

Petroleum and natural gas: Petroleum and natural gas are in most cases related in occurrence. They are both products of animal and plant remains that have decomposed for a long time, usually billions of years.

They appear naturally below the earth's surface and are both fossil fuels. Whereas petroleum is a liquid substance, natural gas is a non-liquid substance. Petroleum and natural gas are in high demand in the world because of their large contribution to power and energy generation for domestic, automobile and industrial use. In Tanzania, natural gas is found in the southern parts of the country, particularly in Mtwara, Lindi and Ruvuma regions. Specifically, natural gas is produced at Songosongo, Mnazi Bay, Msimbati, Kiliwani North and Ntorya. Furthermore exploration of natural gas and petroleum is going on in Tanzania and there are signs of their availability in other coastal regions and islands of Tanzania. In recent years, the exploration has indicated the availability of petroleum and natural gas in Pemba – Zanzibar. The major producers of petroleum and natural gas in the world include USA, Saudi Arabia, Iran, Iraq, Russia, Nigeria, Gabon, Libya, Kuwait, Algeria, Angola, Gabon, Venezuela, Mexico and Egypt.

Petroleum and natural gas are used for different purposes in different sectors. Both minerals are sources of power generation. The power generated is used to run machines and engines. For example, most industrial machines, motor-vehicle engines and generators

use petroleum or gas to operate. Crude petroleum is a raw material for producing various products such as kerosene, diesel, petrol, oil and bitumen. Some by-products of petroleum are useful in chemical industries for manufacturing several products such as jelly, synthetic fibres, grease and other lubricants. In addition, petroleum wastes from refineries are used for road surfacing and wood treatment against damage and attack by insects. Natural gas is used for domestic purposes such as heating and cooking. For example, in recent years, Tanzanians have been good users of natural gas for cooking using gas stoves and gas cookers.

Other important minerals: Other important minerals include mineral salt produced in Tanzania and China; phosphate mined in Tanzania, Uganda, Togo and South Africa; tin mined in DRC, Nigeria, Rwanda, Burundi and Niger; bauxite in Guinea, Ghana, Jamaica and USA; and manganese mined in Gabon, Ghana, DRC, Ivory Coast, Angola and Zambia. Minerals such as stones, gravel and sand are found almost everywhere around the globe. These minerals have various uses in different sectors. For example, stones, gravel and sand are used in the construction industry.

Methods of mining

Methods of mining depend on the location of the mineral in the earth's crust. There are four methods of mining which are surface, underground, alluvial and in-situ mining.

Surface mining: Surface mining is done by removing (stripping) surface vegetation, dirt, and, if necessary, layers of bedrock in order to reach buried ore deposits. Techniques of surface mining include: open-pit mining or open cast mining, which is the recovery of materials from an open pit in the ground; and quarrying, identical to open-pit mining except that it refers to sand, stone and clay. Open cast mining is the cheapest method of extracting minerals. This method is used to extract minerals which usually occur close to the earth's surface. This method involves removing the top layers of the earth and other overlying materials above the mineral ores. Figure 5.3 shows an open cast mine. The extraction involves the use of earth moving machines and bulldozers, and electric shovels. Sometimes explosion is used to blow overlying materials in order to reach the ore beneath. This method is cheaper because the output is bigger than the costs of running. The open cast method is used to extract quarrying limestone, coal, and other surface minerals.

Underground or shaft mining: This method is used to excavate hard rocks to get valuable minerals which lay very deep below the earth's surface. The method is usually used to dig rocks that contain gold, copper, silver, zinc, tin, lead and diamond.



Figure 5.3 An open gold pit mine in Buzwagi, Shinyanga.

Source: <https://tumemadini.go.tz>

Under this method, a vertical shaft is sunk into the earth's crust to reach the layer with mineral ores. Passages and horizontal tunnels are then made to reach mineral deposits. Steel or concrete beams are erected to support tunnels and galleries from collapsing. Then, light railway trucks may be laid to carry the mineral ores to the foot of the shaft for lifting the ore to the surface.

Alluvial/Placer mining: This method is employed where minerals occur in alluvial deposits. The alluvial mining or placer mining method involves mixing of the alluvial deposits with water in a container. This is a simple method used in collecting gold and other alluvial minerals using a pan in a river valley. It is known as panning or placer mining. It involves digging

the sand and gravel from the river bed. The mineral is obtained by mixing the alluvial sand with water and swirling the pan around. Sometimes, it requires rotating the pan physically with force until the lighter particles are washed away and the heavier particles are left. Salt mining is an example of the alluvial mining method.

In-situ mining: In-situ mining is a mining process used to recover minerals such as copper and uranium through boreholes drilled into a deposit, in-situ. It involves dissolving the existing mineral resource and then processing it on the surface without moving rock from the ground.

Methods of mineral processing

Mineral processing involves separating valuable minerals from other materials. There are different methods through which minerals can be processed as described below.

Crushing and grinding: Crushing and grinding intend to reduce the size of ores to extract the valuable minerals from the rock. At the low level, the ore is crushed and dissolved in water but at the advanced level water and other chemicals are mixed together to obtain the minerals. For example, in gold processing, sodium cyanide is added to the solution. The chemical dissolves the gold particles, leaving behind stones and other mineral wastes. A sodium cyanide solution containing gold particles is drained off and mixed up with zinc

dust, which makes gold particles to solidify. The particles are then melted and moulded into different shapes.

Separation: Minerals that are magnetic such as magnetite can be separated from non-magnetic particles using strong magnets because the minerals are attracted to the magnet (ferromagnetic).

Sizing: Sizing is the separation of particles according to size. The method involves screening or passing the particles to be separated, through a screen.

Floatation: Floatation makes possible the processing of complex intergrown ores containing copper, lead, zinc and pyrite into separate concentrates and tailings. In the floatation the ores are crushed and the particles separated based on how they float on water or other liquids that allow unwanted materials to remain. For example, processing of copper ore into small particles involves mixing the ore with water. Then chemicals are added to the mixture and put into a floatation machine. The floating copper particles are then removed. The particles are dried and smelted into copper blisters. Copper blisters contain 97% - 98% copper. The blisters can be refined even further to remove other minerals or impurities.

Exercise 5.1**A. Short answer questions**

1. Mention any five types of minerals found in the world.
2. Explain the term ‘mining’.
3. Briefly explain types of minerals basing on their location.
4. Briefly describe three methods of mining.
5. Explain why diamonds, petroleum and natural gas are important.
6. Assume you are a mining expert, explain the methods you will use to extract minerals located at different depths.

B. Write True or False for each of the following statements:

1. Gold and copper are examples of non-metallic minerals.
2. The major producers of gold in Africa are Tanzania, Ghana and South Africa.
3. USA is the leading country in the production of coal in the world.
4. Alluvial mining is the same as drift mining.
5. In Tanzania natural gas energy is mostly used for domestic heating and cooking.

Contribution of the mining industry to the economy of Tanzania: Minerals are useful in the growth of any country’s economy. Some minerals have more demand than others due to their high value. Minerals are used in countries where they are produced and also they are exported to various countries to obtain foreign currency. The contribution of mining industries to the Tanzanian economy include the following:

Government revenue: The mining industry contributes to government revenue in terms of taxes and royalties. This is crucial for financing developmental plans of the country.

Employment: The mining industry contributes direct and indirect employment opportunities within the country. Some people get employed directly in the industry while others provide services related to mining in mining centers.

National gross domestic product: The mining industry contributes to the Gross Domestic Product (GDP). For example, mining and quarrying activities in Tanzania contributed about 4% to its GDP in 2015.

Raw materials: Minerals provide raw materials for various industries. For example, gypsum is used as a raw material in cement industries.

Social services: Mining stimulates the development of settlements. The

establishment of settlements in or near mining centers forces the government to provide social services such as health, and education. In addition, the development of settlements around mining centers has contributed to the growth of some towns such as Mwadui, Kahama, Geita, and Mererani.

Infrastructure: Mining stimulates the construction of roads to and from mining centers. For example, Kahama road networks were constructed due to gold mining. Similarly, Mwadui roads were built because of diamond mining.

Effects of the mining industry on the environment

Mining and processing activities have negative effects on the environment if not done carefully. The sections below describe some of the effects of mining on the environment.

Pollution: Mining activities can lead to water, air and noise pollution. To begin with, mining produces waste materials which pollute water bodies. For example, chemicals used in processing minerals such as mercury and sodium cyanide can pollute rivers, lakes and underground water. This may cause loss of life of living organisms, which depend on water. Large amounts of dust released into the air affects people, plants and animals found in nearby areas. Also, the blasting process causes noise and vibration which affect people and their properties in nearby areas.

Land degradation: Mining causes pits on the earth's surface. When mining is done on a large-scale, the destruction of the surrounding land is higher. Open cast mines produce much larger quantities of waste than underground mines. These open-pit mines produce 8 to 10 times as much waste as underground mines. In some areas, breaking of rocks may cause landslides on nearby land. Landslides can damage transport routes and nearby property.

Destruction of land surface appearance: This may happen in areas where there are no more minerals and mining activities have stopped, and land left without being reclaimed. In case of the open cast method of mining, land appearance is destroyed, deep holes are left on the earth's surface, creating problems related to soil erosion, health and death. If the holes are filled with water, they become breeding grounds for mosquitoes, which may spread malaria.

Deforestation and loss of biodiversity: Large-scale mining involves clearing of forests and any other vegetation cover. The clearance of vegetation causes loss of different plant and animal species. Mining causes direct and indirect damage to wild animals by altering their habitats. This may lead to the disappearance of various wildlife species such as birds and other animals.

Loss of soil productivity: Rocky soils left behind after mining cannot support

crop production because they have low fertility. In fact, the soil structure and texture is destroyed when it mixes with particles of rocks.

Effects on the water table: Deep mining that reaches the water table may cause underground water to flood the mines. As a result, the water has to be pumped out to allow mining to continue. Continued pumping of this underground water lowers the water table of the area.

Ways of minimising the effects of mining on the environment: The following are ways to minimise the effects of mining on the environment:

Land rehabilitation: Holes produced during mining should be covered with the removed soils. Planting trees and other vegetation cover helps to repair the damaged land.

Proper storage and use of chemicals: It is advisable to store chemicals in a strong room so that no leakage occurs into the soil and water. Moreover, chemicals are to be used with care to avoid polluting soil and water resources.

Waste management: There must be a proper waste disposal from mineral processing industries. This organised disposal includes treatment of the chemicals that flow from the industries into rivers and streams. In addition, there should be dust management programmes to avoid air pollution.

Safety education: Mining companies are required to provide safety education to workers and the communities surrounding the mining areas. Such education may include wearing of protective gear (helmets, gloves, overalls, glasses and masks). This protects the workers from accidents associated with mining activities. The community has to be educated on the importance of reporting any environmental problem they experience as a result of mining activities.

Mining regulations: The government should enforce mining and environmental laws and regulations that guide mining and mineral processing activities, to reduce the negative effects of mining.

Exercise 5.2

Answer the following questions:

1. Explain the meaning of each of the following terms:
 - (a) Alluvial mining
 - (b) Opencast mining
 - (c) Shaft mining
2. Mention any four mining centers found in Tanzania.
3. Explain ways to minimise the effects of mining on the environment and people.
4. Explain the importance of mining to the economy of Tanzania.

Focal studies

Oil production in the Middle East

The Middle East is one of the leading oil producing areas in the world. The major oil producing countries in the area include Saudi Arabia, Iran, Iraq, Kuwait, Qatar and the United Arab Emirates. Figure 5.4 shows major oil fields in the Middle East.

These countries contribute one-third of the total oil production in the world. These countries are members of the Organisation of Petroleum Exporting Countries (OPEC). They play a big role in deciding world oil prices. The main consumers of oil from the Middle East are Western Europe, Japan, USA, Canada and Australia. The Middle East exports about 70 percent of crude oil in the world.

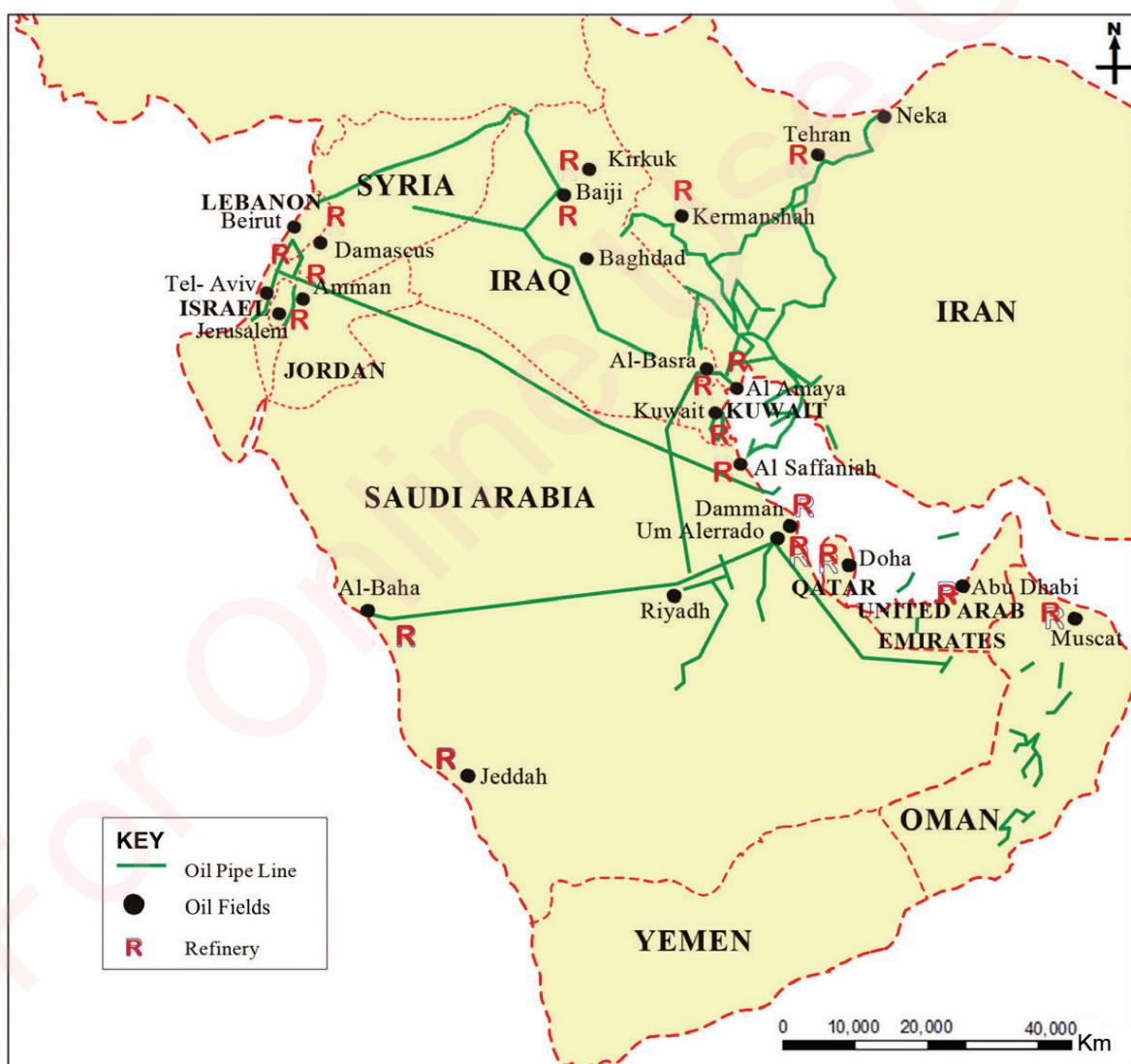


Figure 5.4 Distribution of major oil fields in the Middle East

Crude oil from oil fields is transported via pipelines and tankers to refineries or to coastal shipping terminals. Transportation by pipeline is very expensive because the initial capital for construction of a pipeline is very high. Once constructed, pipelines are very cheap to operate. An example of a major pipeline is the Trans-Arabian Pipelinen(TAP) which runs from inland fields on the Persian Gulf to the Mediterranean Coast. Transportation by tankers is a cheap means of conveyance.

Importance of oil production to

Middle East countries: The Middle East is located in an arid region. Oil production has contributed to economic and social development of the Middle East countries. The countries depend greatly on the exportation of petroleum and petroleum products to earn foreign currency. Companies involved in oil production in most of the Middle East countries are mostly state-owned. However, there are also some oil fields run by private companies. These companies pay taxes to the government. The revenue from oil refining and support industries is used to provide social services such as education and health. The revenue is also used in the construction and improvement of infrastructure such as roads, railways and airports. Jobs are also created in areas that produce oil as many people in the Middle East work in the petroleum refineries and petrochemical industries.

Oil production in the Middle East has stimulated the improvement of the transport sector. The export of petroleum and petroleum products has enabled Middle East countries to develop good transport networks. In addition, petroleum is a resource which provides energy and power for domestic and industrial purposes.

Challenges associated with oil production in the Middle East:

Oil production in the Middle East faces many challenges. With rising global demand, highly volatile prices are increasingly becoming stringe. The oil and gas industry faces three major challenges involving how to reduce costs, optimise the performance of its industrial base assets, and address its environmental footprint. Environmental pollution is one of these challenges. Oil refinery and production of petroleum products produce carbon dioxide and other gases such as methane which are harmful. As countries in the Middle East have large oil production industries, the emission of harmful gases is also high. These gases contribute to the pollution of water, air and land. Burning fossil fuels produces sulphur dioxide and nitrogen oxide. When they move into the atmosphere they produce acid rain, which damages buildings and vegetation in addition to affecting fish and other organisms that live in water. Another challenge facing oil production in the Middle East has to do with civil wars and social violence. Producing crude oil and refined products

at a lower cost to stay competitive on the market is one of the major challenges.

Natural gas production in Tanzania

Natural gas has been discovered at Songosongo in Kilwa and Mnazi Bay in Mtwara. The estimated natural gas reserve for Tanzania is 52 trillion cubic feet. The natural gas is mined and transported through pipelines to Dar es Salaam where it is used to generate electricity. Private companies such as Songas, Pan African Energy Tanzania (PAET), Maurel and Prom (MOP) in co-operation with the Tanzania Petroleum Development Corporation (TPDC) produce natural gas. Songas generates electricity using gas from the Songosongo Island gas fields. Figure 5.5 shows a gas plant at Songosongo.



Figure 5.5 Songosongo gas plant

Source: Ipp media.com

Advantages of natural gas in Tanzania

Tanzania benefits a lot from its natural gas resources. The resources benefit the economy of the country but also

improve the lives of its people. Natural gas has contributed to the improvement of infrastructure. Transport and communication systems to and from source of natural gas areas have been improved. For example, the discovery and extraction of gas in Mtwara Region has stimulated improvement of the airport and the harbour in the region. As a result, air transport to and from Mtwara Region has also improved. Natural gas has also created the demand for labour, goods and services. There has been an increase in the demand for both skilled and unskilled labour to work in the mines and carry out mining-related activities. Moreover, natural gas extraction has added a source of income for the people. Companies involved in natural gas extraction usually pay taxes and other dues to the government. People living nearby natural gas extraction fields also benefit by selling goods, especially agricultural products to the mining community. People surrounding the mining areas also benefit from the social services such as schools, water and hospitals built to support the mining community. Natural gas may reduce environmental pollution as its use does not produce harmful gas substances compared to other sources of energy such as petroleum. Similarly, the use of natural gas at the domestic level may reduce fuel-wood consumption. This may, in turn, reduce deforestation.

Challenges of natural gas production in Tanzania:

Natural gas production faces numerous challenges in different aspects. Natural gas is a non-renewable

resource. Therefore, care has to be taken when extracting this resource. Natural gas production is new in Tanzania and, thus, it faces a shortage of skilled labour, especially in exploration and extraction activities. As a result, the government is often forced to employ foreign experts who are paid high salaries. Regarding the capacity to produce the natural gas, Tanzania has not been able to allocate enough funds for exploration, extraction, processing and distribution.

Tanzania's efforts in addressing the challenges of natural gas production

Tanzania has been trying to overcome the challenges associated with the production of its natural gas. The government has been emphasising the use of revenue from natural gas to benefit the people in the areas producing the gas and the nation as a whole. The revenue from natural gas is used to improve social services in education and health. There have been various public programmes aimed to educate the public on natural gas benefits. The ministries responsible for energy and mineral resources in Tanzania conduct awareness creation programmes through various ways such as meetings and the media. The government also provides opportunities for training to Tanzanians in oil and natural gas. These training opportunities aim to build the country's capacity for exploration, extraction, processing and supplying of natural gas.

Exercise 5.3

A. Write True or False for each of the following statements:

1. Middle East countries produce over one-third of the world's petroleum.
2. Transportation of petroleum by tankers is more expensive than transportation by pipelines.
3. Oil used in the Middle East is always imported.
4. Exploitation of natural gases in Tanzania is only done by public companies.
5. Kuwait, Saudi Arabia, USA and Western Europe are main consumers of oil from the Middle East.

B. Briefly answer the following questions:

1. Outline the importance of oil production to the Middle East countries.
2. Explain the challenges facing oil production in the Middle East.
3. Explain how Tanzanians benefit from the extraction of natural gas.
4. Outline the challenges facing natural gas extraction in Tanzania.
5. Explain how the effects of mining on the environment can be minimised.

Chapter

Six

Tourism

Introduction

In this chapter, you will learn about the concept of tourism, factors contributing to the development and growth of tourism in the world, the importance of tourism and its impact in the world. You will also learn about ways to address the negative impacts of tourism, factors for the development of tourism in Switzerland, Namibia and Tanzania. You will also learn about the problems facing the tourism industry in Tanzania. Finally, you will draw lessons from Switzerland and Namibia to help promote Tanzania's tourism industry.

The concept of tourism

Tourism is a temporary movement of people to places of interest for leisure, pleasure, studies and trade or business, outside their normal working stations or home. A tourist is a person who travels to different places for leisure. Tourism can be classified as either domestic or international. Domestic tourism comprises of tourists who travel within their own country. For example, if a Tanzanian living in Iringa visits Serengeti National Park he or she is a domestic tourist. International tourism, on the other hand, comprises of tourists who travel from their country to another country. For example, people from Switzerland can travel to Tanzania to visit national parks such as the Serengeti, Mikumi or Ruaha.

Factors for the development and growth of tourism in the world

The following are factors for the development and growth of tourism. These factors are features that encourage tourists to visit places for leisure, pleasure or education.

Tourist attractions: Tourist attractions include places with pleasant climate, beautiful and varied sceneries, different cultures, historical sites and monuments. Also, some features in Tanzania such as Mount Kilimanjaro, the highest free-standing mountain in the world, attract tourists.

Advancement in communication and transportation network: Reliable communication network and advanced technology encourage the development of tourism in a country. For example, the use of the internet, television

programmes, and social media, tourism trade fair and exhibitions has facilitated availability of information on tourism, hence it has led to an influx of tourists.

Good infrastructure: Presence of good infrastructure that makes a place easily accessible at affordable rates by car, train, bus, water and air helps to attract tourists. For example, air transport has shortened the time that a tourist spends for travelling to and from Tanzania and other parts of the world.

Good accommodation: Presence of adequate, comfortable and affordable hotels, camp sites and resorts attracts tourists. For example, in Tanzania, the presence of accommodation facilities which cater for tourists of varied economic status is one of the factors that attract tourists.

Peace and stability: Peace and stability in any country encourage the growth of the tourism sector. Tourists prefer to visit places with assured peace and security. Moreover, countries with political instability discourage tourism due to fear of war, violence and terrorist attacks, for example, Sudan, Democratic Republic of Congo (DRC) and Somalia.

Good hospitality: Tourists prefer to visit places where people are honest, generous and with hospitality. In fact, the tourism industry is more developed in various parts of the world where emphasis has been placed on training personnel to master hospitality skills.

Marketing: Countries with good marketing strategies also have the potential of attracting a great number of tourists. Marketing the tourism industry helps to communicate information about various attraction centers, hence calling for more visitors. Some of the marketing strategies include the use of diplomatic missions abroad such as embassies, high commissions and consulates, the mass media, special tourism envoys and advertisements during international exhibitions.

Importance of tourism in the world: Tourism contributes to the socio-economic development of the country. The tourism industry employs many people directly and indirectly, for example, hotel staff, tour guides, porters, drivers and airline staff. Others include those employed in the manufacturing of goods such as postcards, souvenirs and local handicrafts.

Tourists prefer and are encouraged to visit countries with which they have diplomatic relationship because this is one way of promoting cultural exchange to enhance international understanding and foster collective solving of global problems. People from different nationalities also learn to appreciate other cultures, hence promote cultural tolerance.

Generally, governments are committed to conserving tourist attractions because tourists are attracted by the presence of historical and cultural sites,

and wildlife. In Tanzania, the government also promotes sustainable conservation of the sites and national parks to ensure the growth of the tourism sector.

Tourism services also generate the much-needed foreign currency. Tourists arrive in the country with convertible currencies which boost the country's foreign currency. Moreover, taxes from this sector contribute to the growth of the national economy. This, in turn, lead to the development of other sectors such as health, education, infrastructure and water. Furthermore, existing roads are improved and new ones are built to connect tourist attraction sites. Airports are also developed and improved. Communication infrastructure is also improved to serve these areas.

Impact of tourism in the world

The tourism industry has both positive and negative impact in the world.

Positive impact of tourism: The tourism sector has the following positive impact on society. The development and expansion of international tourism has led to the creation of various *job opportunities*. Similarly, the tourism industry has led to job creation in rural areas, thereby reducing levels of rural-urban migration. An example can be cited from the area around Mount Kilimanjaro and Arusha in Tanzania where people secure jobs as porters, translators and guides on a sustainable basis.

As a result, both skilled and unskilled personnel find employment in the sector as well as the hospitality industry; hence they improve their standards of living.

Also, *roads, railways, airports* and *hotels*, are attractively constructed and maintained to sustain the tourism industry. For example, transport means to tourist attraction centers in Tanzania such as the Serengeti, Mikumi, and Mount Kilimanjaro national parks as well as Bagamoyo historical sites are well developed. Tourism has also encouraged *increase in production* in other sectors to meet the tourist needs. For example, other sectors such as transport, agriculture, trade and commerce are highly favoured.

Negative impact of tourism: The negative impact of tourism includes the following:

Tourism has sometimes led to *cultural interference and conflicts*. Sometimes tourists bring with them practises that are unacceptable to the people in the host country, for example, ways of dressing, food style and language.

Moral decay has occurred in places that are visited by tourists. For example, cases of prostitution, same sex relationships (homosexuality) and drug abuse have become common in areas with tourist attractions such as beaches and night clubs.

In addition, tourist activities in national parks and other protected areas may lead

to *environmental degradation* such as off road driving and dumping of waste such as paper and plastics.

Moreover, the continued presence of people and vehicles in the tourists sites may lead to *change in animal behaviours*.

Ways of addressing the negative impact of tourism

The following ways can be taken to minimise the negative impact of tourism:

- (a) Enforcing policies, laws and regulations by the Tanzania Government to provide guidance on the best ways of managing tourist activities to maximise benefits and minimise the negative effects.
- (b) Encouraging eco-tourism to conserve vulnerable natural ecosystems and create a conducive environment to enable local people share economic and social benefits.
- (c) Educating the local communities on cultural differences and the associated risk of copying cultural practises from the tourists (awareness creation and appreciation of other people's culture).
- (d) Promoting new tourism areas as alternative attractions, for example, Gombe Stream National Park, Katavi National Park, Selous Game Reserve (the lower part of Selous) and Ruaha National Park, to reduce congestion in the more popular ones such as the Serengeti, Ngorongoro, Mount

Kilimanjaro and Mikumi. For example, the government through the Ministry of Natural Resources and Tourism is currently promoting tourism in the southern circuit attractions through a dedicated Safari Channel in Tanzania Broadcasting Corporation (TBC) television.

- (e) Integrating tourist activities with the promotion of environmental conservation, to reduce negative impact on the environment.

Exercise 6.1

Answer the following questions:

1. Define the term 'tourism'.
2. Describe five benefits of tourism to Tanzania.
3. With examples, differentiate between domestic and international tourism.
4. Mention five factors for the development and growth of tourism in the world.
5. Mention any four positive and four negative impacts of tourism.
6. Mention any four ways of minimising negative outcomes of tourism in Tanzania.

Focal studies on the tourism industry
 In this section, you will study the tourism industry in selected countries, namely, Switzerland, Namibia and Tanzania. The purpose of focal studies is to enable you to understand how different countries practise tourism and learn best practises from them.

Tourism in Switzerland

Switzerland is a small land-locked country, located in Central Europe, east of France and north of Italy. It has a total area of 41,290 square kilometres. The country is mountainous with a physical landscape of plateaus of rolled hills, plains, glaciers and large lakes. For example, the Alps Mountains occupy about 60% of the total land. This offers a variety of scenery which comprises snow peaks, lakes, forested areas and glaciers. Switzerland is bordered by Austria, France, Germany, Italy, and Liechtenstein. Tourism in Switzerland takes place in the summer months of July - September when it is easy to view the snow-capped mountain peaks, clear blue skies and cascading

waterfalls. Winter months are decorated by abundant snow on mountain slopes for skiing and ice-skating.

The most frequently visited areas during the summer are the Swiss Plateau of Lausanne, Geneva, Bern, Zurich and lake shores. Other places are Tucino Mountain with towns like Lucerne and Lugano. Switzerland is referred to as the playground of the world because most of its fame comes from its tourism industry. Figure 6.1 shows tourist centers in Switzerland.

Pyramidal shaped mountains of the Alps and the U-shaped valleys are unique glaciated features that attract most of the tourists. Figure 6.2 shows the pyramidal peak and valleys of the Swiss Alps.



Figure 6.1 Tourist centers in Switzerland



Figure. 6.2 Pyramidal peaks and valleys of the Swiss Alps

Source: independent.co.uk/topic/swiss-alps

Other features such as lakes Geneva and Constance also add to the beauty of the country. Most of the tourists come from the United States of America, Western Europe and China.

Factors for development of tourism in Switzerland: Several factors contribute to the development of Tourism in Switzerland. Switzerland is located in the center of Europe, making it accessible from various countries of Europe, America, and Asia. These countries include France, Germany, Italy, Britain, United States of America and China.

Switzerland has abundant beautiful sceneries, including the Alps Mountains with a large variety of peaks and valleys which attract many tourists. Also, its slopes have abundant snow which attracts tourists interested in skiing and ice-skating. Others are hills, plateaux, plains, large lakes and rivers.

On one hand, the alpine climate and landscapes are favourable for tourists as they consist of cold snowy winters and warm sunny summers. The snow during winter attracts winter sports such as skiing and ice-skating whereas warm and sunny summers attract tourists to view the beautiful sceneries, and engage in swimming and sunbathing.

The Swiss people are hospitable, and the personnel handling tourists are well trained. The Swiss speak a variety of languages, namely, German, French and Italian. With these languages, the Swiss can easily communicate with tourists from various countries. Switzerland has a well-connected transport network which ensures easy and cheap movement of tourists within and outside the country. A variety of means of transport such as buses, electric trains, cable cars or aerial lifts and airways help to access various tourist attractions in the country. The country has a great number of high class hotels to suit the needs of the tourists. Also, there are cottages, camping sites, taverns and guest houses.

Switzerland has been and continues to tolerate different political ideologies. Thus, tourists from various countries of the world find it comfortable to visit Switzerland. Many towns in Switzerland such as Geneva, Bern and Zurich are headquarters of most international meetings by different organisations and associations such as the World Health Organisation (WHO), International Labour Organisation (ILO) and Federal International Football Association

(FIFA). Therefore, people attending these meetings also take time off to visit tourist attractions, hence contributing to the country's tourism industry.

Importance of tourism in Switzerland:

Tourism contributes to the economic development of Switzerland.

Tourism promotes Switzerland's international relations and co-operation with other nations through tourist activities. Tourism also stimulates other related sectors of the economy such as agriculture, market and transportation since they all strive to help the provision of services in the tourism sector. Moreover, tourism is the major industry in Switzerland. It is the third largest export earner and contributes significantly to the national economy. Tourism promotes employment opportunities both within and outside the industry, therefore, it helps to improve people's living standards. Tourism promotes the spirit of appreciating other people's cultures which, in turn, brings about cultural tolerance. Furthermore, tourism contributes to the expansion of infrastructure throughout the country. Revenue collected from the tourism industry finances the expansion of roads and other related sectors such as education and health. Tourism also contributes to the earnings of foreign currency which facilitate the country's economic growth. Both domestic and international tourism are sources of foreign currency.

Challenges facing the tourism industry in Switzerland: Heavy snow during winter hinders movement on roads, rails and runways which lowers the influx of tourists. In some cases, the number of tourists fluctuate due to other competitive countries such as the United States of America. Tourist attraction centers also experience environmental pollution through littering and noise from transport means such as trains and cars.

Tourism in Namibia

Namibia is bordered by South Africa to the south, Botswana to the east and Angola to the north. It is also bordered by rivers Kunene and Okavango in the north and the Orange River in the south. From the coast, there is the Namib Desert with huge attractive sand-dunes and the largest canyon in the southern hemisphere. The Namib Desert is also known as the "living desert" because a large number of species live there. In the eastern part, Namibia is occupied by the Kalahari Desert. The land between the Namib and the Kalahari deserts is a rolling plain of 1,200m above sea level. Namibia has an area of 825, 419 square kilometres with a population of about 2,610,954 by 2018. Namibia's general climate is desert with scarce and unreliable rainfall. The country's attractive landscape makes it naturally attractive to tourism activities. It has rivers such as the Kwando that cuts through the Caprivi Strip, and Zambezi which flows along the north-eastern border. Namibia's landscape is mostly dominated by a high plateau which also

impresses visitors. This country is a home to a variety of wildlife including antelopes, rhinos, giraffes, lions, elephants and cheetahs which make it one of the leading countries in wild animal population in the world. Windhoek, the capital city of Namibia and the coastal town of Swakopmund have German buildings built during the colonial era. The Windhoek's Christukirche (Christ Church) built from quartz sandstone by the Germans in 1907 is one of the important structures that attract tourists.

Generally, the major tourist attractions (honey pots) in Namibia include the Skeleton Coast, Seal Reserve, Caprivi Game Park and Daan Viljoen Game Reserve. The Etosha National Park, Fish River Canyon and the Gross-Barmen Hot Springs Resort add to the list of tourist attractions. Other tourist attractions in the country include the Hardap Recreation Resort, Khaudum National Park and Naukluft Mountain Zebra Park. Figure 6.3 is a map of Namibia showing tourist attraction sites.

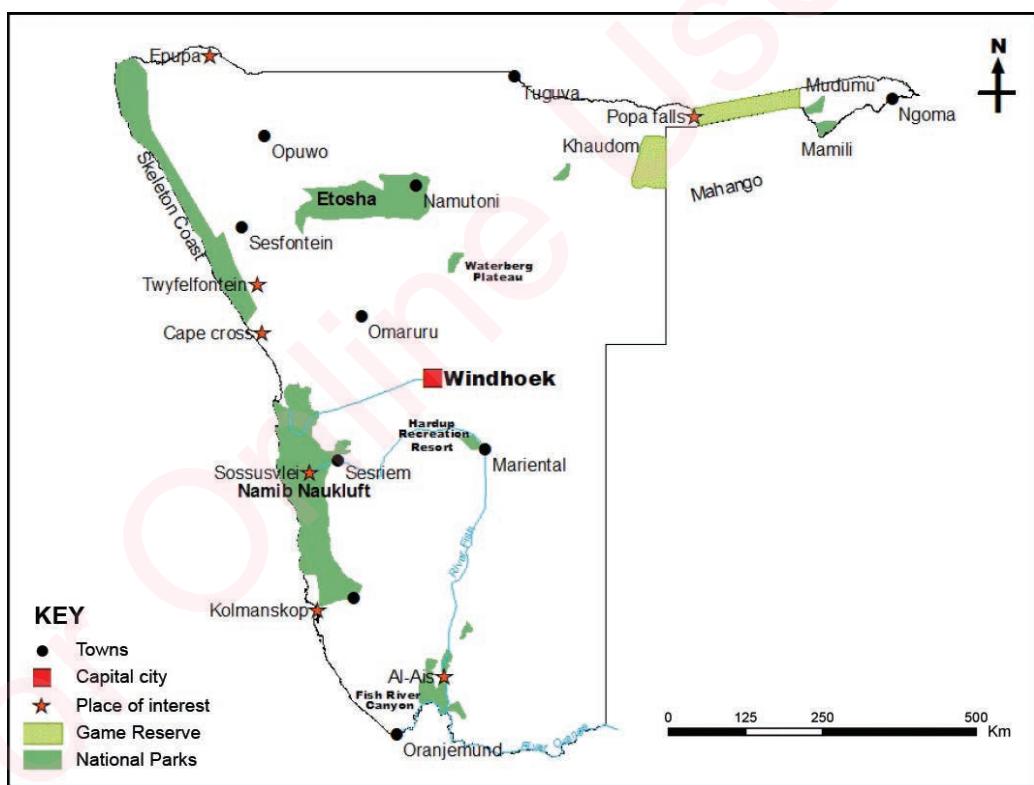


Figure 6.3 Major tourist sites in Namibia

The Namib Desert is one of tourist attractions in Namibia that possesses unique and the largest sand dunes of the world. Figure 6.4 shows sand dunes in the Namib Desert, Namibia.



Figure 6.4 Sand dunes in Namib Desert, Namibia

Source: touropia.com/tourist attraction

Tourism ranks third in Namibia's economy after mining and agriculture. The importance of the tourism sector in Namibia has forced the government to incorporate it in the National Development Plan. Under this plan, the government is committed to enhancing tourism development through several initiatives, as explained in the following sections.

Promoting access to tourist attraction centers: The distances between tourism sites in Namibia are large. This has forced the country to have a strong strategic upgrading of tourism infrastructure to promote the growth of the tourism industry.

Protecting the biodiversity: More than 17 percent of the land area in Namibia

is protected. The large number of parks and protected areas with flourishing wildlife populations is a significant ongoing attraction for international and domestic visitors.

Improving the tourist environment: Namibia has several advantages compared to its competitors in the region. It has attractive and unique tourism attractions such as the landscape, wildlife and indigenous culture. It is also a peaceful country. It has also a safe and extensive road network and sufficient lodging options. There are also abundant opportunities for adventure tourism which includes hiking, sky-diving, dune boarding, and game and trophy hunting. Adventure travel is one of the fastest growing sectors of the long-haul travel market.

Factors for the development of tourism in Namibia: Numerous attractions including the climate with plenty of sunshine, abundant wildlife, rivers and desert landscapes have contributed to the development of the tourism industry in Namibia. Other tourist attractions are the diverse cultural attractions such as baskets, shells, jewels, embroidery, bead works and traditional dances.

Improved infrastructure: The government has also invested in the improvement of infrastructure to facilitate access to tourist attractions. For example, there is a luxury train that runs between Swakopmund and Windhoek. Also, Air Namibia offers

several scheduled domestic flights to enhance tourist movements. The private sector is also working closely with the government to improve accommodation facilities.

Strong tourism policy: Namibia's national tourism policy aims to provide a framework for mobilising tourism resources to realise long-term national goals as defined in the country's Vision 2030. The policy ensures that tourism is developed in a sustainable, equitable and responsible manner. The policy also insists on eco-tourism as an integrated approach which involves carrying out tourist activities with minimum negative impact on the natural environment. This has, in turn, made a significant contribution to the economic development of Namibia that benefits all the people.

Namibia Tourism Board: The Namibia Tourism Board (NTB) is charged with the responsibility of regulating and marketing tourism activities. This board is also responsible for training people engaged in the tourism industry. For example, the NTB has established offices abroad to market and promote tourism in Namibia. These offices are in different parts of the world such as Johannesburg, Cape Town, Germany, New York, England and Spain. As a result, this aggressive promotion increases the number of tourists in the country.

Regional cooperation: Namibia is a member of Southern Africa Development

Community (SADC) which helps its members to promote tourism through the Regional Tourism Organisation of the Southern African Countries. This country has benefitted through this strategy.

Importance of tourism to Namibia

Many people have secured jobs in the tourism industry, for example, hotel staff, tour guides and drivers. Others are employed in the local handicrafts industry such as wood carving from Okavango and Caprivi and basketry from Himba. The tourist industry also contributes to the earning of a lot of foreign currency; for example, earnings from travel agencies, hotels and restaurants, entertainment groups and shops, as well as the National Reserve. The transport and communication network around tourist attractions have also been improved. This has benefited both the tourism industry and local communities. The provision of education, health services, water supply and electricity have improved as a result of the development of the tourism industry. This has, in turn, contributed to improvement of the standard of living of the people. Furthermore, tourism contributes to the growth of GDP, hence making it a valuable sector within the country. Tourism is a major industry contributing Namibian dollars (N\$) 7.2 billion to the country's GDP per year.

Challenges facing tourism in

Namibia: The tourism industry in Namibia is facing strong competition

for tourists from other neighbouring countries especially Botswana and South Africa. In addition, tourism industry in Namibia suffers from a shortage of a well-trained personnel who can offer standard services to tourists. Also, tourist opportunities are in the rural areas where the majority of the people are not well educated. The industry also suffers from high cost of investment, especially in the construction of infrastructure such as roads and hotels. Running costs such as maintaining the rural feeder roads to make them passable throughout the year also needs a lot of funds.

Furthermore, Namibia has a restrictive regime for business visas and work permits which lowers business in the tourism industry. As a result, skilled people from abroad who could serve the industry efficiently cannot easily get work permits. Other challenges facing tourism in Namibia include the growing rate of crime, corruption, poaching, poor water crisis management and high commodity prices.

Tourism in Tanzania

The United Republic of Tanzania is the largest country in East Africa located in the eastern coast part of Africa. The country has an Indian Ocean coastline of about 1,424 kilometers long. It covers an area of 947,300 square kilometers between latitude 10° and 12° S, and longitudes 29° and 41° E. It borders Kenya and Uganda to the north, Rwanda,

Burundi and the Democratic Republic of Congo (DRC) to the west, and Zambia, Malawi and Mozambique to the south. The country is gifted with unique and diverse natural and cultural tourist attractions such as national parks, game reserves with many species of wildlife, conserved areas, lakes, large plateaux, several marine parks, cultural heritage sites and several historical sites. Some of the National Parks include Serengeti, Ruaha, Mikumi, Lake Manyara, Katavi, Tarangire, Bugiri-Chato, Udzungwa Mountains and Saadani. Some of the game reserves include the lower part of Selous, Rukwa, Maswa, Mpanga-Kipengere and SwagaSwaga. Figure 6.6 is a map of Tanzania showing major tourist sites. Tourism in Tanzania is also marked by Mount Kilimanjaro (Figure 6.5) which is a National Park.



Figure 6.5 Mount Kilimanjaro in Tanzania

Source: <https://www.tanzaniatourism.go.tz>

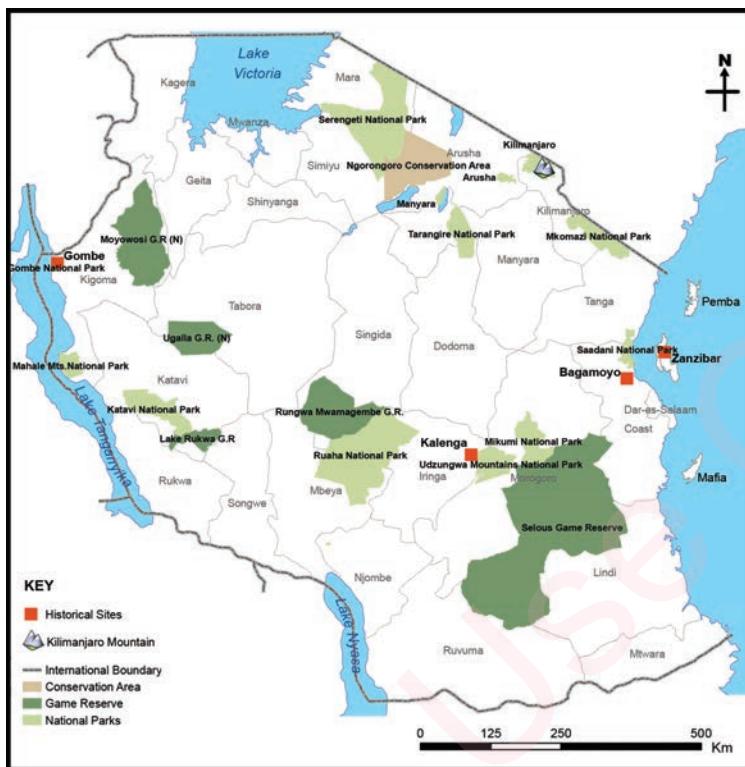


Figure 6.6 Major tourist sites in Tanzania

Management of national parks and game reserves in Tanzania: National parks in Tanzania are managed by the Tanzania National Parks Authority (TANAPA). This authority is responsible for the management and regulation of the use of all areas designated as national parks. The Tanzania Wildlife Authority (TAWA) is responsible for the management and regulation of the use of all the areas designated as game reserves and all wildlife outside national parks and the Ngorongoro Conservation Area (NCA). The NCA is managed by the Ngorongoro Conservation Area Authority (NCAA). This is the only conservation area in Tanzania where humans, livestock and wildlife share the same environment (multiple use

area). National parks, game reserves and the NCAA have the responsibility of ensuring that conservation benefits are shared with surrounding communities. This is done through provision of social services such as schools, water and health facilities, and provision of employment opportunities to local communities.



Figure. 6.7 Wild beasts in Serengeti National Park

Source: <https://depositphotos.com>

Factors for the development of tourism in Tanzania: Tanzania has a stable government, with peace and security which promote the tourism industry. In Tanzania, there are varieties of attractive sceneries including Mount Kilimanjaro, Ngorongoro Crater, Great Rift Valley and Amboni Caves. These landmarks contribute much to the development of tourism in the country. Others are Oldonyo Lengai and Mount Meru.

The country also has several national parks, game reserves and zoos which play a significant role in attracting different tourists. Examples of zoos include, the Dar es Salaam Zoo and Ifisi Zoo in Mbeya. The Indian Ocean also has good beaches and conditions favourable for aquatic sports such as swimming. Fine sand beaches in Mafia and Zanzibar, clear warm waters of the Indian Ocean and the inland lakes are attractions for both domestic and international tourists. Whereas national parks include Serengeti, Ruaha, Mikumi and Kilimanjaro, game reserves include the lower part of Selous, Ibanda, Mpanga Kipengere, Moyowosi, Ugalla and Mkomazi. Tanzania has moderate temperature and abundant sunshine which attract many tourists.

Tanzania has a national museum and several historical sites such as Olduvai Gorge, Isimila and Kalenga, Stone Town in Zanzibar and the meteorites in Ndolezi, Mbozi in Songwe Region. Other tourist attractions include local paintings in Kondoa-Irangi in Dodoma.

The improvement of transport and communication contributes to easy movement of tourists from one place to another. Tanzania is investing in improving airline transport to strengthen the tourism industry.

In addition, Tanzania has adequate and comfortable accommodation to cater for tourists with different economic status, hence attracting a large number of tourists. Tanzania also has friendly and hospitable people. The country is also rich in cultural diversity with more than 120 ethnic groups. Each of these ethnic groups has its unique culture which presents a wide range of cultural tourist attractions. Tanzania is also well known and respected for its unique language, Kiswahili which is ever expanding in Africa and worldwide.

Importance of tourism in Tanzania

(a) The tourism industry contributes to the Gross Domestic Product (GDP). Currently, tourism contributes about 17.5 % of the GDP. For example, Table 6.1 shows revenue collected by national parks in Tanzania Mainland in the years 2017 and 2018.

Table 6.1 Revenue collected by national parks in Tanzania Mainland in US\$

Year	Revenues (US\$ in millions)
2017	2,019.00
2018	2,043.00

Source: Standard Digital April 2019

- (b) The money obtained from tourism helps to improve and develop other sectors such as health, education, water supply, agriculture and transport.
- (c) Tourism also creates employment opportunities among Tanzanians. Both skilled and unskilled workers can secure jobs in national parks and game reserves, hotels and lodges, transport and tour companies.
- (d) Tourism contributes to the development of local handicraft industries. Tourists buy large quantities of handicrafts, especially wood carvings such as Makonde carvings, and wooden materials which attract more people to engage in such artistic productions.
- (e) Tourism promotes international relations through co-operation and cultural tolerance among people, to foster cultural diversity.
- (f) Tourism facilitates the development of infrastructure and services such as roads, airports, communication networks, water supply, electricity, hotels and proper sanitation. As a result, better services and standards of life are ensured for both tourists and natives.
- (g) Tourism promotes the spirit of environmental conservation and preservation of historical sites. This, in turn, leads to sustainable use of tourist attractions for national development.
- (h) Tourism is the source of foreign currency. Tourists pay for services they are provided with in foreign currency.
- (i) Tourism facilitates the creation of different recreational centers to attract even more tourists. Such attractions include night clubs, swimming pools and beaches.

Challenges facing tourism in Tanzania:

The tourism industry in Tanzania is faced with problems of transport and communication, which are not that well-developed, hence limiting tourist movement. For example, some of the roads are rough and, therefore, it is impossible to use them during the rainy season. Internet services are also expensive and not reliable. The country also faces a problem of poor co-ordination between the government and other players in the industry. In addition, there is a shortage of funds for the development of the tourism industry. Moreover, Tanzania does not have adequate and sustainable marketing strategies to advertise and promote the unique attraction sites available in the country.

Increase in population for settlement and agriculture expansion has led to encroachment on national parks and game reserves. This has led to degradation of wildlife areas, threatening their existence. In addition, crime and violent activities in some areas will discourage tourists from visiting such areas.

Promoting tourism in Tanzania: The following are the ways that can be used to promote tourism in Tanzania:

Marketing strategies and publicity: Marketing of the tourism sector both domestically and internationally should be enhanced. There is a need for the government and other players in the industry to market aggressively the country's tourist attractions in international media and forums.

Provision of training: Tourism is a service industry that demands quality services for its sustainability. It is, therefore, important to have trained personnel who can offer quality services to meet international standards. This, in turn, will lead to increased influx of tourists.

Development of tourist attractions: The government should invest in expanding the tourist attractions in the country. This can be done by opening up new areas and diversifying tourist activities but also by promoting them as viable alternatives.

Improvement of infrastructure: There is a need to improve the existing accommodation, transport and communication infrastructure. This will improve the provision of services needed by tourists in the hospitality industry.

Involving the local communities: Involvement of local communities will promote a sustainable tourism industry. Indeed, protection of national parks and

game reserves needs the commitment of the people living near the parks and game reserves. Moreover, communities should enjoy the benefits obtained from the use of protected areas by tourists.

Promotion of domestic tourism: Domestic tourism is not well-developed in Tanzania because of the high costs and lack of touring interest among natives. Therefore, domestic tourism should be promoted by offering affordable rates to natives. Also, eco-tourism should be established.

Lessons drawn to promote the tourism industry in Tanzania: The following are some of the lessons that can be drawn from focal studies discussed in relation to promoting the tourism industry in Tanzania.

Marketing: The Government of Tanzania as well as private players in the tourism industry should invest in marketing the country's tourism attractions all over the world. By doing so, the number of tourists will increase, thus contributing to the national economy.

Strong tourism policy: The government should formulate and enforce a strong tourism policy that is geared towards promoting culture-based tourism and eco-tourism.

Package tours: The government should promote package tours that allow for tour arrangements, including hotel reservations and travels to be done by a

company. This will increase the number of tourists visiting the country.

Regional co-operation: Tanzania, as a member of Southern Africa Development Community (SADC), has to fully utilise opportunities aimed to promote the tourism industry especially through the use of the Regional Tourism Organisation of the Southern Africa Countries (RETOSA).

Exercise 6.2

Answer the following questions:

1. Name any three tourist attractive sites for each of the following countries:
 - (i) Tanzania
 - (ii) Switzerland
 - (iii) Namibia
2. Draw a map of Tanzania and indicate five tourist attractions.

3. Explain how tourism is important in Tanzania, Namibia and Switzerland.
4. List and explain any three negative impacts of tourism in the world.
5. Explain the challenges facing the tourism industry in Tanzania.
6. Briefly, explain any five factors for the growth and development of tourism in Switzerland.
7. List any three lessons that Tanzania can learn from the tourism industry in Switzerland and Namibia.
8. Suggest any four ways:
 - (i) In which the tourism sector can be used to generate more income in Tanzania.
 - (ii) To promote tourism in Tanzania.
9. In a group of ten students, pair and share three major tourist attractions of a selected region in Tanzania.

Chapter Seven

Manufacturing industry

Introduction

In this chapter, you will learn about the concept of manufacturing industry, the importance of the manufacturing industry, types of manufacturing industries and the products of each type. You will also learn about factors necessary for locating an industry, and pollutants from manufacturing industries. Besides, you will learn about the production of cars in Japan, electronic devices in South Korea and textiles in Tanzania.

The concept of manufacturing industry

The manufacturing industry involves the processing and changing of raw materials into different semi-finished or finished products using tools and machines. It plays a major role in bringing about the development of a country. The ever growing population with increased demands for goods and services is accommodated by the establishment of manufacturing industries. Such increased population demands more food, shelter, clothes and other services. The following section explains the importance of manufacturing industries in the world.

Importance of manufacturing industries

(a) Manufacturing industries are sources of employment for both skilled and unskilled labour. These employees can raise their standards of living and improve quality of life with the income

they earn. The income they earn caters for basic needs such as food, shelter, clothes and education.

(b) Manufacturing industries also lead to the diversification of the country's economy due to their potentials for promoting other sectors of the economy. This reduces over-dependence on one or two economic sectors, which can be affected by fluctuation of prices in the world market.

(c) Manufacturing industries enable countries to process locally produced raw materials before they are exported. This process helps to add value to the exports.

(d) Manufacturing industries stimulate the development of infrastructure such as railways and roads. These means of transport are useful in carrying raw materials to manufacturing centers and the finished or unfinished goods to the markets.

(e) Industries also help to create a large internal market as workers get wages and salaries from industries which enable them to buy goods and services. In fact, the more the workers, the larger the market for manufacturing industries.

(f) Manufacturing industries also lead to increased agricultural production. For example, the textile industry requires cotton as raw material. Thus, it can stimulate the expansion of cotton growing.

(g) Manufacturing industries are sources of foreign currency. The products manufactured in a country are exported to other countries for sale which, in turn, attract foreign currency.

(h) Manufacturing industries reduce the country's dependence on imported goods because a country with well-developed manufacturing industries can meet the needs of the people.

(i) Manufacturing industries also stimulate the development of science and technology. Indeed, for a country to develop well in manufacturing industries, it needs to invest in science and technology to increase production.

(j) Manufacturing industries improve international relations through trade transactions with different countries. These trade transactions improve relations between the importing and exporting countries.

Types of manufacturing industries

Manufacturing industries can be grouped into two main types, namely, processing and fabrication industries.

Processing industries: Processing industries use raw materials from the primary industries. They produce goods which can be used as raw materials for other industries or can be directly consumed. These industries are also concerned with the processing of bulk raw materials into other products. Some of these are described below.

(a) *Textile processing industries:* These industries deal with spinning and weaving of textile materials from cotton, wool and silk. Artificial fibres such as rayon, nylon and dacron are used in textile industries. Textile industries in Tanzania include Musoma Textile (MUTEX), Mwanza Textile (MWATEX), Karibu Textile Mills (KTM) and Morogoro Polytex.

Leather processing industry includes hides, and skins. Despite its potential to contribute to the economy in terms of employment creation, income generation, foreign earnings and poverty reduction, its current contribution to development is still low. The comprehensive leather sector development strategy of Tanzania endeavours to generate the conditions for a favourable expansion of the industry so as to contribute to overall socio-economic development. Such development will require the coordination of various

activities such as the ability of stakeholders to plan and coordinate actions in results. The plants include Moshi industries, Tanzania leather industry, Afro leather, Kibaha Tannery, Himo Tanners and Salex Tanners.

(b) *Chemical industries:* These are industries which produce highly specialised products such as acids, gases, medicine, paints, pesticides, alkalis, soaps and fertilisers. Good examples are the Mansoor Daya Chemicals, Zenufa Laboratories and Unilever Tanzania which deal with detergents, soaps and other products. Their raw materials include acids, dyes and fertilisers. Zoom Tanzania manufactures chemicals for households and for industrial purposes, such as Pine disinfectant, A1 liquid soap, clorite bleach, and kioo glass cleaner.

(c) *Food and beverage processing industries:* These industries deal with the preparation of food stuffs and drinks such as meat packaging, fruit canning, flour milling, bottling and brewing, sugar refining, meat processing and packaging, Coca Cola, Pepsi Cola, Azam Cola and brewing industries. Examples include Cool Blue Tanzania (producing mineral water), Chai Bora (Tea leaves), Said Salim Bakhresa & Co. Ltd (Mzizima Flour Mill).

(d) *Metallurgical industries:* Metallurgical industries deal with the production of iron and steel as raw materials in engineering industries, for example, Aluminium Africa Limited (ALAF), the Motisun Group in Dar es Salaam and AIM Steel Ltd in Arusha that deal with steel and pre-coated sheets.

(e) *Craft industries:* These are industries which deal with spinning, weaving, dyeing of cotton cloth, tanning and leather making, wool carving, basket making, pottery and gold, and silver smelting. Examples include MIKONO Craft Industry, Kwanza Collections, Maznat Designs, Makonde Handicraft Village, Nyumba ya Sanaa in Dar es salaam.

Fabrication industries: Fabrication industries produce new products from processed raw materials. Such fabrication industries can be heavy or light. Heavy fabrication industries produce bulky and heavy products such as iron and steel. Other heavy fabrication industries include car assembly and ship building. Light fabrication industries produce light products such as plastics, textiles, shoes and electronics.

Types of manufacturing industries in East Africa: There are different types of manufacturing industries in East Africa. They can be grouped as follows:

- Food and beverage industries
- Chemical industries
- Textile industries
- Mineral extraction industries

- v. Iron and steel industries: They make iron and steel bars, wires, and other iron and steel products.
- vi. Lumbering industries: These industries deal with the production of timber, wood pulp and other products from wood. Paper industries rely on softwood which grows fast.
- vii. Fuel and power industries: These industries deal with the extraction of oil, petroleum, coal, natural gas, and refining and generation of power from various sources such as steam and coal.

Factors for the location of manufacturing industries: The establishment of an industry in a certain area depends on many factors, some of which are described below.

Availability of raw materials: Closeness to the sources of raw materials reduces transport costs and time for the materials to reach the industry. In most industries, transportation of raw materials from the source to the industries is part of the production cost. Industries which use heavy and bulky raw materials are usually located near the source of raw materials. For example, Twiga Cement Industry in Dar es Salaam is located near limestone deposits (Figure 7.1). Other cement industries are Dangote (Mtwara), Tanga Cement and Mbeya Cement in Tanga and Mbeya respectively.



Figure 7.1 Lorries carrying cement at Twiga Cement factory, Tanzania

Power supply: Industries need reliable and adequate power supply to run machines. The availability of this power supply ensures constant production of goods in the industries. The common sources of power used in manufacturing industries are hydro-electrical power, coal, natural gas, solar and nuclear power. Industries located close to sources of power are more profitable than those located far away.

Transport and communication networks: Transport is an essential component in movement of raw materials to the industrial areas and the manufactured goods to the markets. A good transport network helps to reduce costs and facilitates the movement of raw materials and manufactured products. The commonly used means of transport are roads, railways, waterways and airways.

Market: The availability of a reliable market for the manufactured goods is one of the essential factors that account for the development of manufacturing industries. Availability of the markets can determine production efficiency.

Industrial production depends on the demand for goods, which also determines the location of such industries.

Labour: The labour force required by an industry depends on the type of the manufacturing industry. Both skilled and unskilled labour is required for the development of manufacturing industries. Thus, the development of manufacturing industries tend to flourish in areas where labour is available and stable.

Capital: Availability of capital is a very important factor for the development of manufacturing industries. This is money invested in starting a business. Money is required to buy the site, build offices, purchase raw materials, pay workers and market products.

Government policy: Government policies may encourage or discourage the location of industries in certain areas due to social (population or market), economic (introduction of protective tariffs), political (civil wars, political influence) or environmental (climate) reasons. Supportive policies attract both internal and external investors. Supportive policies provide possibilities for financial support through loans and friendly conditions to investors.

Water: Availability of regular and abundant supply of water is essential for the development of industries since most industries require large quantities of water for their operations. For

example, iron and steel industries require water for cooling purposes, textile industries for washing fibres, chemical, pulping and timber industries for proper functioning. Water may be required either in the processing of raw materials or for cooling machines.

Activity 7.1

With the guidance of your Geography Teacher visit a nearby manufacturing plant and find out the reasons for its location, the source of power used in that industry and identify the manufactured products and their market. Then in groups, discuss the importance of that industry.

Pollutants from manufacturing industries:

Industrial pollutants are substances that make air, water and soil harmful to living organisms. The manufacturing industries produce different pollutants which are dangerous to human health and the environment. These pollutants are categorised as gas, solids, liquids and noise.

Industrial pollution: The manufacturing process turns raw materials into useful goods. But some of the by-products of manufacturing waste materials left over or substances produced by the manufacturing process itself, may be harmful to the environment. Manufacturing contributes to air and water pollution for example the Wazo Hill Cement industry in Dar es Salaam.

Air pollution: Pollution can easily be observed from oil refining industries. These manufacturing industries use heat from coal or diesel furnaces to provide steam power to run the plants. Burning this fuel can also release pollutants into the air.

Gases: Industrial activities produce harmful gases that pollute the environment. Such gases are sulphur dioxide, nitrogen dioxide, carbon dioxide, methane and other hydrocarbons. The gases emitted may cause respiratory and skin diseases. Sulphur dioxide can form sulphuric acid when it comes into contact with water in the atmosphere to form acid rain. Such rain corrodes rocks, iron sheets and pollute soils, lakes and rivers. Carbon dioxide is produced due to incomplete combustion of gases, oil, coal and wood. The high concentration of carbon dioxide in the atmosphere causes global warming.

Industrial solid waste: Solid waste such as paper and plastic products, bottles and cans, food and garden wastes from industries pollutes the environment. Waste is harmful as it may contribute to the transmission of diseases to human beings and plants.

Liquid pollutants: Dirty water from industries may contain heavy metals such as lead and mercury, harmful chemicals, radioactive waste or organic sludge. This waste pollutes water when discharged into rivers, oceans or lakes and destroys aquatic life. If water with

liquid pollutants is used for irrigation, it may harm the crops and people's health. These pollutants may also alter the soil composition and texture, hence making it unproductive.

Noise pollution: The operation of machines may produce loud noises that disturb people working in the industries. The noises can also affect hearing in human beings, and may also disturb people living near the industries, by disrupting their sleep and rest.

Major ways of reducing industrial pollution

There are several ways of reducing pollution from industries. These ways include the following:

- (a) Locating industries away from residential areas. There should be a proper policy on locating industries.
- (b) Laws and by-laws should be enacted to protect the environment against pollution.
- (c) Encouraging the use of alternative sources of energy which are environmental friendly, for example, the use of solar energy and hydro-electric power.
- (d) Complete combustion of fuels in industrial machines should be ensured as it reduces air pollution.
- (e) Liquid waste from industries should be treated before it is discharged as waste, to reduce the effects on the environment.

- (f) Industrial waste can be reduced through re-use and recycling of plastic materials, bottles and cans to produce other materials.
- (g) Routine inspection and maintenance of industrial machines should be carried out on a regular basis.

Exercise 7.1

Answer the following questions:

1. Define the following terms:
 - (a) Manufacturing industries
 - (b) Processing industries
2. Mention two types of manufacturing industries and give two examples for each type.
3. Describe five types of processing industries in Tanzania and give two examples for each type.
4. Describe any three factors affecting the location of industries.
5. Define industrial pollution.
6. Mention any three industrial pollutants and explain their effects to people and environment.
7. Outline five ways of reducing industrial pollution.

Focal studies

Car manufacturing industries in Japan

Japan is a chain of islands in the eastern part of Asia. It has an area of about 377,972 square kilometers. The population of Japan was about 126.8 million people in 2018 (Population, 2019). It is located between North Pacific and the Sea of Japan. It is one of the leading car producers in the world ahead of other producers such as Germany, United States of America, France, United Kingdom, South Korea, China, India and South Africa. The major industrial centers in Japan are located in the coastal cities of Tokyo, Osaka, Kobe and Yawata. Other cities include Nagoya, Kyushu, Shikoku, Honshu and Hokkaido. Japan produces various types of vehicles such as Mitsubishi, Isuzu, Suzuki and Toyota. Cars from Japan are more marketable because they are durable and of high quality. Spare parts are also easily available and affordable.

Factors contributing to the development of industries in Japan

The growth of car manufacturing industries in Japan has been facilitated by the following factors:

Power supply: Japan has a good supply of reliable power to support industrial development. The country has well-developed hydroelectric power and nuclear energy to provide power for industries.

Harbours: Japan has natural harbours for large ships that enhance the importation and exportation of both raw materials and manufactured products in large quantities.

Reliable market: Car manufacturing industries in Japan have a reliable market both within and outside the country. The growing Japanese population offers market for the manufactured cars. Moreover, the quality and availability of spare-parts from Japan guarantee the ever growing market almost all over the world.

Labour: The educated population of Japan provides reliable source of skilled labour able to work in various industrial fields. The government has invested much in science subjects in schools and universities to create highly skilled labourforce to work in industries.

Good transport and communication network: Japan has a well-developed transport and communication network including roads, modern railway systems, seaports and airports. These promote development of car manufacturing industries. Transport and communication network facilitates the movement of raw materials to the industries and manufactured goods to the markets.

Capital: Japan's economy is one of the biggest in the world, hence the country has adequate capital to support industrial development. This has enabled it to finance the development of its giant car manufacturing industries.

Technology: Japan is highly developed in technology useful in car manufacturing industries. The use of computer and robot technology in manufacturing has increased production. Research in Japan is also an ongoing practise that ensures better methods of industrial production.

Hard working: The Japanese are well known all over the world for their spirit of hard-work. They are committed in their work and to the development of their country. This spirit has improved their car manufacturing industries.

Electronic equipment industry in South Korea

South Korea is located in Eastern Asia south of the Korean Peninsula. It occupies the southern half of the peninsula. It has an area of about 98,000 square kilometers. The population of South Korea was about 51.5 million people in 2017. It is one of the highly industrialised countries of the world in electronic manufacturing. Its economy is growing very fast due to foreign investments in many electronic equipment such as televisions, radios, calculators, watches, magnetic discs for computers, computer software, cell phones, computer terminals and radar.

The major electronic production centers include Busan, Daegu, Gwangju, Jeju and Seoul (Figure 7.2). Daegu alone has more than 150 electronic factories. The major electronic manufacturing

companies in South Korea are Samsung, LG electronics, Daewoo and Hyundai. Other competitors in the electronic manufacturing industry include Hong Kong, Singapore, Malaysia and Taiwan.



Figure 7.2 Electronic production centers in South Korea

Factors contributing to the development of electronic manufacturing industries in South Korea

The following are factors that contribute to the development of electronic manufacturing industries in South Korea:

Capital: South Korea has capital which is available through bank loans and government assistance. This capital has enabled the growth and diversification of industries. Also, the capital has facilitated the development of infrastructure and factories in addition to funding scientific research for the development of such industries.

Policies: South Korea's government has supportive policies that promote the development of electronic industries by providing financial support through loans and research. The policies are also supportive in attracting foreign investors from Japan and the USA to invest in electronic manufacturing industries through friendly policies.

Labour: South Korea has a skilled labourforce since the country has invested heavily in education and technological innovations. For example, the literacy level is estimated to be over 98 percent with emphasis on science subjects in schools and colleges.

Transport and communication: There is efficient means of transport and communication that facilitate the transportation of raw materials and manufactured goods.

Market: The electronic industries produce goods of high quality which are also in high demand both within and outside the country. The products have a ready market all over the world which, in turn, promotes production.

Science and technology: South Korea has invested heavily in science and technology and, as a result, it sets high standards of new technology. The country puts emphasis on scientific innovation, investigation and research. This focus has given the country's electronic industry an edge over other electronic manufacturers in the world.

Energy: South Korea has available and affordable energy that is generated from different sources, including nuclear power that contributes to about 45 percent of the total power production. Other sources include solar energy and hydro-electric power, which are reliable and affordable, thus enhancing production.

Research and development: Electronic manufacturing industries in South Korea rely much on research and development to attract and widen the market. A lot of government funds are directed towards the improvement of the existing products and developing new ones.

Activity 7.2

In groups, note down the similarities in the factors contributing to the development of car manufacturing industries in Japan and electronics manufacturing industries in South Korea and then present to the class.

Textile industries in Tanzania

Textile industries deal with the manufacturing of clothes from cotton, wool, silk, nylon, rayon or linen as raw materials. Textile manufacturing involves the design, production and distribution of textiles, fabrics and clothes. Examples of textile industries in Tanzania include Urafiki Textile Mills, Kilimanjaro Textile Mills (KILTEX), Karibu Textile Mills (KTM), Mwanza Textile Mills (MWATEX), Musoma Textile Mills (MUTEX) (Figure 7.3).

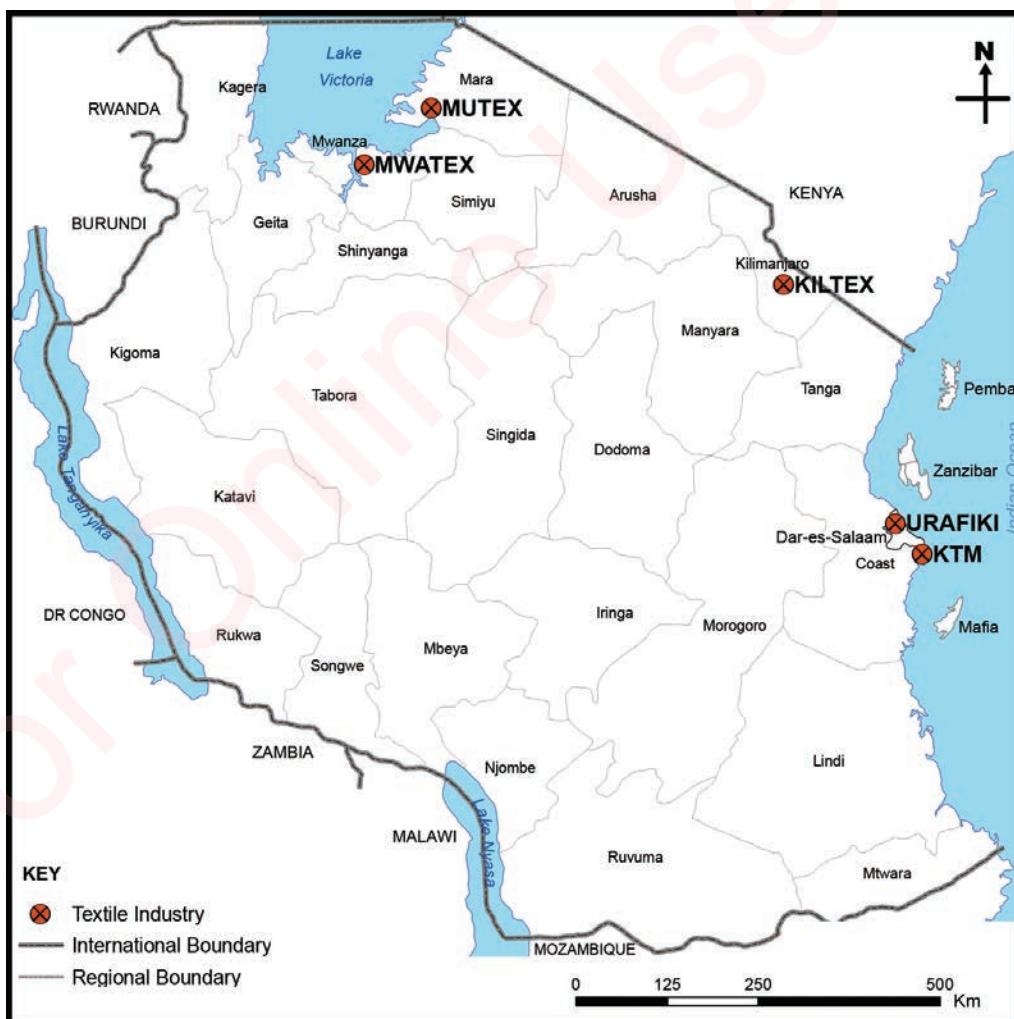


Figure 7.3 Location of some textile industries in Tanzania

Importance of textile industries in Tanzania: The textile industry provides employment opportunities to both skilled and unskilled labourers. Skilled labour is required in the textile industry for designing, spinning, cotton weaving, bleaching, dyeing and printing of cotton fabrics. These workers are specialised in one section. Unskilled labour is equally needed to support skilled workers, for example, by clearing and providing security.

The textile industry also stimulates production in other sectors of the economy such as agriculture, transportation, commerce and trade. The industry operates because raw materials are readily available. In Tanzania, cotton is the main raw material for the textile industry. Farmers will continue to produce cotton when they are assured of ready markets for their cotton.

Another important contribution is the development of transport infrastructure such as roads and railways. Good transport enables cotton to reach the factory and products to reach the market at a minimum cost, and in time. In addition, textile industries are sources of foreign currency. The development of the textile industry depends on the availability of both internal and international markets. Since there is no country that can meet the demands of its people by only using locally produced goods, there is a need to produce more for export to get foreign currency. Textile industries

also promote international relations through trade. There is so much trading in the world because of differences in resource endowment and climate. For example, there are countries producing cars (Japan) while others produce textile materials (Tanzania). This distribution of manufactures justifies the need for trading of the products among nations, which also helps build healthy and good relations.

Challenges facing textile industries in Tanzania:

Many of the textile industries have been operating for a long time in such a way that their machines have become out of date. With the advancement of technology, the old machines in textile industries need to be replaced by new ones for efficiency purposes. There is also lack of adequate skilled labour. This leads to the need to import labour from outside the country, resulting in increased production costs. Lack of adequate capital and inadequate supply of raw materials limit the ability of the industries to increase productivity.

Poor transport and communication system also hinders timely transportation of raw materials to industries and manufactured goods to the markets. High costs and unreliable power supply constitute other challenges because they reduce profit from industrial production. The chemicals used in textile industries are also expensive. This also leads to reduced profit from textile industries.

Lessons from Japanese and South Korean industries for Tanzania

Japan and South Korea are industrialised countries. They produce electronic equipment and cars of good quality which are sold all over the world. The following are some of the lessons Tanzania can learn from Japan and South Korean:

Management of industries: Various industries in Japan and South Korea are properly managed. For example, industries employ skilled workers with the required qualifications. Workers use time and other industry's resources effectively. As a result, they produce efficiently for profit. The industrial managers work on a set of objectives and are not involved in any type of corruption. The same practises should be adopted in Tanzania's industries.

Improved transport and communication network: Well-developed transport and communication in Japan and Korea play a big role in the development of industries as the transportation of raw materials tends to be easy and at low costs. Similar conditions should be created to increase productivity in Tanzania's industries.

Investment in research: Both Japan and Korea have heavily invested in research and development particularly on better, efficient and effective production methods. This has continually improved their production methods and made the costs manageable. Therefore, Tanzania needs to invest in research.

Training and development of workers:

Japan and Korea have been allocating adequate funds for training to enhance workers' productivity. This is something that Tanzania should also do to improve the industrial sector.

Spirit of commitment and hard work:

The workers in Japan and South Korea are committed to accomplishing the duties and responsibilities assigned to them. This practise has led to increased efficiency in their industrial production. Therefore, workers in Tanzania's industries should develop the same spirit.

Production of high quality products:

Industrial products from Japan and South Korea are of high quality and can compete with similar products from other competitors. Therefore, Tanzania has the duty to ensure that its industrial products meet international standards.

Reliable source of power and energy:

Japan and South Korea exploit different sources of energy, hence making power cheap and available all the time. They have hydro-electric power and nuclear power which make the availability of power very reliable. Tanzania should follow this example by exploiting various sources of energy rather than depending only on hydro-electric power.

Exercise 7.2**Answer the following questions:**

1. Mention the regions in Tanzania where textile industries are located.
2. Explain the following terms:
 - (a) Fabrication industries
 - (b) Processing industries
 - (c) Manufacturing industries
 - (d) Industrial pollution
3. Mention any five ways in which textile industries are important in Tanzania.
4. Describe any four factors contributing to the development of manufacturing industries.
5. Mention any five factors contributing to the development of electronic equipment industries in South Korea.
6. List major electronic equipment produced in South Korea.
7. Mention two major industrial areas in South Korea.
8. Explain any five factors contributing to the development of industries in Japan.
9. List down four lessons that Tanzania can learn from Japan's and South Korea's industries.
10. Name and explain any five problems facing textile industries in Tanzania.

Chapter Eight

Sustainable use of power and energy resources

Introduction

Power and energy are important for every aspect of human life. They may be generated from waves, winds, waterfalls, solar, natural gases, geothermo, oil and coal. In this chapter, you will learn about the major sources of power, the methods of acquiring and extracting power and energy, and the uses of power and energy resources. You will also learn about the problems facing power and energy production, specifically solar and wind power production in the USA, hydroelectric and biogas production in Tanzania. Finally, you will learn about problems related to power and energy extraction in the USA and Tanzania.

The concept of Power and Energy

Power: Power is the flow of energy at any one time, and can be generated from renewable energy resources through solar conversion (solar, thermal electricity, solar heating); harnessing water (hydropower for electricity, wave and tidal generation through turbines); harnessing the wind (wind pumps for water, wind turbines for electricity); and a variety of other energy sources. The main power sources are petroleum (oil), natural gas, water, coal and nuclear. Other sources include the earth's interior (hot springs), wind, sun, tides, and waves, wood, peat and cattle or cow dung (biogas).

Power is found within our bodies, machines, in plants and bodies of animals, insects and birds. Power is also inherently present in natural forces like wind, tides, waves, and water whose

movements can be utilized to drive machines, or generate electricity. In our daily lives, power is needed to cook food, to drive machinery in industrial plants , to provide light and heat, and to propel vehicles of different types.

Energy: Energy can be defined as the capacity for, or equivalent of, doing work. Energy is the ability to work so as to produce motion. For example, when water turns a turbine, electricity is produced. Also energy is used to drive machines and provide heat and light.

The society requires energy for transportation, heating and cooling of buildings, powering production processes in industry, and various household needs. Energy can be grouped into various types as explained below.

Primary and secondary energy: Primary energy sources are those that are either found or stored in nature. This type of energy is captured directly from natural resources. Common primary energy sources are coal, oil, natural gas, and biomass (such as wood). Other primary energy sources include available nuclear energy from radioactive substances, thermal energy stored in the earth's interior, and potential energy due to earth's gravity. The primary energy sources are converted into secondary energy sources; for example coal, oil or gas are converted into steam and electricity. Also, heat is a primary energy, which can be transformed into secondary geothermal or solar electricity.

Commercial and non-commercial energy: Energy sources are regarded as commercial if they are available in the market for a definite price. The most common examples of these energy sources are electricity, coal, and refined petroleum products. These sources are the basis for industrial, agricultural, transport and commercial development in the contemporary world. Likewise, they are predominant sources of household energy especially in developed countries. Likewise, the non-commercial energy sources are not available in the commercial market for a price. They include fuels such as firewood, cattle dung, and agricultural waste used by households. These are traditionally gathered and not bought at any price especially in rural areas. Examples include firewood, agro-waste, solar energy for water heating, electricity

generation, drying grain, fish and fruits; animal power for transport, threshing, lifting water for irrigation, crushing sugarcane; wind energy for lifting water and generation of electricity.

Renewable and non-renewable energy: Renewable energy is energy generated from sources that are essentially inexhaustible. Examples of renewable energy sources include wind power, solar power, geothermal energy, tidal power, and hydroelectric power. Non-renewable energy includes conventional fossil fuels such as coal, oil and gas, which are likely to get depleted with use.

Conventional and non-conventional energy: Conventional energy is an energy source which is fixed in nature like oil, gas, and coal, and hydropower generation. It is also termed as non-renewable energy or thermal energy. The conventional energy resources are being used extensively; as a result, their known reserves have been depleted to a great extent. The use of conventional energy has emerging effects on the environment.

The non-conventional energy involves energy generated by wind, tides, solar and biomass. These are renewable sources of energy and not exhaustible.

Major sources of power and energy
The primary source of energy is the Sun. Other sources of power and energy are fuelwood, water, coal, natural gas, oil, hot springs, wind, biomass and tidal waves. The sources of energy are categorised as renewable and non-renewable.

Renewable energy sources: Renewable energy is any energy source that is naturally replaced. The energy can be derived from sunlight, tides, wind, water, geothermal, or hydroelectric action. Likewise, energy produced from the refining of various forms of biomass is often classified as renewable. The renewable energy sources are usually regarded as environmentally friendly, because they release few chemicals that can harm the environment. These are energy resources that are naturally reused. Renewable sources are sustainable if they are carefully managed and maintained. They have minimal negative effects on the environment. Renewable energy sources include sunlight, geothermal heat, wind, tides, water and various forms of biomass. Some of these energy sources are described in the following sub-sections.

Biogas energy: Biogas is a mixture of gases produced by decomposition of organic matter such as waste from manure, plant materials, sewage, green waste, or food waste. The main components of biogas are methane and carbon dioxide. Biogas may be used to reduce high cost associated with other sources of energy and reduce over-dependence on fuelwood as the only source of energy. Biogas is less costly than other sources of energy and does not require specialised knowledge to operate.

Wind energy: Wind energy refers to the energy that is generated from wind. Wind mills have been used for hundreds of years to pump water from the ground. Currently, wind turbines are used to generate electricity. Wind is the second most frequently applied energy source in the world with a total installed capacity of 539.123 Gigawatt (GW) in 2017. Before harnessing wind energy, research on variables such as speed, direction and persistency is necessary. Thereafter, wind turbines have to be set. A wind turbine operates on the following simple principles:

- (i) The power from the wind turns the windmill that has two or three propeller-like blades around a rotor.
- (ii) The motor is connected to a main shaft that spins a generator to generate energy. Figure 8.1 shows a windmill farm.

In Tanzania the utilisation of wind energy is encouraged by factors such as the increase in the costs of oil along frequent hydro power cuts, and increased demand of power which is influenced by high population growth. Tanzania has areas of high wind potential that cover more than 10% of its land.

Research works indicate that Tanzania has a lot of wind energy resources in the areas of Great Lakes, the plains, and the highland plateau regions of the Rift Valley. Also areas such as Makambako (Njombe) and Kititimo (Singida) have sufficient wind speed for grid scale electricity generation.

The advantage of using wind energy is that it does not pollute the environment. Also, it occupies a small ground space. The limitation of using wind energy is that wind turbines can disturb, or kill flying creatures like birds.



Figure 8.1 Windmill farm

Source: <https://www.desertsun.com/story/tech/science/energy>

Solar energy: Solar energy is generated from the Sun using collector panels. The collected energy can be used to provide heat, light, or other forms of electricity. It is used in Tanzania though in small-scale. The distribution of solar energy depends on the overhead sun of a particular place. It is harnessed by using two methods: (i) through plates which are used to collect and reflect heat to power generators; (ii) by using Photovoltaic Cells (PV) composed of semi-conducting materials

that convert sunrays into electric currents. This method is commonly used in many places for lighting homes and traffic roads as well as street lights.

The PV cells are combined to form solar panels (Figure 8.2). The panels usually differ in size depending on the purpose of their installation. The series of combined PV cells are usually placed on roofs of houses or on top of traffic lights to form the panels, which capture solar energy. For adequate energy to be obtained, solar panels should face the sun so that more sunrays are converted into electrical energy.

China, Germany, Italy, the USA, and Japan possess the biggest solar photovoltaic (PV) technology capacity in the world.

In Tanzania, solar energy is used as a source of power by 24.7% of the households that have access to electricity. High potentials of solar energy resources are found in the central parts of the country.

Currently, solar energy is used in different parts of Tanzania. Solar thermal is used for heating and drying; and photovoltaic is used for lighting, water pumps, refrigeration purposes and telecommunication. Solar energy is used mostly in rural areas by about 64% of its people compared to urban areas with only 3.4%. The regions of Lindi, Njombe, Mtwara, Katavi, and Ruvuma lead in the use of solar power electricity in Tanzania. The advantages of using

solar energy is that it is friendly to the environment. However, the technology for utilising and harnessing solar energy is expensive.



Figure 8.2 Solar panels

Source: shuttersstock.com

Geothermal energy: Geothermal energy refers to the heat energy generated and stored in the earth. Tapping this energy involves pumping cold water into hot rock boreholes and extracting the steam through another borehole. Due to the force by which the hot water comes out, it has the ability to drive turbines to generate electricity. Geothermal power production is mostly found in volcanic areas. Geothermal evidence in Tanzania is found in Mara, Manyara, Mbeya and Rukwa. In these areas, water naturally flows out as hot fountains. Geothermal evidence is also found in Kenya, South-Eastern Nigeria, Madagascar, USA, New Zealand and Iceland. Figure 8.3 shows a geothermal plant generating electricity. Geothermal energy can be used for domestic purposes or on large-scale by industries. It was used during earliest times for bathing and space heating. The biggest disadvantage with geothermal energy is that it can only be produced at selected sites.



Figure 8.3 Geothermal Plant

Source: Free photoon.pixabay.com

Hydro-electric power energy: Hydro-electric power is created by the force of flowing water from mountains or high landform streams. Thus hydro-electric power is a result of water in motion. Moving water possesses energy which can be converted into electric energy if the following conditions are met:

- (i) There should be a constant supply of water. This is possible if the sources of water are areas where there is heavy rainfall, natural lake or melting water from mountain glaciers. It is also possible where there is a reservoir that could be a lake or dam to store the water needed.
- (ii) There must be a ready market for the power generated. The aim is to minimise the cost of transmitting electricity.
- (iii) The ground has to be steep to allow fast flow of water. For example, a waterfall that can drive hydro turbines.

A dam can be constructed across a river or along the coastal strip where tidal waves are common. The power house is

constructed adjacent to the dam. Then, water at very high speed (from streams, glaciers, natural water falls or man-made dams) is directed to the turbine chamber.

As the turbine rotates, the generator or dynamo also rotates to produce electric power. The power generated is then transmitted to the transformer where it is transmitted for industrial and domestic uses, as shown in Figure 8.4.

HEP is primarily advantageous because it does not discharge pollutants into the environment. In addition, if people turn to using hydroelectric power, deforestation caused by use of fuelwood may be reduced. The problems faced with hydropower have to do with the aging of the dams. It is costly to maintain them for their functionality and safety. Globally, China has the biggest hydroelectric generation capacity in

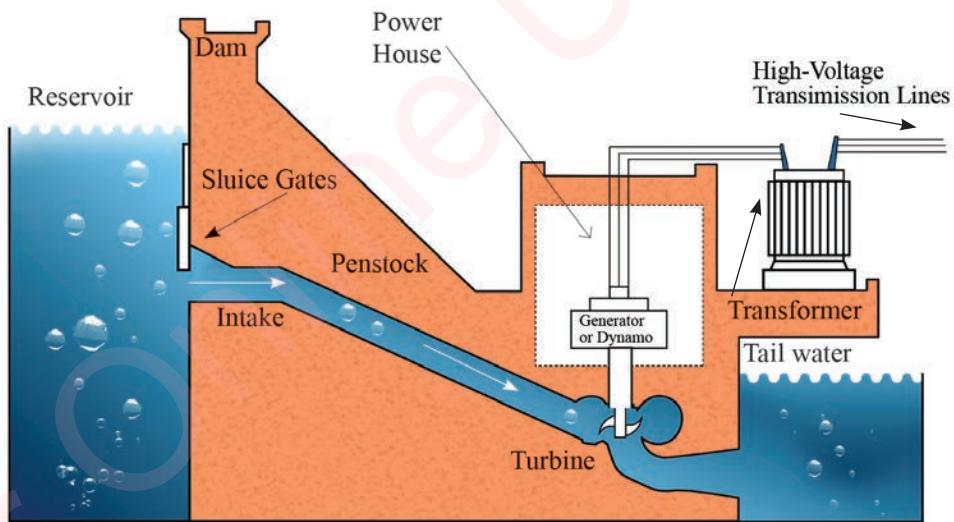


Figure 8.4 A model of a hydro-electric power plant

the world, followed by Brazil, Canada, and Russia. Currently, hydropower constitutes over 45% of the total power generated in Tanzania.

Fuelwood: Wood energy is energy generated from wood extracted products through combustion processes. The energy is used for cooking, heating, and generation for electricity. Likewise, the term “wood energy” is used to refer to wood and materials developed from wood used for energy purposes (“woodfuel”). Woodfuel can be in solid, liquid or gaseous form. Examples of solid woodfuel include firewood, charcoal, and wood pellets produced from wood or wood residues. Liquid woodfuel include Bio-oil, Bioethanol and gaseous woodfuel including wood gas.

Fuelwood comprises unprocessed wood biomass harvested from stems, branches or other parts of trees. Likewise, sometimes it is generated from wood residues such as sawdust and wood shavings generated from timber harvesting, or wood processing industries. Globally, roughly 2500 million people rely on wood fuel for heating and cooking. In USA, the community uses about 85% of all the wood collected from forests as fuel or charcoal for heating and cooking.

In Tanzania, biomass/bio-power (wood) is the largest energy source. More than 1 million people engage in charcoal production and supply. Currently, there is an upsurge in modern biomass

utilisation. The raw materials available such as municipal solid waste, forest residues, sugar bagasse, rice husk, sisal, and coffee can be used to generate power.

Non-renewable energy sources: These refer to sources of energy that cannot be re-used. They are non-renewable because their formation takes a long time, usually millions of years. Fossil fuels such as coal, oil and natural gas are non-renewable sources of energy. They originate from remains of plants and animals which have decomposed for a long time under high pressure and heat. These energy sources are described in the following sub-sections.

Nuclear energy: Nuclear energy is derived from atoms by altering or breaking their structure. Alteration of the structure of the atom leads to a release of energy in the form of heat. Released energy is used to generate electricity. An important raw material for this process is uranium. Although nuclear energy itself is a renewable energy source, the material used in nuclear plants is not renewable. Nuclear power is mostly generated in USA, France, Russia, China, India, Canada, Israel and UK. Nuclear power plants do not produce or emit greenhouse gases. They can be built in both rural and urban areas, and do not destroy the surrounding environment. However, nuclear energy is difficult to harvest and nuclear plants are very complicated to build and run. Likewise, in many communities there is limited capacity to develop a safe and reliable

nuclear energy programme. Nuclear energy also produces radioactive materials, which increase health risks in the communities where the plants are located.

Coal energy: Coal occurs in sedimentary rocks in layers or seams of varying thickness. It is available in different countries such as Tanzania, China, USA and South Africa. If the coal seams are near the earth's surface, coal is extracted through strip mining. Under this method, coal is exposed via an open-pit into coal deposits. If coal is found in a mountain peak, extraction involves the removal of the highest part of that mountain to recover the coal. Burned coal produces heat energy, which is used for purposes such as domestic heating, smelting of iron and steel, boiling of water and steam production.

Petroleum: Petroleum is organic in origin. It occurs in the pore spaces between sedimentary rocks. Once a drilling site is decided upon, a steel derrick about 30 metres or more depending on the location of the petroleum bearing rock is fixed upright and the equipment for drilling is used. Steel tubes are inserted into the boreholes. Once the drill reaches the oil bearing rock layer, oil flows out through the boreholes and keeps flowing as shown in Figure 8.5. The oil is then transported through pipelines to the refinery.

Natural gas energy: Natural gas is often found together with petroleum. It is found concentrated in the uppermost part of the trap. Sometimes, natural gas occurrence is independent of petroleum. Natural gas is mainly composed of hydrogen, carbons and methane. Other ingredients of natural gas include butane, propane,

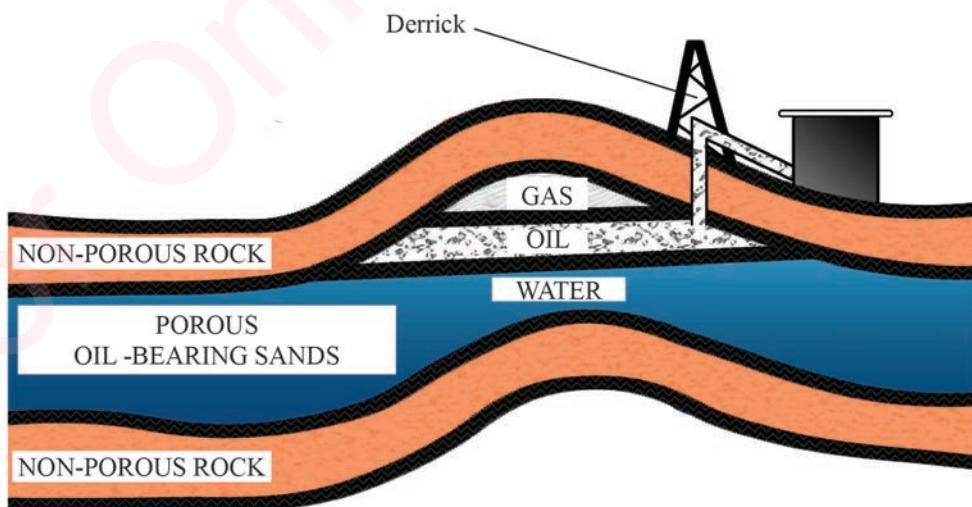


Figure 8.5 A derrick at an oil well

ethane, helium, nitrogen, carbon dioxide and hydrogen sulphide. Natural gas is extracted by drilling a borehole in the ground before inserting steel tubes into the borehole. Once the drill has reached the gas-bearing rock layer, gas flows out through the borehole and keeps flowing through special pipes up to the power generating plant where the refining takes place. Figure 8.6 is an example of a natural gas plant.



Figure 8.6 Natural gas plant at Kinyerezi 1, Dar es Salaam

Source: <http://csi.energy/project/kinyerezi-1-power-plant-150-mw/>

Importance of power and energy

The following section explains why power and energy are important to human life.

Running machines: Power and energy are used to run machines in industries and provide light at homes, schools, hospitals and other institutions. In the agricultural sector, energy is used to run farm machinery and equipment such as tractors and combine harvesters.

Raw materials: Some sources of energy are raw materials of some industries. For example, oil is a raw material for petrochemical and refinery industries in the making of plastics, medicines, clothes and ropes.

Transport enhancement: Energy plays an important role in improving the transport sector because vehicles, locomotives, aircraft and vessels use petrol or diesel.

Economic development: Energy is a source of foreign currency. Some countries export electricity to other countries. Other sources such as oil, coal and natural gas are exported to other countries and earn foreign currency, which is used to develop other sectors such as agriculture, education and health. Also the generated electricity can be sold to other countries and earn foreign currency.

Tourist attraction: Places with energy installations tend to attract tourists, for example, geothermal, HEP stations, and windmill plants.

Fishing and irrigation areas: The dams constructed to produce HEP become useful in fishing and irrigation. For example, Mtera Dam has become a source of fish for commercial and domestic use.

Employment: Power and energy generation employs so many people who work in the power plants.

Challenges facing power and energy production

Power and energy production is facing many challenges. Some of these are described below.

Drought: Prolonged droughts decrease the volume of water, which in turn reduces the ability of hydro-electric power plants to produce electricity.

Inadequate capital: The construction of dams and hydro-electric power stations requires heavy capital outlays. Capital is also essential in the production and transportation of natural gas. Unfortunately, many developing countries lack capital to harness fossil fuel and hydropower potentials.

Transport and communication networks: These are inadequate in many developing countries, which hinders the extraction or transmission of energy and power.

Poor technology and lack of skilled personnel: Some energy and power production systems such as nuclear, tidal and geothermal energy require advanced technology, which is lacking in most developing countries.

Environmental pollution: Energy and power production may lead to environmental pollution. This happens when fossil fuel produces pollutants, including greenhouse gases such as carbon dioxide, methane and nitrogen oxide due to burning. This contributes to water and air pollution, global warming, and climate change.

Dam siltation: Siltation of dams constructed for HEP reduces the capacity of reservoirs. This affects the generation of hydro-electric power, and sometimes causes flooding.

Disposal of nuclear waste: Nuclear waste is highly radioactive. It needs to be safely disposed off or stored for many years. But the process is extremely expensive.

Environmental disaster: Nuclear power generation if not well-handled can be disastrous due to leakage at nuclear plants. For example, Fukushima in Japan in 2011 and Chernobyl in Russia in 1986 had nuclear leakage, which led to environmental disaster including air and land pollution, and loss of biodiversity.

Forest degradation and loss: Establishment of hydro-electric power stations leads to clearance of vegetation or submerges large tracts of land which destroys wild life habitats and, sometimes, reduces land for agriculture.

Price fluctuation: Fluctuations of prices of fossil fuel affect production. Sometimes, oil producing countries have to reduce oil production to control the price in the world market. This calculated reduction affects economies of supplying and buying countries.

Addressing the challenges of energy and power production: Different measures can be taken to address power