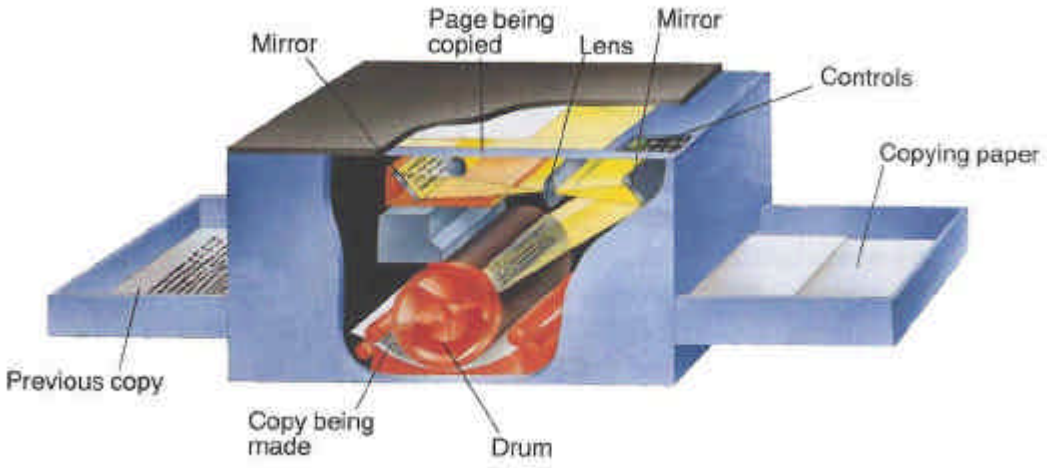

Figure 16: Parts of an office photocopier. In a photocopier, an image of a page is projected on to a light sensitive drum. The drum transfers the image to a piece of copying paper. Source: Heinemann Children's Encyclopedia.

Topic 12: Communications systems

Today, people in Port Moresby may switch on the radio and listen to a concert taking place in Boston. Or they may switch on the television set and see news pictures coming live from New York via a communications satellite. They may talk to friends in Sydney over the telephone.

These communications systems allow us to talk to, hear or see others instantly anywhere in the world. They bring us entertainment and information of all kinds, even pictures of worlds far away in space. Organizations depend on communications systems to bring them the information they need in order to operate effectively. In many cases, computer networks link computers in different places that exchange information.

All communications systems work by changing speech, pictures or writing into electric signals. These signals are then sent along wires, or they may be sent through the air or space as radio signals. The signals travel very fast and are received almost instantly. Then they are changed back into speech, pictures or writing.

Communications systems began in the 1830s, when Samuel Morse sent messages in Morse code along wires in the form of long and short electric signals. Important developments that followed were the telephone in 1876 by Alexander Graham Bell and radio in the 1890s by Guglielmo Marconi. Worldwide communications increased greatly with the first communications satellites in the 1960s.

Communications satellites

Unmanned satellites orbiting in space relay telephone, television and radio signals between continents. Navigation satellites send out radio signals that help ships and aircraft work out their positions. Several satellites orbit the earth above the equator at a height of 35,900 kilometres. At this height, they take 24 hours to go once around the earth and therefore stay in the same position above the ground.

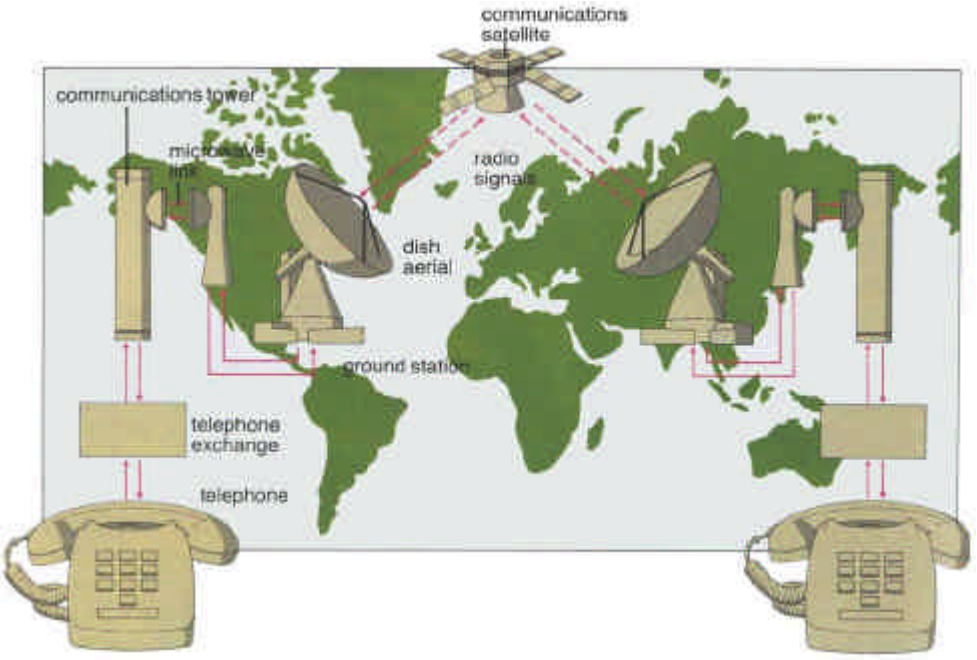

Figure 17: International telephone calls often go via a communications satellite. Dish aerials at ground stations send and receive the calls. Source: Heinemann Children's Encyclopedia.

Among these satellites are communications satellites. They receive radio signals from ground stations and send them to other stations. In this way, telephone calls and television programmes can be sent around the world. Direct broadcasting satellites also send television programmes direct to homes on earth.

Recording systems

Recording is a way of keeping pictures, sounds or computer data for later use. Cassettes, compact discs, video tapes are all methods of storing recordings. Recordings are made and played on portable cassette players, hi-fi systems, tape recorders, video recorders (VCRs) and computers. All these systems use electronics to record sound and pictures and play them back.

Recordings like those on records and video tape recorders, record signals as a continuously varying pattern. They are called analogue recordings. A better way of storing such information is with signals in a kind of code (digits). The quality of digital recording is very high and can be transferred without being altered. Information recorded on compact discs (CDs) is scanned by a laser beam that does not actually touch the disc so the hard plastic surface is not worn or scratched easily.

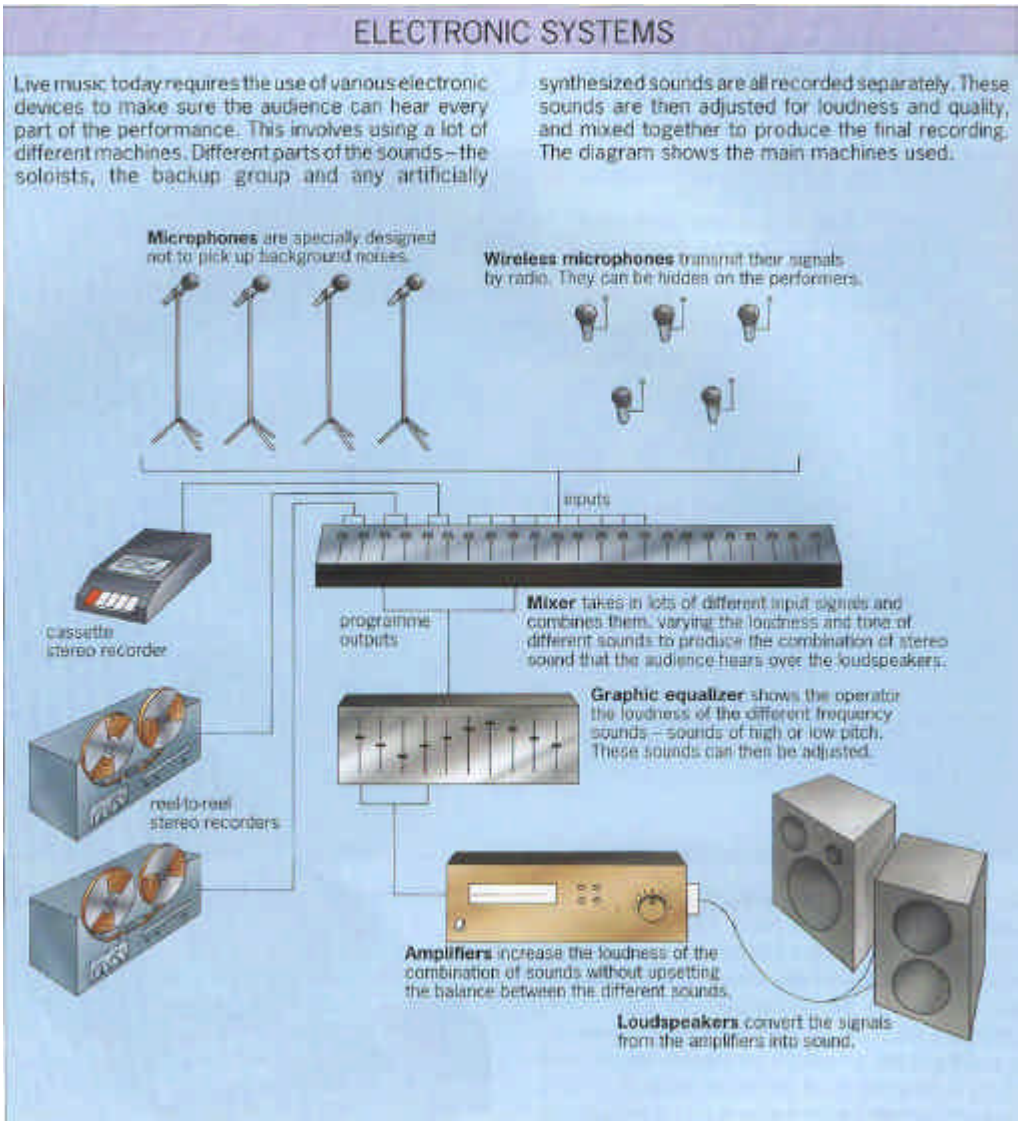

Figure 18: Music recording systems. Source: Ultimate Visual Dictionary of Science.

Telephones, facsimile (fax) and email

A telephone lets you talk to people who are far away. It is the most widespread means of communication and there are over 525 million telephones throughout the world. Facsimile transmission is the sending of text, photographs, maps, drawings, or handwriting across telephone lines. The original piece of text is scanned and the images are changed into an electric current. The current is sent over normal telephones lines and changed back into an image on paper by a receiver at the other end. Nowadays images can be transferred from one computer to another without having to put them on paper first.

☞ 3.6 Activity 5

Why didn't societies in PNG develop an alphabet or system of writing? How was knowledge transmitted instead?

Find out how each of these printing processes work – letterpress, lithography, gravure.

In Expressive Arts, try some vegetable or ink printing

Paper can be recycled over and over again – find out how and make your own paper

Detail in simple diagrams the way a daily newspaper is produced.

What are the main components of the PNG postal service? How does mail find its way from Kundiawa to London?

Study early photographs of PNG. Compare them to recent photographs. What do they tell you about the subjects and the art of photography?

If possible, experiment with still, video or digital cameras. Experiment with creating different effects on computers.

Watch TV programs about special effects in the movies. Watch movies and work out how special effects were created.

Discuss the implications for us if most pictures we see are manipulated. What is reality? How does this false reality influence people eg violence on TV?

How important is radio to communities in PNG? Why?

Explain with the use of simple diagrams how either cameras, radio or television works

Provide a profile of one of these famous inventors - Daguerre, George Eastman, Alexander Graham Bell, John Baird, Bill Gates, Thomas Edison, Henry Ford.

Section 6: Information Technology

Calculators

Calculators are machines that add subtract multiply and divide. Many can do complicated calculations. They are used by students, engineers, accountants and anyone who works with figures. At one time calculators were mechanical. They used rods, levers and gearwheels to do their working out. Nowadays most calculators are electronic. They work using tiny electric currents. They are very fast and do not make mistakes unless numbers are fed in incorrectly. Electronic calculators have a tiny logic circuit inside them which do all the working out and then display the answer on a small screen. There are two types of electronic calculators – desktops which are plugged into a mains power supply and portable which are small enough to fit into a pocket. Portable calculators need very little power. Their batteries last for years. Some do not use batteries but run off solar cells which turn light into electricity.

Topic 13: Working with IT

Many people use information at work and for daily activities such as shopping and banking. Banks use computers to store account details. Companies use them to work out bills and wages. Travel agents and airlines use computers linked by telephone to make bookings. Aircraft flights are directed by computers. The store of information on these computers is called a database.

Figure 19: Office computer system.

Information technology enables the use of plastic cards instead of cash. Plastic cards contain a magnetic strip which can be read by a computer, checked and billed later or immediately. Plastic cards can be used at ATMs (automatic teller machines) or EFTPOS (electronic funds transfer at point of sale) machines at checkouts, in shops or banks. The machine reads the data on the card when the card is passed through it. Other electronic equipment in frequent use is the bar code and laser scanner. Bar codes are light and dark lines printed on products. The lines are a code which represent a number. The computer uses the number to look up a price or other product details. The machine which moves a tiny beam of laser light or a bar code is a laser scanner. A detector picks up the light and dark reflections and changes them into electrical signals which a computer can understand.

The Internet

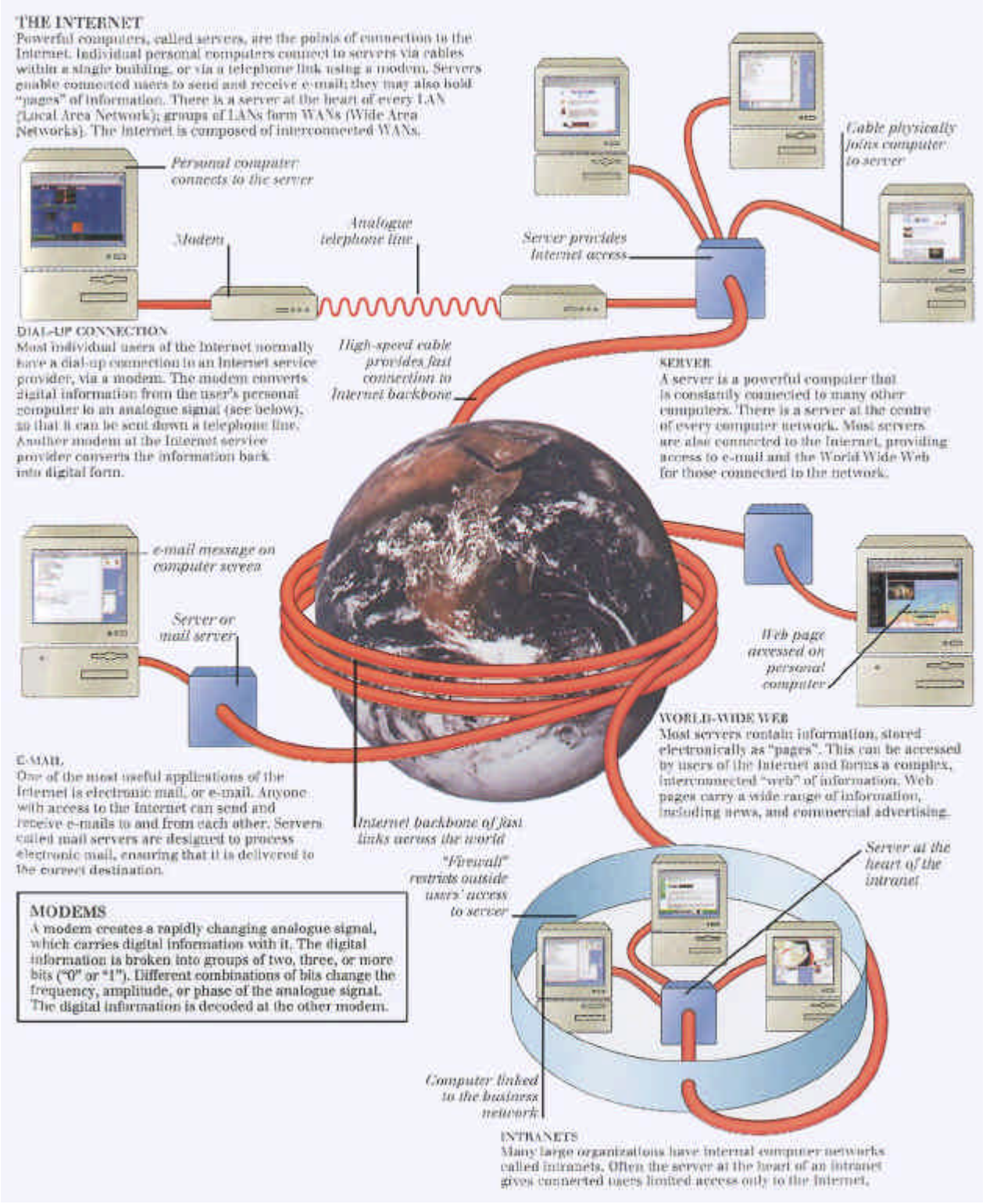

Figure 20: The Internet computer network. Source: The Illustrated Factopedia.

☞ 3.6 Activity 6

Observe and list all the places in your local area which use calculators for quantities and prices. Pick three different examples and describe how they are used.

Banks, schools, companies, government departments all use information technology to store data about people. Why are people concerned about this?

Information and other electronic and digital technology changes rapidly. What IT equipment is available now that was not in use 10 years ago?

List uses of computers. Draw a simple diagram of the components of a computer system eg keyboard, printer. Label your diagram with a brief description of the function of each component.

Listen to music on a cassette tape and a music CD. Describe the difference in what you hear.

What are DVDs, VCDs and CD ROMS?

☞ 3.6 Activity 7

Study each pair of images below. Describe the technological changes which have occurred in each situation.

Source: Colonial Intrusion

Source: N. and S. Lauer

PNG has a music industry because of technology – discuss!

Short essay - To what extent has modern technology impacted on traditional crafts such as bilum making and pottery?

How has modern technology been incorporated into tribal fighting?

Debate – The introduction of 'Western' technology has destroyed traditional culture in PNG.

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