Human Geography

for Advanced Secondary Schools

Student's Book
Form Five and Six

Tanzania Institute of Education

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Human Geography

for Advanced Secondary Schools

Student's Book

Form Five and Six

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION,

SCIENCE AND TECHNOLOGY

Certificate of Approval

No. 738

Title of Publication: Human Geography for Advanced Secondary Schools Student's Book Form Five and Six

Publisher: Tanzania Institute of Education

Author: Tanzania Institute of Education

ISBN: 978-9987-09-401-1

This book was approved by the Ministry of Education, Science and Technology on 2nd March, 2022 as a Textbook for Form Five and Six students in Tanzania Secondary Schools as per 2010 Syllabus.

Dr Lyabwene M. Mtahabwa

Commissioner for Education

Tanzania Institute of Education

HUMAN GEOGRAPHY FORM V-VI._FRIDAYindd.indd 1 13/03/2022 16:16

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Published 2022

ISBN: 978–9987–09–401–1

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Acronyms and abbreviations

AAKIA	Abeid Aman Karume International Airport
ATCL	Air Tanzania Cooperation Limited
ASFR	Age Specific Fertility Rate
BC	Before Christ
BRT	Bus Rapid Transit
CBR	Crude Birth Rate
CDR	Crude Death Rate
CFC	Chlorofluorocarbons
CMR	Child Mortality Rate
CO_2	Carbon dioxide
COVID-19	Corona Virus Disease of 2019
CWR	Child Women Ratio
DFZs	Disease-Free Zones
DHS	Demographic and Health Survey
DRC	Democratic Republic of Congo
DTM	Demographic Transition Model
EIA	Environmental Impact Assessment
GDP	Gross Domestic Product
GFR	General Fertility Rate
GHGs	Green House Gases
GIS	Geographical Information System
GNI	Gross National Income
GNP	Gross National Product

GPS	Global Positioning System
GRR	Gross Reproductive Rate
HDI	Human Development Index
HDSS	Health and Demographic Surveillance System
HEP	Hydroelectric Power
HIV	Human Immunodeficiency Virus
ICT	Information and Communication Technology
ILO	International Labour Organization
IMF	International Monetary Fund
IMR	Infant Mortality Rate
ITB	International Tourism Board
KIA	Kilimanjaro International Airport
JNIA	Julius Nyerere International Airport
LE	Life Expectancy
LEDCs	Least Economically Developed Countries
LDCs	Least Developed Countries
LVEMP	Lake Victoria Environmental Management Project
MDGs	Millenium Development Goals
M&E	Monitoring and Evaluation
MMR	Maternal Mortality Rate
NAFCO	National Agricultural and Food Corporation
NBS	National Bureau of Statistics
NCA	Ngorongoro Conservation Area
NEMC	National Environment Management Council

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NFRA	National Food Reserve Agency
NIDA	National Identity Authority
NFP	Natural Family Planning
ODK	Open Data Kit
OSHA	Occupation Safety and Health Authority
R & D	Research and Development
RITA	Registration, Insolvency and Trusteeship Agency
RNI	Rate of Natural Increase
SAFJA	South African Fruit Juice Association
SADCC	Southern African Development Coordination Conference
SDGs	Sustainable Development Goals
SGR	Standard Gauge Railway
TAA	Tanzania Airport Authority
TAFICO	Tanzania Fisheries Corporation
TAFIRI	Tanzania Fisheries Research Institute
TAH	Trans African Highways
TANAPA	Tanzania National Parks Authority
TANROADS	Tanzania National Roads Agency
TARURA	Tanzania Rural and Urban Roads Agency
TAZAMA	Tanzania-Zambia Mafuta Pipelines Limited
TAZARA	Tanzania-Zambia Railway Authority
TBAs	Traditional Birth Attendants
TB	Tuberculosis
TCAA	Tanzania Civil Aviation Authority

TCRA	Tanzania Communication Regulatory Authority
TFC	Tanzania Fertilizer Company
TFR	Total Fertility Rate
TIC	Tanzania Investment Center
TICTS	Tanzania International Container Terminal Services
TPA	Tanzania Port Authority
TRC	Tanzania Railways Cooperation
TRE	Transnet Railway Engineers
TTB	Tanzania Tourist Board
UK	United Kingdom
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNCED	United Nations Commission on Environment and Development
USA	United States of America
WFP	World Food Programme
WTO	World Trade Organization

Acknowledgements

The Tanzania Institute of Education (TIE) would like to acknowledge the contributions of all organisations and individuals who participated in designing and developing this textbook. In particular, TIE wishes to thank the University of Dar es Salaam (UDSM), the University of Dodoma (UDOM), the Dar es Salaam University College of Education (DUCE), school quality assurance (SQA) department, teachers' colleges and secondary schools. Besides, the following individuals are acknowledged.

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TIE also appreciates the contribution of the secondary school teachers and students who participated in the trial phase of the book manuscript. Likewise, the Institute would like to thank the Ministry of Education, Science and Technology for facilitating the writing and printing of this book.

Dr Aneth A. Komba
Director General
Tanzania Institute of Education

Preface

This textbook, *Human Geography for Advanced Secondary Schools* is written specifically for Form Five and Six Students in the United Republic of Tanzania. It is written in accordance with the 2010 Geography Syllabus for Advanced Level Secondary Education Form V-VI, issued by the then Ministry of Education and Vocational Training.

The book consists of six chapters, namely Population and development, Agricultural development, Sustainable use of natural resources, Environmentally friendly tourism, Manufacturing industries, and Transport and communication. Each chapter contains texts, illustrations, pictures, exercises and activities that enhance learning. You are encouraged to do all the activities, exercises as well as other assignments that your teacher will provide you. Doing so, will enable you to develop the intended competencies.

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Chapter

One

Population and development

Introduction

The concepts of population and development are subjects of various contentions. These concepts are closely related in such a way that one affects the other. In this chapter, you will learn about population and development, and their related concepts. You will also learn about the relationship between human population and development. Moreover, you will learn about population structure, population dynamics and quality of life, population policy, population growth and socio-economic planning. Through case studies, you will make comparative analyses of population issues in different areas and their effects in sustainable development. The competencies developed will enable you to relate human population and socio-economic development at the family and national levels for the future developmental planning.

Concepts of population and development

Population

The word population originates from a Latin word '*populi*' which means people. In general, the term refers to a particular section, group or type of people, animals or plants living in an area or a country. It can also be defined as inhabitants in a place belonging to a specific socio-cultural, socio-economic, ethnic or racial subgroup.

Specifically, human population is the total number of people or inhabitants in a given country or region at a particular time. Human population can also refers to a group of people occupying or residing in a certain geographical unit such as a village, district, region or country. A scientific discipline that specialises in studying population is called Demography. It covers population growth, birth, mortality, migration and distribution, as well as aspects of economic and social development.

Development

Development can be defined as a change in terms of advancement in social, political, economic and technological spheres. It refers to the socio-economic and political changes that allow humans to realise their needs from lower to higher stages. It is the process in which people increase their freedom and improve their standards of living.

Development also implies a qualitative and quantitative improvement in the utilisation of resources. It can, therefore be said that development is a significant consequence of the process of progressive

change. Human population is related to the development process, in a sense that it is not only the number of people that matters, but also its quality, distribution, structure and how it manipulates resources in the production process for socio-economic development.

Indicators of development

There are several indicators of development of a country or region level. According to multilateral agencies and financial institutions such as the World Bank, International Monetary Fund (IMF) and the United Nations, indicators are mainly divided into economic, social and political aspects. These indicators are contextualised by each nation for measuring development.

Economic indicators of development measure how developed a country is in economic terms. Social indicators measure how developed a country is in terms of non-financial and non-economic factors. Political indicators measure how developed a country is in terms of political aspects such as human rights, democracy and civic education.

It is difficult to judge development of a country using a single indicator, thus a combination of the following indicators offers a more holistic view of a country's development.

Gross Domestic Product (GDP): GDP is the total value of goods and services produced by a country in a year. This measure indicates the performance of economic activities and the productivity of a population in a country. It enables one to judge whether the economy is declining or growing.

Gross National Product (GNP): GNP, also known as Gross National Income (GNI), measures the total economic output of a country, including earnings from foreign investments. It is the total domestic and foreign output claimed by residents of a country, consisting of a gross domestic product (GDP) and factor income earned by foreign residents minus income earned in the domestic economy by non-residents.

Although GNP and GDP indicate economic development, these measures do not show whether people in a country have good quality of life or not. Also, because they are presented averages they hide information about people who are very rich or very poor.

Economic growth: Economic growth is measured by an annual increase in GDP and GNP of a country. An increase in these indicators suggests that a country is developing.

Aid received: Aid received measures the amount of money a country receives as a percentage of its GDP. Higher values in aid would suggest that a country is unable to create enough wealth domestically to provide for its population.

Literacy rate: Literacy rate measures the percentage of adults in a country who are able to read and write using their common language. A higher literacy rate is an indication of higher standards of education and improved ability of the population to secure formal employment.

Number of people per doctor: Number of people per doctor measures the average number of people that can be attended by a doctor at a time. Higher number of people per doctor indicates low development. This occurs due to low investment in training of health staff and low health budget.

Human Development Index (HDI): HDI is a measure of a country's achievement in socio-economic development. It captures health, education, and income growth of a country. In the educational dimension, it measures the number of years of schooling. In health dimension, it gives an emphasis on a long and healthy life as measured by life expectancy. HDI was developed by the United Nations and it is considered to be a reliable measure of development across the globe.

The nature and characteristics of a population in a given area has a great impact on its socio-economic development, hence the concept of sustainable development is increasingly appreciated and integrated in population studies. This suggests that the nature of the population in a given area needs to be integrated within the indicators and practices for sustainable development.

Sustainable development

Sustainable development is the development that meets the needs of the present generation without affecting (compromising) the ability of the future generations to meet their own needs as well. There are three dimensions of sustainable development; environmental, economic, and social. These have been developed to assess our current and future development practices. In the environmental dimension, sustainable development emphasises sustainable use of resources such as water, energy, minerals, land and forests to ensure that they are not destructed or destroyed.

In the economic dimension, sustainable development emphasises continuity in income generation activities, employment generation, productivity and investments. The social dimension emphasises that any strategy for delivery of social services should consider the environment by enhancing conservation, protection, and proper utilisation of natural resources.

In 2000s, the Millennium Development Goals (MDGs) were formulated by the United Nations. In 2016, they were revised to form 17 sustainable development goals (SDGs). The goals were designed to guide human efforts to ensure that development in terms of GDP, GNP, access to social services, infrastructures, human rights and efficient utilisation of resources is sustainable. To achieve sustainable development, principles of sustainability and dimensions have to be considered. Among them are; no poverty, zero hunger, good health, and wellbeing, quality education, gender equity, clean water and sanitation, and sustainable cities. Population characteristics must also be balanced with the environment.

Sustainable development deals with issues of poverty, education, population, governance, health, natural and human hazards, atmosphere, land, ocean, sea and coasts, freshwater, biodiversity, economic

development, global economic partnership and consumption, and production patterns. On political aspects, sustainable development deals with basic human rights such as the right to live, move, speak, and choose employment freely. It can therefore, be said that freedom of speech, health rights, development and the environment are closely interlinked. Lack of progress in one of the aspects will have a constant threat to the development of the others.

Exercise 1.1

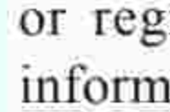
1. With examples, describe the following concepts;
   (a) Population
   (b) Development
2. Sustainable development has various dimensions. Discuss.
3. Describe at least five indicators of development.
4. With examples, evaluate how indicators of development can be used to measure development of a certain country.

Activity 1.1

Read textbooks and other relevant sources on sustainable development. In your group, discuss and present in a class:

(a) Five strategies used by your country to promote sustainable development.

(b) Three themes from at least two international conferences on sustainable development, and they relate to population



Activity 1.2

In your group visit a library. Find and study the 2012 demographic and socio-economic survey data then, discuss and make a comparison between population and development of any two regions of your choice.

Population data

Population data refer to the information on the population of a given country or region at a particular time. The information includes socio-economic and demographic data such as income, education, employment, age, sex, birth, death, and migration. These data are very important for development planning of any given country.

Characteristics of population data

Age and sex data

Age and sex data inform us a lot about the current and future population structure, which informs us of the size of the productive and dependent in a population.

Marital status data

Marital status data are also significant population data for planning. They relate to the numbers of the married, divorced, widowed, single, and separated persons in a particular geographical area.

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Location data

Data about where people live provide information about people present in a geographical space, as well as about their movements. Furthermore, location data inform on the spatial distribution of a population.

Socio-economic data

Socio-economic data are related to economic activities, occupation, labour force, and social services including;water, health, education, transport, and communication. The socio-economic data may be used to characterise population in a region or country.

Land and housing data

Land and housing data relate to land ownership, land tenure systems, and land uses. and housing conditions. All of these characteristics of population data are significant since they form demographic patterns of a country in which government planning and programmes for the development are based.

Sources of population data

There are two major sources of population data. These include; traditional and non-traditional sources:

Non-traditional sources

These are data sources other than those commonly referenced in the traditional sources and they are also known as non-conventional sources of data. They are classified as follows;

Registers: They include parish registers, school registers and direct taxation registers that record individual data. They also include registers for maternity clinics, child welfare services, social security in reproductive health, records from insurance companies and social security claims, burial society registers, and special levy registers.

Registers also provide information on a population crossing borders of another countries. They are normally used in frontier customs posts, airports and harbours which allow people to cross a boarder of another country. These are known as migration data.

Uses of non-traditional sources of population data

Non-traditional sources of population data help to provide information on the size of the population and its distribution by age and sex and by their social, professional, and occupational statuses. Furthermore, they can also help to verify or match data obtained from a formal surveys. They also facilitate growth of a historic review known as demographic phenomena which is observed over a period of time.

The advantages and disadvantages of non–traditional source include; they can be used at any time when an event occurs. They are also easy to obtain compared to conducting censuses. Additionally, non-traditional sources provide up to date information.

The non-traditional sources, however, may have information that does not cover the whole relevant population. Some records may also be outdated especially where individuals may happen to have

infrequent and irregular contact with the administrative system. Data obtained from non-traditional sources are difficult to be compared because they are recorded for specific events.

Traditional sources

These are also known as conventional sources of data. They include censuses, sample surveys, and vital registrations.

Census

The word census has its origin from a Latin word "censere" which means to value or tax. The original meaning indicates that early censuses were related to taxation. The ancient Greeks used it in counting of adult males for military purposes. Population census is the process of collecting, compiling, analysing, and publishing demographic, and socio-economic data of a population for a specific time within a specified geographical area. This process is an official enumeration of the inhabitants of a country with statistics relating to their location, age, sex, marital status, literacy status, language, education level, economic activity, number of children and migration.

Essential characteristics of a census

Individual enumeration: Individual enumeration means each individual is enumerated separately. The characteristics of each person within a household are recorded separately and are treated confidentially. This is different from the early years census practice where people would assemble in a particular place for the households or group information to be collected.

Periodicity: Periodicity suggests that census is taken at regular and defined intervals so that comparable information is made available in a fixed sequence. A series of censuses makes it possible to appraise the past, accurately describe the present and rationally predict or forecast the future. For example, censuses which are held at defined regular intervals of every 10 years are known as *decennial census*. Countries such as Tanzania and United State of America (USA) are examples of countries conducting decennial census. For example, in Tanzania census were conducted in 1967, 1978, 1988, 2002 and 2012. There are countries which conduct census after every 5 years and this type of census is known as *quinquennial census*. Such countries include Japan, Australia, Ireland, New Zealand, and Canada. It should be noted that conducting a census may sometimes be affected by factors such as civil unrest, war and economic stagnation.

Sponsorship: Census is usually sponsored by national governments. It is the responsibility of a government of a country to provide and mobilise its resources from various sources necessary to finance a census.

Universality: Universality suggests that a census covers all people living at a particular time in a particular country or region. When universality is not met or achieved for reasons such as war and hostility of some tribes or groups of people, then the type of coverage used

and achieved should be fully described in the census publications.

Simultaneity: Simultaneity in census means the total population recorded should refer to a specified point in time. Censuses are to be held at the same time and for a specified period of time throughout the country or region. This is important for comparative purposes since data collected at the same time can well be compared than data collected at different times. In Tanzania, for example, all censuses were conducted on the last sunday of August in respective years. Although the enumeration exercise was not completed on the same day, the official reference period for conducting census was the mid-night of the census day.

Types of censuses

There are two major types of census; *de facto* or *de jure* which are differentiated on the basis of the method of conducting a census.

De facto census

De facto census is the type of census which allows people to be enumerated or counted wherever they are on the day of census enumeration. It allows people who slept in a household during the night of a census day to be enumerated under that household regardless of whether or not they are permanent members of that household. Generally, this census is called a one-night enumeration because it is conducted for one day only. It is a common type in developing countries like Tanzania where the many people, especially in rural areas, are illiterate and they cannot fill in a questionnaire by themselves.

De jure census

De jure census is the type of census conducted by counting people according to their permanent places of residence. In this type of census, only permanent residents of a household are counted. Compared to *de facto*, this is more practical and scientific. Nepal (in South Asia) is one of the very few countries which use this method or type of census. Advantages of this method include; allowing enumerators sufficient time to collect information from households by making frequent visits, which avails possibility of collecting a wide range of information relating to sex, age, language, education, and occupation of people.

Generally, a census has several advantages. First, it does not suffer from sampling errors because it covers the whole population in a country or region. Second, results of a census can easily be compared with the results of censuses of other countries because of its universality. Third, it provides comprehensive or holistic information on socio-economic development. Fourth, it provides information on age and sex, labour force and unemployment, literacy rate, mortality, fertility levels, population distribution, and trends and change. Fifth, it is the most reliable source of demographic data especially in developing countries. Sixth, it helps in the making of population policy. Seventh, it is used by an election commission of a country to demarcate constituents and to allocate seats for

Municipal councils, state legislatures, and national parliament. Eighth, it is helpful to governments in planning and allocating human resources and social services to different geographical areas of a country.

Steps in conducting census enumeration

Planning: Planning is the first step before the actual census. It is done by the responsible authority. In the case of Tanzania, it is the National Bureau of Statistics (NBS) which is responsible for the planning of the census exercise. Planning involves preparation of resources; financial, human, and materials required in conducting census enumeration.

Developing and designing questionnaires: This second step involves developing and designing of the questionnaire for data collection. This step takes several months because it involves writing and revising questions as well as determining the data required.

Pretesting of questionnaires: The third step involves pretesting of the questionnaire. This includes selecting one region or few places where pretesting of the questionnaire prepared is done before the actual census activity. This step provides room for examining the relevance and flow of questions. After this step some questions may be revised.

Recruitment and training of enumerators: The fourth step involves recruitment and training of census enumerators or data collectors. In Tanzania, census enumerators are sourced from the public service most often teachers. Enumerators also include graduates from various universities.

Enumeration or data collection: The fifth step involves an actual enumeration process on the census day. It is a process where enumerators visit households to collect data.

Analysis and presentation: This sixth step involves processing and analysing the collected data by a responsible authority such as NBS in Tanzania. Both qualitative and quantitative analysis are used in this step.

Dissemination: This is the seventh step in which reports are produced and are disseminated first to the government and, thereafter, the public for consumption. At this stage, data can be used for planning and implementation of various development activities.

Uses of census data: This is the eighth and last step in conducting census enumeration. It involves the use of census data to provide a profile of the country's population. Data is used to generate a database for planning and evaluation of performance of plans, and forecast a future population size and distribution. It is also used to; investigate adequacy of the relationship between demographic and socio-economic processes, allocate parliamentary seats/constituencies, facilitate administration, economic and social research, forecast the voting population in constituencies and in a country at large, and provide data for planning.

Challenges facing the census process

Census is likely to face various challenges. One of the challenges is that only a limited number of questions can be asked and a census may not be long enough to accommodate public concern. Another challenge is that a census can only be carried out at intervals of five or ten years because the exercise is too expensive to be carried out at shorter intervals. These intervals are too long to satisfy data requirements of developing countries whose population growth and change occur very fast.

Moreover, in some areas census can be affected by factors such as topography (mountains, valley, rivers and forest), distances, and accessibility. Due to these challenges and where plans for addressing them are not in place, census data are likely to be characterised by a high margin of error and inaccuracy since enumerators can only provide estimated data.

Another challenge is that, a census is very costful. A census also requires a lot of resources and time. It also requires a lot of trained manpower for collecting, compiling, and analysing data. Due to these costs, some countries, like the Democratic Republic of Congo (DRC) and Ethiopia have not been conducting censuses periodically as is required. The government of Tanzania also did not conduct a census in 1998 due to the financial challenges.

Lastly, census is always not well perceived by some tribes and indigenous groups. They do not feel secure when counted, thus they run away to avoid being counted.

Sample survey

Sample survey is another method of collecting population data. It involves collecting data for a portion or selected geographical area such as a district or a region which is used to complement censuses data. The sample is taken on random or non-random mode to generate detailed information on specific characteristics of a population such as family size, birth intervals, age at marriage. The sample also provides the basis for estimating population parameters, especially when the sample is based on a random method.

Collection of information from a sample can be undertaken using a questionnaire through personal interviews, telephone interviews, self-enumeration or direct observation. Surveys can be used to collect a variety of demographic information such as fertility, health and disability statuses, labour force participation, training and occupation, income levels, wealth and poverty as well as nutrition status. They are also used to assess the impact of programmes or existing policies in order to influence the government and other funding agencies.

Sample surveys are used to look at the impact of economic, social and environmental factors on population or how the government policies influence the levels and patterns of health, mortality, fertility, and migration. Examples of sample survey include household surveys such as Household Budget Survey (HBS) which are used to collect data on living conditions of the population; and

Demographic and Health Surveys (DHS) which are used to collect information on demographic aspects such as health, sexual and reproductive conditions and women's health.

Types of sample surveys

Single round surveys: A single-round survey involves conduct only one interview with the respondents. More often this type of design permits the use of large samples and it is more convenient in countries where addresses are not well defined or where the population is highly mobile. A good example of the type of sample survey is the Demographic and Health Survey (DHS).

Multiple rounds surveys: The multiple-round surveys include a variety of surveys which make use of population or the same respondents from the same geographical location. In this case, respondents are re-interviewed several times. Such surveys are commonly known as follow-up, panel or longitudinal surveys. These are often used in Health and Demographic Surveillance Systems (HDSS) which are conducted in many developing countries, including Tanzania. They provide indications of life trends overtime, including the seasonality of deaths and births.

Advantages of sample survey

First, sample surveys are cheaper and simpler to administer compared to censuses. Second, they offer plenty room for designing and collecting some specific data or meet a certain purpose. For example, household food and dietary surveys aim at assessing food and dietary status of a population, while land tenure surveys are used to assess land ownership statuses at household levels. Third, they may be used together with other methods such as documentary review. Forth, more details can be collected with sample surveys and can be useful to study and understand the population. Fifth, they can be planned and carried out in shorter periods of time depending on the needs, unlike census.

Disadvantages of sample surveys

First, they are affected by the method of sampling or sampling errors. Second, they may not be representative of the general population. Third, sampling may be characterised by some errors that are human and technical. Fourth, in case where survey data are not representative, they may not be useful in planning for a particular population.

Vital registration

A vital registration is used to record vital event which is defined as a major change in individual status that leads to a change in the composition of the population. Examples of vital events are marriages, births, deaths, divorce, separation, annulments, legitimisation and migration. Censuses and surveys describe a state of the population at a fixed point in time. Vital registration are a major source for the study of a population change because they are collected on a continuous basis for various registrations which include deaths, births, and marriages.

Vital events which are registered frequently include births, deaths, migration and

marriages. In Tanzania, the Registration, Insolvency and Trusteeship Agency (RITA) and the Department of Immigration (DI) are responsible for registration of these vital events and issuance of birth and death certificates, passports, as well as work and residence permits.

Advantages of vital registration

First, they provide current information since they are registered continuously. The number of births, deaths, marriages, and migration are recorded on a daily basis and continuously. Second, they show dynamics occurring in mortality, fertility, and migration, which can be useful in planning. Third, birth registration records provide necessary legal and documented evidences to certify a person's age, parentage, birth place, and nationality or citizenship. Forth, birth registration certificates are used in the determination of person's eligibility for admission to school, to obtain a passport, to enter a certain field of employment, and to vote. Fifth, a death certificate is mandatory for civic functions, such as entitlement to family property, insurance claims, care of children, and tax reductions or benefits. Sixth, vital statistics provide legal evidences relevant to claims of property use and ownership to insurance claimed on the life of a deceased person. It may also be used when making inheritance claim or family allowance where death creates a financial need. Seventh, marriage and divorce records are the basis for establishing ones right to re-marry. Eighth, the statistics may be used as a check on census enumeration, particularly records of infants and young children. Ninth, in the populous countries, statistics can be useful in formulating population control programmes and in evaluating the effectiveness of such programmes. Tenth, data about the deaths and their causes as recorded on a death certificate are essential in the planning of health services for specific areas and for an entire country. For example, statistics on causes of death is helpful in forecasting future causes of age specific mortality. Eleventh, epidemiological studies based on morbidity data have strong influence on the reduction of mortality and they are usually based on records of vital statistics.

Lastly, vital statistics can be integrated with modern technologies and software to provide real time data. There are various computer and mobile phone softwares that can be used to collect and provide these vital events. In Geography, for example, the Geographical Information System (GIS) is one of the important tool that could be useful for registration of vital events. Through mobile phones, softwares like *koBocollect* and Open Data Kit (ODK) can be used for data collection, processing and submission.

Disadvantages of vital registration

First, vital statistics may not provide accurate information because they are sometimes affected by under-enumeration of vital events, such as non-registration of births of children who die a few hours or days after they are born. Second, they may fail to provide legal evidence because sometimes they suffer from misreporting of information, such as, age of the deceased or causes of deaths.

Third, vital statistics may not be reliable sources for the study of population change because they are sometimes affected by outdated and inadequate legal framework and they lack coordination within and between civil registration systems.

Exercise 1.2

1. Briefly, describe the following concepts:
   (a) Population data
   (b) Census
   (c) Sample survey
2. Examine five characteristics of population data.
3. Discuss five features of a census.
4. Identify two types of censuses and explain three advantages and disadvantages of each type.
5. Describe in details, steps to be followed in conducting censuses in countries like Tanzania.
6. Discuss five challenges facing population census in the developing countries.
7. With examples, explain three advantages and three disadvantages of vital registration in Tanzania.
8. Describe five characteristics of non-traditional sources of population data.
9. Discuss three advantages and three disadvantages of a sample survey.

Activity 1.3

1. Study the data in Figure 1.1 from the National Population and Housing Census report of Tanzania between 1967 and 2012 and answer the following questions.
   (a) In a group of five students discuss the trend of population in Tanzania?
   (b) Explain five importance of these census data for the development in Tanzania.

Activity 1.4

In a group;

(a) Discuss and establish a plan to conduct the census and then present it in a class.
(b) Explain the characteristics of census.

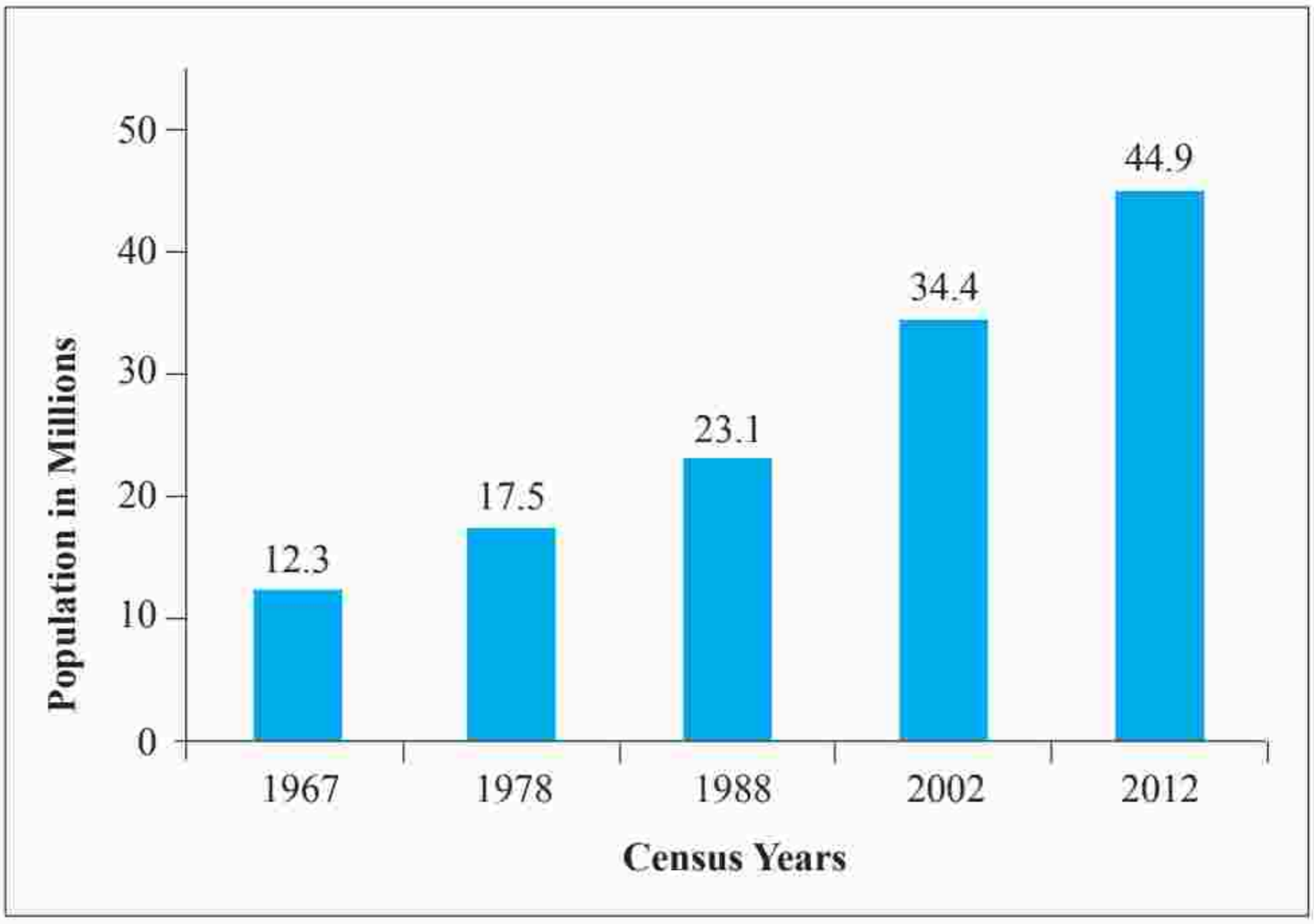


Figure 1.1: *Tanzania census data from 1967 - 2012*

Source: Tanzania Housing and Census Data (1967-2012)

Importance of population data

Collecting and analysing population data is an essential activity that provides a country with invaluable information. Population data are needed for development. The following aspects explain the importance of population data:

Understanding population trends: Population data are important in understanding trends in population. Population trends may show an increase, a decrease of stagnation of the population. For example, increase in population could be an opportunity for development because it offers labour force and market. It could also be a burden to development because it entails more costs to the government in terms of provision of social services by the government.

The budgeting process: Population data is important for budget preparation. Understanding the number of people living in a particular area helps the government in the planning, decision making, and allocation of resources allocating for provision of social services and infrastructure.

Addressing challenges that arise due to population change: Understanding population trends provides governments with an opportunity to establish plans for handling population change and related issues, such as shortage of food, housing, and social services, like water, health care, electricity and security in a situation where there is population increase.

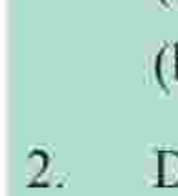
Developing plans for population control: Population data helps the governments

to formulate population policies and appropriate strategies for population control. For example, in the late 1970s, China introduced a one-child policy to put its population growth high whereas in 2013 it adopted a two-child policy to enhance population growth.

Planning for social services delivery: Population data are important for proper planning and provision of social services. It is possible for the government to provide appropriate services when it has accurate information on the required services, such as education, healthcare, infrastructure, and water.

Exercise 1.3

1. Describe the following terms as used in demography:
   (a) *De facto* census
   (b) *De jure* census
2. Describe three methods of collecting population data.
3. Planning without population data could be difficult. With five points, justify this statement.
4. What are the three advantages of a *De jure* census over a *De facto* census?



Activity 1.5

With the assistance from your teacher, walk around the streets or your school environment and conduct a sample survey. Thereafter, answer the following questions:

(a) What type of survey was appropriate for the community you have visited?

(b) What steps did you follow in conducting the survey?

(c) Mention four types of information you collected.

(d) In which five ways can these data be used for development?

(e) Explain five challenges that you have faced in preparing and conducting your survey.

Relationship between population and development

Population trends have various impacts on socio-economic development, human welfare, and the environment. This relationship has been perceived differently by different scholars. There are those who view that when population growth is not well controlled, it may affect development. This view suggests that reduction in the population growth improves countries prospects for economic development, which in turn is believed to enhance countries ability to improve lives of their people.

This school of thought was mainly contributed by Thomas Malthus through his essay on population growth which was first published in 1798. He specifically pointed out that, population is growing geometrically while resources are growing arithmetically. Thus, the population is

likely to contribute to the destruction of the environmental resources. He therefore, advocated for preventive checks such as moral restraints, delayed marriages, celibacy, sexual abstinence, and attachment to one wife to reduce reproduction rates. Malthus further argued that, if preventive checks are not applied, and the population keeps on increasing, positive checks such as diseases, famine and war will occur and eventually take control of the population.

Negative effects of population growth on development

Shortage of food and intensification of hunger: Rapid population growth may intensify hunger in most of the rapidly growing countries. This is mostly likely to occur when food production is not in line with population increase.

Overutilisation of resources: Rapid population growth requires more resources. Human beings utilise resources to meet their needs. In a case where there is high population growth than the available resources, competition and overutilisation of resources may occur in a particular geographical area.

Shortage of social services: Rapid and uncontrolled population growth leads to the shortage and uneven distribution and allocation of social services such as water, education and health services. When social services are not properly planned for, inadequacy occurs, which results into poor service delivery or uneven allocation of services.

Unemployment: Rapid growth of population may enhance high demand for employment in private and public sectors. Where plans for employment and promotion are not well designed and implemented, population growth tends to cause unemployment.

Shortage of housing and sanitation services: Population growth that does not correspond to provision of housing and sanitation services is an obstacle to development. This is because; when people are unable to access good houses, quality water and sanitation services they are likely to experience frequent diseases outbreaks, which normally affect provision of health services.

High dependence rates and low investment: At the levels of individuals and families, high rates of population growth are associated with high dependency ratio. This happened when the number of children and aged adults increase rapidly while investment on human capital is low, which affect the economy and life in general.

Positive effects of population on development

Another population view is that when population growth is well planned and managed to the extent that it corresponds to the available resources, it contributes to development and becomes a catalyst for development. This contention is supported by Ester Boserup (1965). In her book titled "*The Condition for Agricultural Growth*" Boserup argues that subsistence farmers select farming systems that permit them to maximise their leisure time and they will only change if population increases

and it becomes necessary to increase food supply accordingly. She also argued that in subsistence societies, the population growth requires that farming is intensified so that the supply of food is increased to feed the additional population. In this case, population growth seems to be a positive effect in improving human welfare. For example, population growth triggers demand for more food and people will come up with strategies to produce more while technology may also be there to facilitate the process. Other positive effects of population growth on the development are;

Source of labour: Population growth provides manpower to be used in various sectors of an economy, which is likely to improve productivity. This is important especially when a country has large youths and middle-aged population.

Motivation for agricultural productivity: Growth of a population is a motivation for improving productivity. Increase in the number of people will force the government and individuals to design strategies aiming at meeting the needs of the increasing population. Such strategies may be; providing credit to the farmers through cooperative societies or agricultural banks, improving agriculture through mechanisation and agricultural extension services, subsidisation of agricultural implements, and improved trade information and markets for agricultural produce.

Population provides market for commodities: An increase in the population offers assurance to producers and business people of reliable market. Population growth acts as a stimulant for an increase in the production of goods and services.

Contributes to innovation and technological development: Population growth is likely to generate more ideas from the growing population. Such ideas can be applied to foster technological advancement through innovations.

Population and development in rural and urban areas

The term rural may be defined as an area which is sparsely populated and where majority of the people depend on agriculture as their main livelihood activity. A rural area is a small settlement outside the boundaries of a town area. It may include countryside areas, villages or hamlets. Urban refers to an area which is relatively highly populated in the region where majority of people depend on non-agricultural jobs such as trade, commerce or provision of services.

In most urban areas there is a high rate of industrialisation which offer numerous employment opportunities to people. Life in an urban area is characterised by easy access to various services, better transportation facilities, entertainments, education services, and health facilities than in rural areas. People in urban areas, however, suffer from problems like environmental pollution caused by industries, vehicles, and human beings. Such problems lead to increased health problems to the people. In the context of development, there is a strong rural-urban linkage.

The relationship between urban and rural areas can be seen in the aspects like labour market, food production and processing, physical distance, and demand. This relationship indicates that rural and urban areas depend on each other. Rural areas supply different goods and services to urban areas and urban areas supply various goods and services to rural areas too. The goods and services supplied between the two are summarized in a Table 1.1.

Table 1.1: *A summary of goods and services supplied between rural and urban areas*

From rural to urban	From urban to rural
Labour force	Finished products
Raw materials and goods (crops, animals and animal products)	Agricultural inputs
	Equipments
	Information
Rural skills	Urban life styles
Rural life styles	Income (remittances)

Due to the relationship existing between rural and urban areas, development policies need to ensure that this linkage is improved through development of infrastructure (roads, communication) in rural areas, provision of financial services to rural people, and establishment of small and medium-sized satellite towns in urban areas. Other strategies include investment in information and communication technology (ICT) through TVs, radio stations, and mobile phone services. Moreover, investment in rural internet services will enable farmers in rural areas to access online information on markets in other places without having to visit urban areas. This will facilitate the flow of goods from rural to urban areas. Crops will reach urban market timely and urban goods (agricultural inputs, fertilisers, pesticides) will reach rural areas timely.

Exercise 1.4

1. Explain five ways through which ICTs is contribute to the growth of rural-urban linkages in Tanzania.
2. Explain the relationship between population growth and development.
3. What are the five positive effects of rapid population growth on development?
4. What are the five negative effects of rapid population growth on development?
5. Examine five strategies that can be used to enhance linkage between rural and urban areas in Tanzania.

Activity 1.6

You have been asked to write a report on the trend of population growth in relation to your village development for the five years from 2015 to 2020.

(a) Identify the data you would need to accomplish your report.

(b) Write a report to describe the population and development trends.

(c) Suggest five ways that could be used to improve population growth in relation to development at your village.

Population characteristics

Population characteristics include size, density, marital status, migration, income, education, spatial distribution, age structure, birth, and death. In the population studies, there are several parameters which are important in describing the population characteristics. Understanding how population characteristics change over time can help scientists or the governments to make informed decisions.

Population structure

Population structure refers to the composition of population in terms of age and sex. The population structure varies from one country to another. Usually, a population structure is influenced by three main factors, namely; birth rates, death rates, and migration. For examples, in developing countries, there is a rapid population growth because of high birth rates. As a result, the population structure has a broad base and a narrow apex. The population structure is usually presented and illustrated by a population pyramid.

Population pyramids

A population pyramid or age-sex pyramid or age structure diagram is a graph which represents the age and sex structure of a particular population at a given point in time. The graph normally divides the population into 5 years age groups (for example, 0–4, 5–9, 10–14) on the vertical axis and male and female data on the horizontal axis. The number in each age group is given as raw figure or as percentage of the total population and it is indicated by horizontal bars with males located in the left side and females in the right side of the central axis.

The numbers by sex and age depend on the interactions between fertility, mortality, and migrations. By showing the past changes, the population pyramid can predict both short-term and long-term changes in the population. The population pyramid also shows historical events of a certain population such as large scale migration, age and sex of migrants, large scale wars, and major diseases that have occurred and affected people in a particular area.

Types of population pyramids

Population pyramids are of various shapes. Shapes change over a period of time, depending on the age and sex structure of a specific population. Therefore, different countries have unique population pyramids. The following are the major types of population pyramids.

Expansive pyramid: This is a population pyramid which has a broad base and displays a successive decline in the distribution of population at the higher age groups. Its broad base represents large numbers or percentages of people in the younger age groups. This pyramid represents situations of high fertility, high mortality, low life expectancy, higher population growth rates and low share or distribution of old age persons. The upper part of that age groups is narrow showing that there are more deaths due to several reasons including poor health

and sanitation services, and poor fertility. This type of pyramid is typically depict population structures in developing countries, mainly in Africa and Asia. Figure1.2 is a population pyramid for Tanzania in 2017.

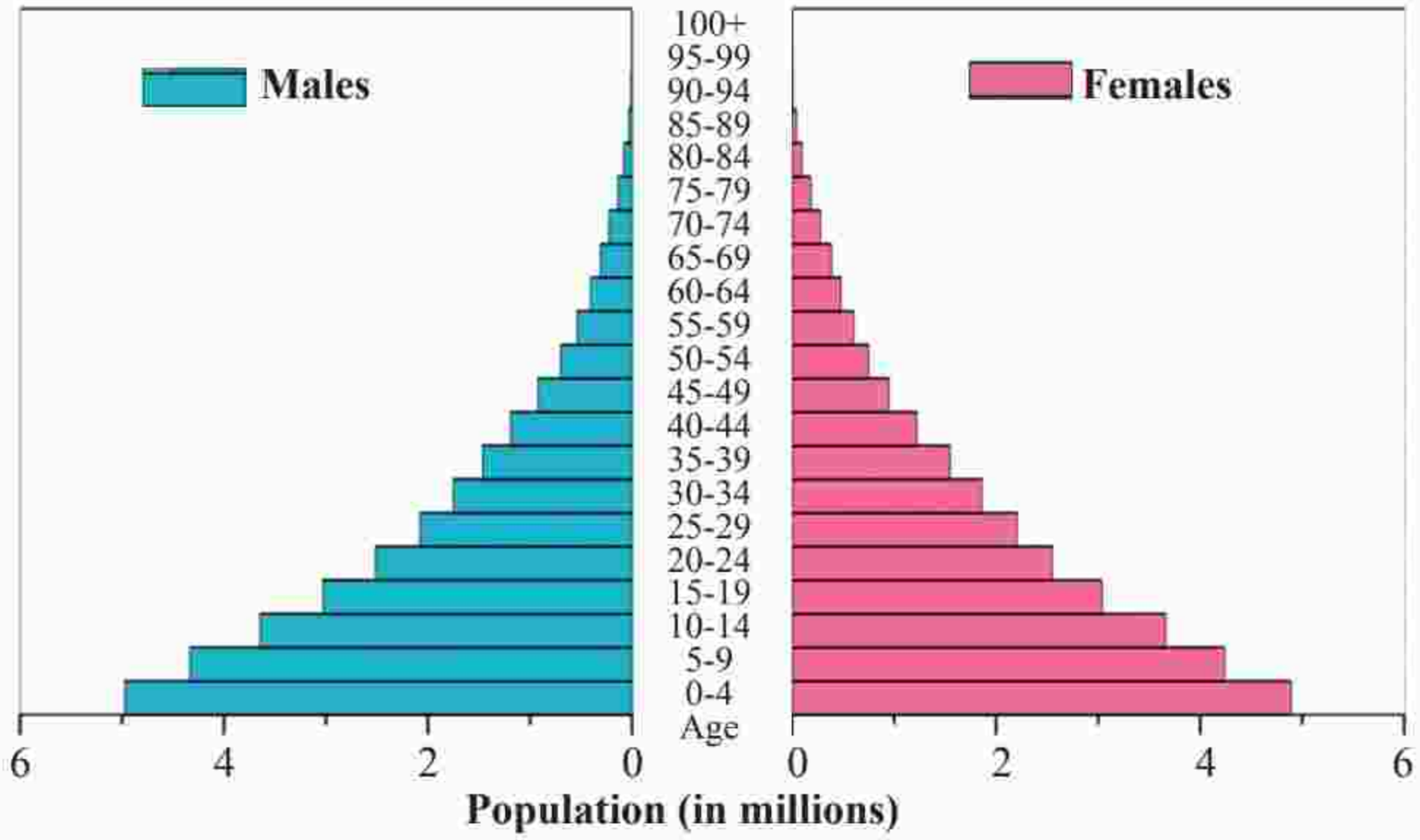


Figure 1.2: *Population pyramid for Tanzania in 2017*

Source: United Nations, 2019

Stationary Pyramid: This is a population pyramid in which the distribution of population remains relatively constant in different age groups over a period of time. It represents a situation of low fertility, low mortality and high life expectancy. This type of pyramid reflects population in developed countries whose age groups bottom up have little variations in their percentage. This situation leads to the bulging of the population pyramid in the middle which is a sign of decrease or increase in population as well as slow population growth or stable population.

The population pyramid further shows almost equal distribution of the age groups, deaths and births. Austria, China and Scandinavian countries are examples of countries whose population is represented by this pyramid. Figure 1.3 is a population pyramid for China in 2018.

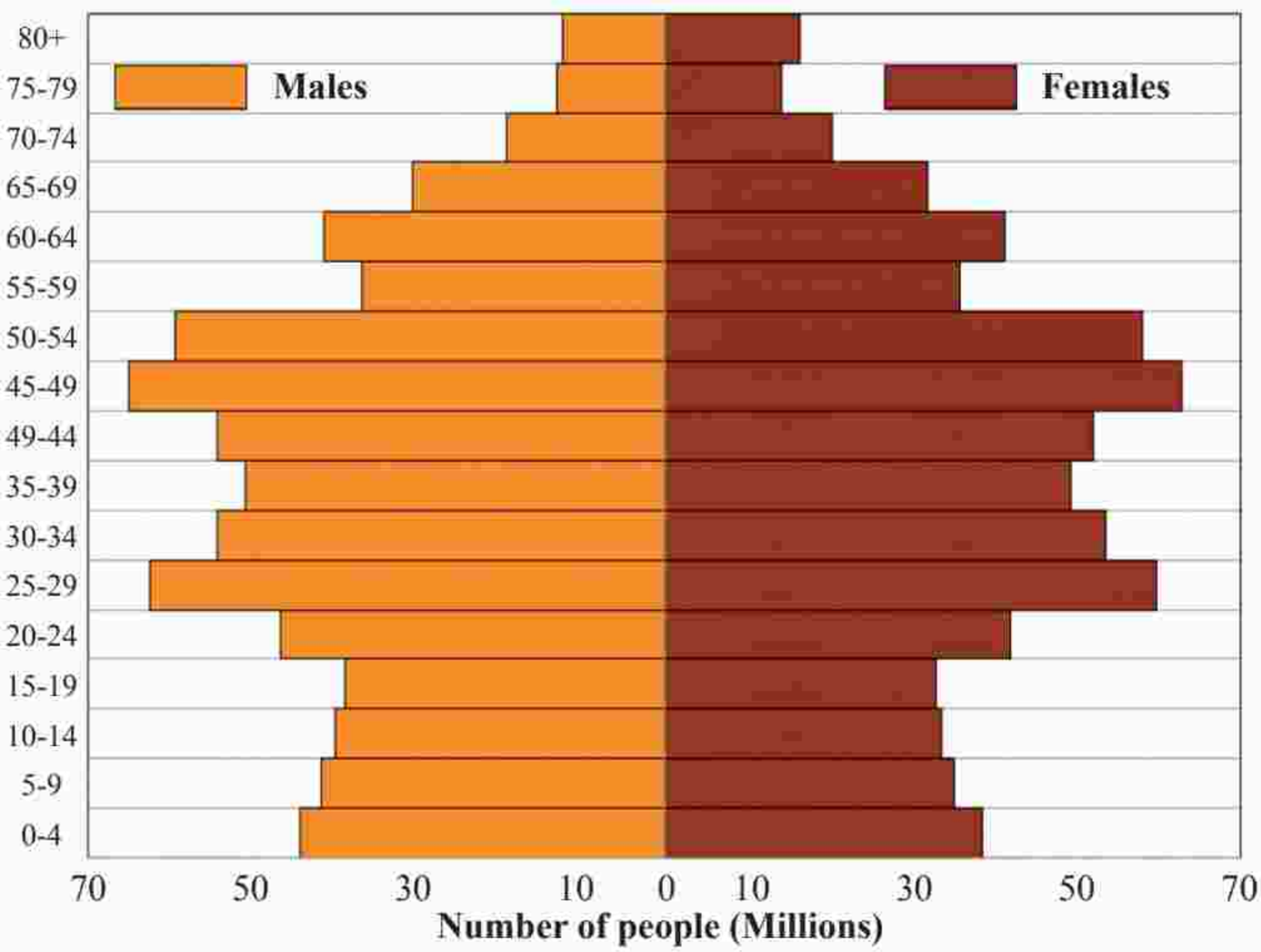


Figure 1. 3: *Population pyramid for China in 2018*

Source: National Bureau of Statistics, China Statistical Yearbook, 2018

Constrictive or regressive pyramid: This is a population pyramid with a narrow base. This pyramid represents low fertility, low mortality, high life expectancy, and ageing of population. It is characterised with high socio-economic development and it mainly represents a population structure of very advanced or developed countries which have a high level of literacy, birth control measures, and very good health and medical facilities. The pyramid consists of a population with high percentage of elderly people and it shrinks and narrows at the base, which gives it a beehive shape that indicates low birth rate and high life expectancy. Countries with such a shape of population pyramid are the United States of America, United Kingdom, Japan, Norway and Denmark. Figure 1.4 is an example of a constrictive pyramid.

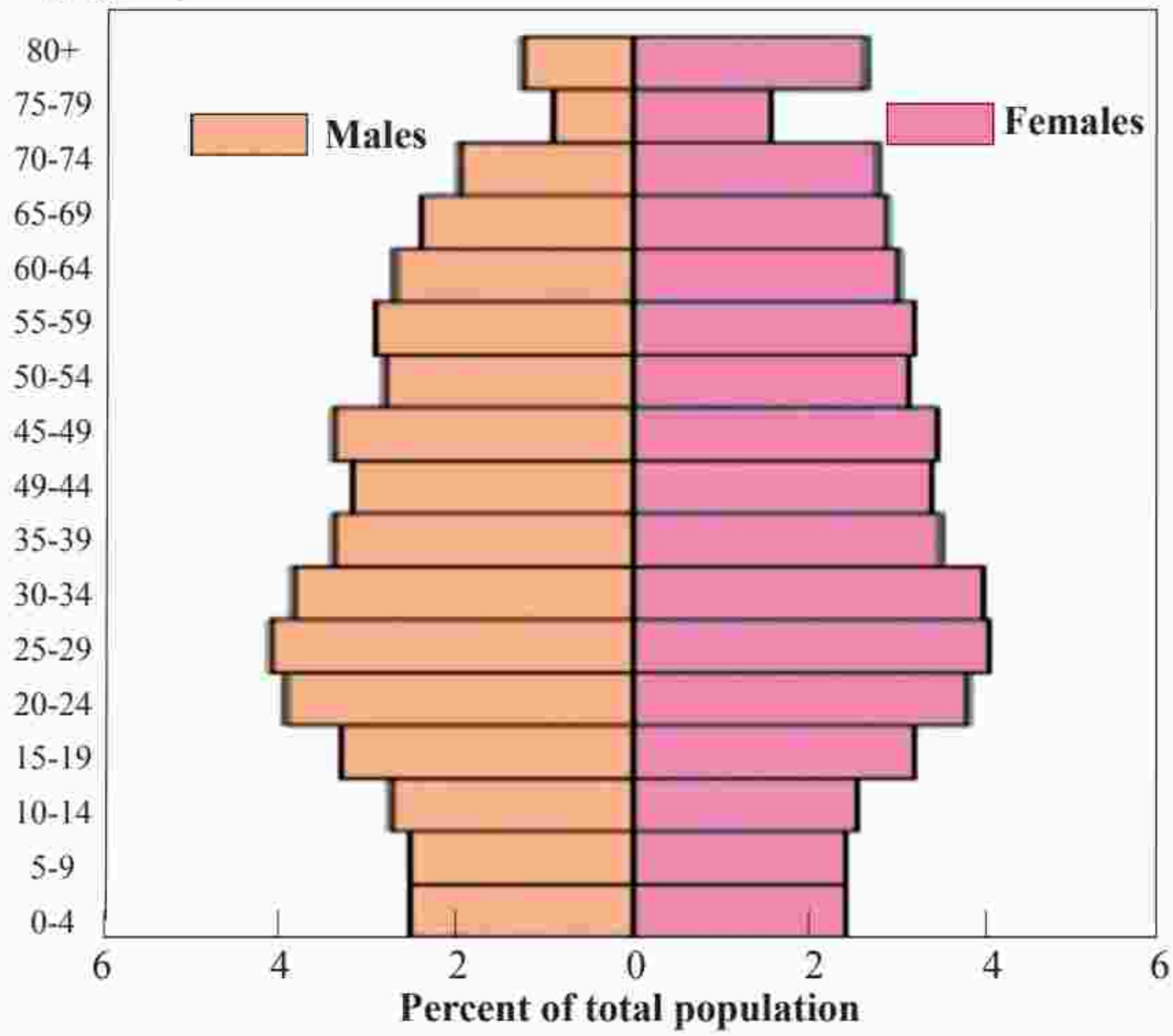


Figure 1.4: *An example of a constrictive population pyramid*

Source: United Nations, 2019

Population pyramid: Case studies

Population structure of Norway

Generally, the population structure of Norway depicts stability in fertility, mortality and migration aspects. Norway experienced a "baby boom" situation after the Second World War. The "boom" was long lasting in Norway compared to many other countries at the beginning of the 1970s where total fertility rate was as high as 2.5. However, from 1970s, the fertility started to decline and in the early 1980s, fertility rate was around 1.6 to 1.7. In 1983s, it hit the historic worst rate of below 1.4 and throughout 1990s the fertility rate in Norway remained at 1.8. Currently, the fertility rate is still below 2.

Moreover, life expectancy in Norway is high, well above 80 years, with women's life expectancy being higher than the men. Infant mortality rates are below 2, and the deaths for under 5 years of age is below 3. Furthermore, over 80% of the population in Norway lives in urban areas. A large portion of Norway's population belongs to 40-50 years age group which also indicates that the percentage, of old people is moderate. There is however, a problem emerging in the future: people

above 65 years are increasing and the government is worried that there would be shortage of labour force in the future due to low fertility. To address the problem of low fertility, Norway has been adopting various policies such as giving finances and incentives to families with a new born child and those who adopt children. Figure 1.5 illustrates a population pyramid of Norway by 2016.

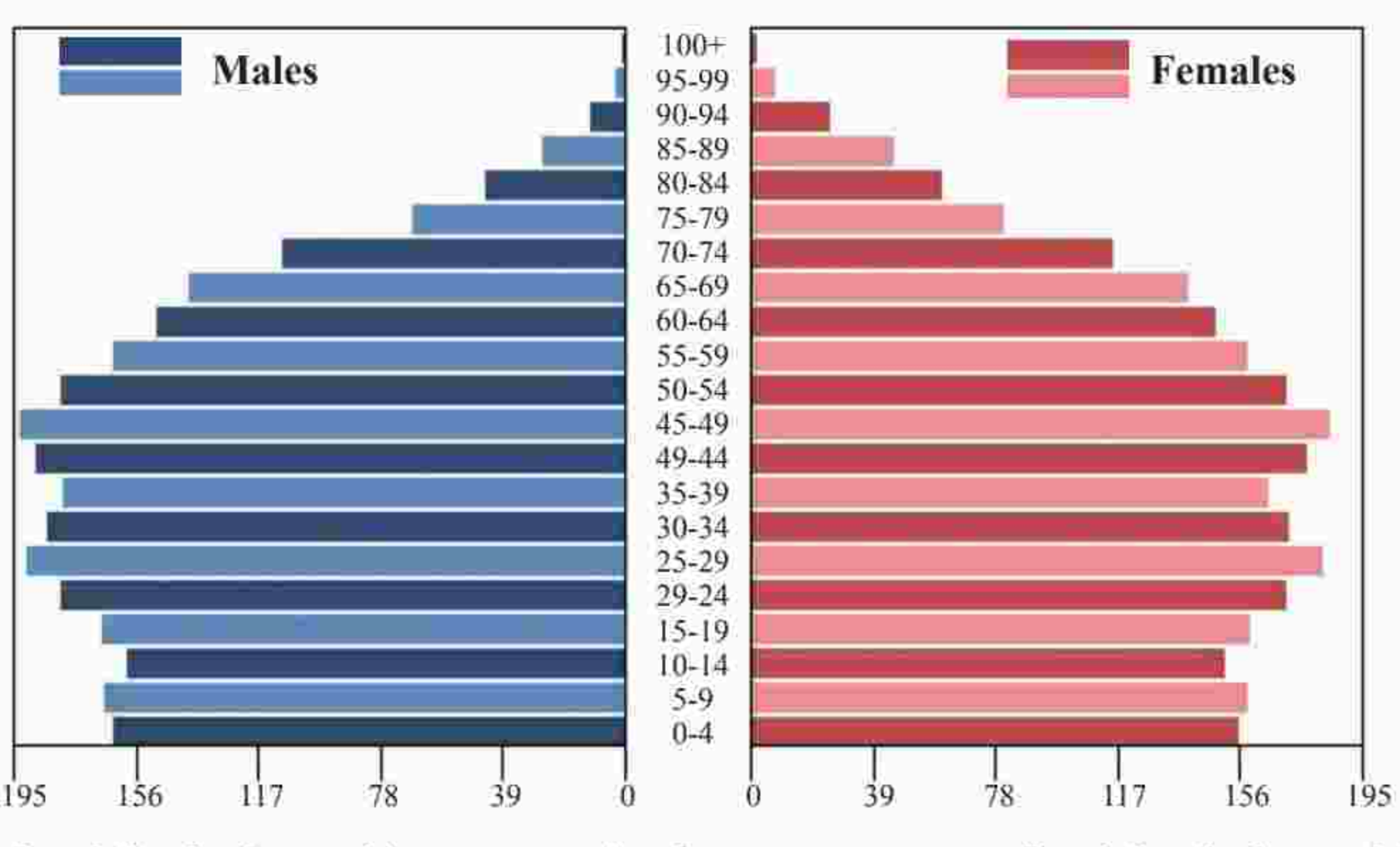


Figure 1.5: *Population structure of Norway for 2016*
Source: United Nations, 2017

Population structure of China

China's population pyramid is a result of an interaction of fertility (birth rates), mortality (death rates), and migration. The shape of a pyramid also reflects historical events such as wars and diseases, socio-economic factors, and political policies that affected the population growth. For example, in 1979, China established a "One-child Policy" to reduce the rate of population growth. Rapid population increase in China had resulted from a national wide call that large population brings about a strong nation. As a result during 1960s, the population of China increased by 15 million people every year. China's population in 2016 shows a large bulge in the 25 – 29 and 45 – 49 age groups which represent high birth rates prior to 1990 and 1975 respectively.

To control an increase in birth rate China has introduced basic state policies. For example, there is an encouragement of late marriage and late child bearing and practice of one couple, and one child with proper spacing. Through such attempts, China currently has a low fertility and mortality rates. However this situation is projecting that, 25% of China's population

would be aged 65 and above by the 2040 which suggests the government will have the burden of caring for the country's elderly population in the future. Figure 1.6 is a population pyramid of China for 2016.

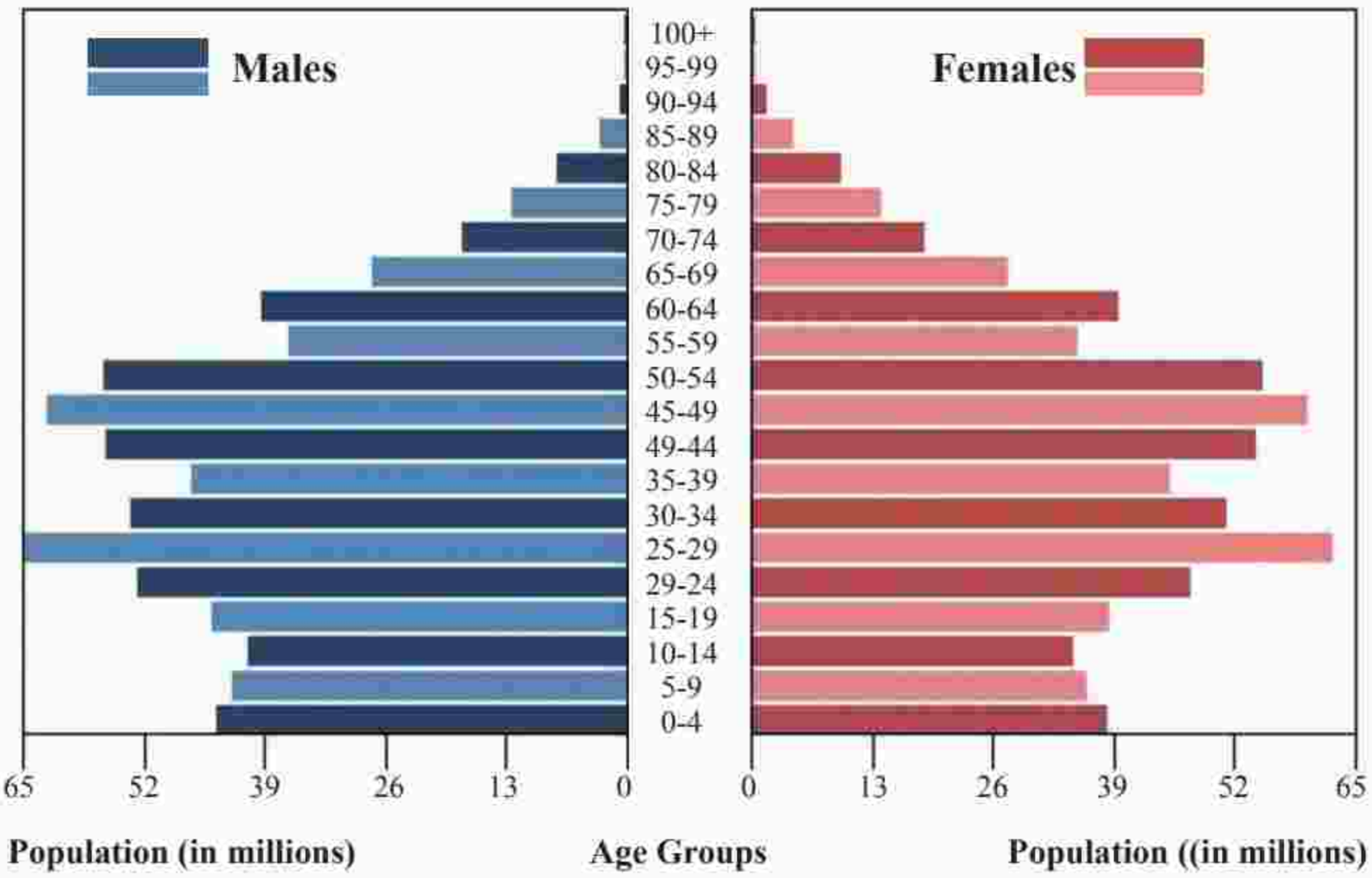


Figure 1.6: *Population structure of China in 2016*

Source: United Nations, 2017

Population structure of Tanzania

Tanzania's population is estimated to be 52 482 726 people, according to 2016 statistics. The estimates take into account the effects of excess mortality due to HIV /AIDS which resulted into lower life expectancy, high infant mortality, higher death rate, lower population growth rate, and changes in the distribution of population by age and sex.

Tanzania's youth population is growing rapidly because of the high total fertility rate of 4.8 children per a woman. Moreover, about two-thirds of the population is under the age of 25. Progress in reducing birth rate has stalled, sustaining the country's annual population growth of nearly 3%. The maternal mortality rate has decreased since 2000, but it remains very high because of early and frequent pregnancies, inadequate maternal health services and lack of skilled birth attendants. These problems have severe effects more on poor and rural women. Tanzania has made significant progress in reducing infant mortality rate.

Most of the migration in Tanzania is internal, involving rural to urban movements. There are also some temporary labour migrations from towns

to plantations which take place seasonally and for harvesting. Others move temporarily for fishing and mining activities. Tanzania was Africa's largest refugees hosting hundreds of thousands of refugees from the Great-Lakes region, specifically from Burundi.

Between 2002 and 2014, the government of Tanzania executed an assisted repatriation and naturalisation of tens of thousands of Burundian refugees. This drastically reduced the refugee population in the country. In addition to refugees who have contributed to the growth of population, Tanzanian population has been growing due to some illegal immigrants from the horn of Africa at different times chosen to settle in Tanzania. Figure 1.7 provides an example of population pyramid in Tanzania.

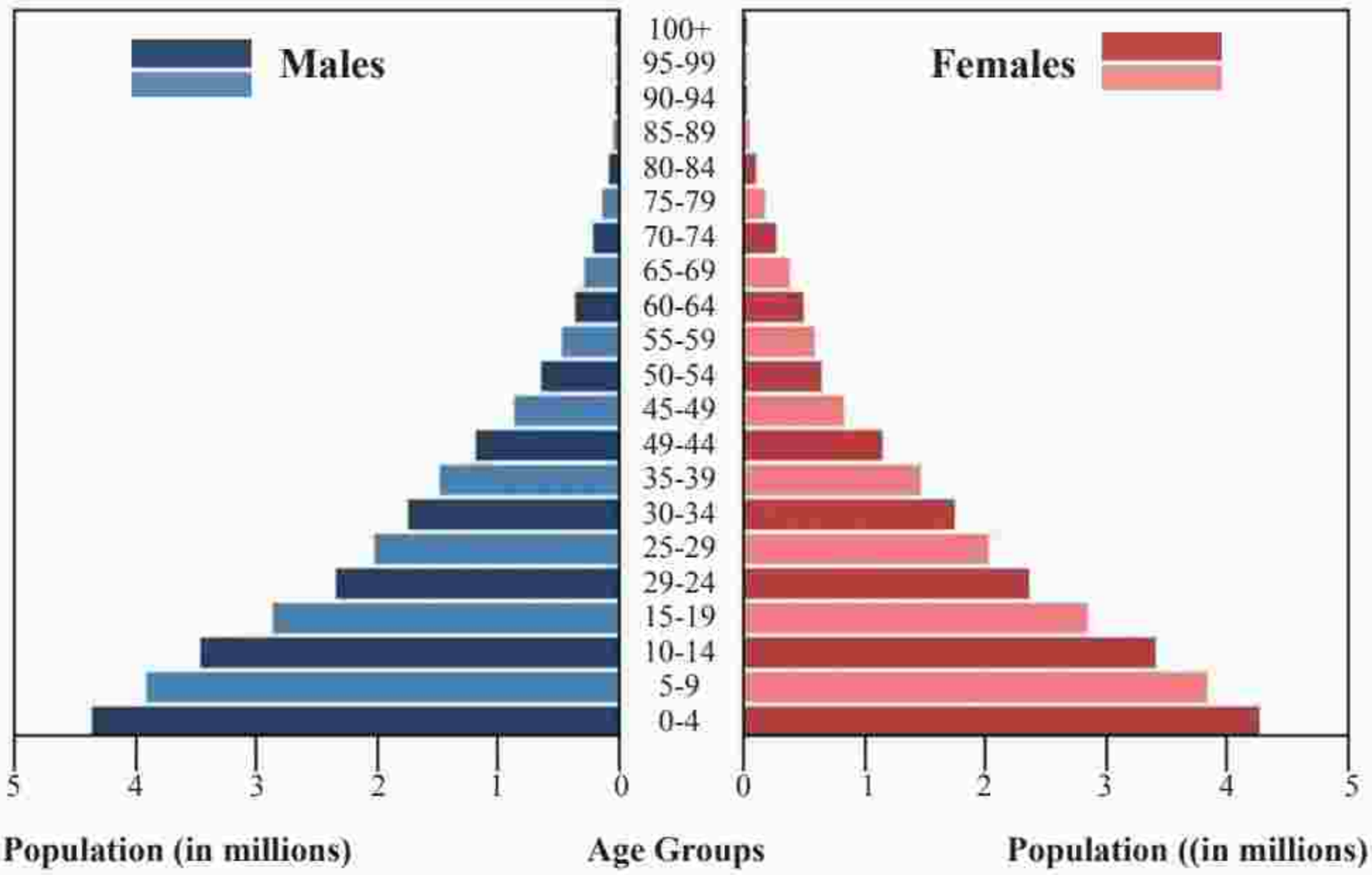


Figure 1.7: *Population structure of Tanzania in 2016*

Source: NBS, 2016

Importance of population pyramids

The shape of a population pyramid conveys important information about age-sex structure of a specific population in a given country which is useful for planning purposes. Population pyramids, makes it easier to relate the population of a country with its level of socio-economic development. A broad-base pyramid indicates that birth rates are high and there is a high concentration of population in the lower age groups. This indicates high fertility and death rates in a country. Government, thus may use the information to formulate population policies, like family planning, to address the problem.

Broad-based population pyramids indicate that in the near future the population growth rates would remain high because the population will be concentrated at reproductive age groups. A narrow or pointed top pyramid indicates that the general population is made up of a relative small population of old age persons (65 years and above) and a large proportion of youth population (< 15 years).

In the case of the most developed countries (MDCs), the pyramids show a small size of youth population and a big size of ageing/old population, which informs a state of dependent ratio in a given country. A population pyramid can be used to assess the number of economic dependants by calculating the ratio of the sum of youths and the ageing population (0-14 years + 65 years and above) over a working population (15-64 years) multiplied by a hundred. The population pyramids of Least Developed Countries (LDCs) show more young dependants and those (MDCs) show more elderly dependants. Population pyramids also detect sex ratio imbalances according to age groups in a population. In the majority of populations, the number of females is relatively greater than that of males in older age groups. The life expectancy for females is above 74 years compared to 70 years for males.

However, in the MDCs, the life expectancy for females is 82 years while for males is 76 years, and in the least Developed Countries, it is 72 years for females and 69 years for males. This can indicate age-sex ratio as well as the level of economic development of a country. In case of a population pyramid which indicates both a low birth and a low death rates, the implication is that currently and in the future fewer children will be registered in schools, whereas, more elderly people's homes will be needed. Population pyramids also influence patterns of purchasing and consumption in a given country. This can help to notify the current and future population size as well as labour force of a country.

Exercise: 1.5

1. What is the significance of population studies to planners?
2. How can the age-sex structure of a population determine the needs of that population?
3. Using the 2012 population data, draw the population pyramid of Tanzania, then comment on its shape.
4. What are the problems associated with ageing populations?
5. Explain the three major factors which determine the population structure and size of a country.

Activity 1.7

1. Study the hypothetical data in Table 1.2 on a sample of population of Tanzania, China and Norway and do the following tasks.
   (a) Draw population pyramids for the three countries. Suggest four possible reasons for the observed population structures in each country.

(b) Calculate the sex ratio for 0 - 4 years for each of these countries.

(c) Explain the four implications of such population structures in socio-economic development.

(d) Compare population structure of the 20-49 years age groups for the three countries.

2. Using the population data of China, draw a population pyramid and comment on its shape.

Table 1.2: *The population of Tanzania, China and Norway (in %)*

Age	Tanzania		China		Norway	
Groups	Males	Females	Males	Females	Males	Females
0-4	7.6	7.4	3.1	2.6	3.0	3.1
5-9	6.3	6.4	2.9	2.5	3.0	2.9
20-24	3.6	3.9	4.5	4.9	3.5	3.4
25-29	3.1	3.3	3.7	3.5	3.5	3.2
45-49	1.2	1.2	3.7	3.5	3.3	3.1
60-64	0.6	0.7	1.8	1.9	2.9	2.9
75-79	0.1	0.2	0.5	0.6	0.9	1.2

Activity 1.8

In a group, use library and web resources to propose at least two strategies for each country to utilise their population structures for development.

Demographic transition model

Changes in population by its increase or decrease resulting from a balance between births and deaths over time can be shown by the Demographic Transition Model (DTM). The model describes a sequence in population change over a period of time by establishing a relationship between birth and death rates and overall population change as a country develops from pre-industrial to an industrialised economic system. The model is based on the population changes in several industrialised countries in the Western Europe and North America. This model shows a particular pattern of demographic change from high fertility and high mortality to low fertility and low mortality.

This transformation is associated with an advancement of a largely rural agrarian and illiterate society to an urban, industrial, literate, and modern or postmodern society. The assumption

behind the DTM is that all countries passed through or will pass through similar demographic transition and stages (population cycles) at a given time. The DTM has five (5) stages. The 5th stage is unpredictable and it provides reasons for changes at each transition. Figure 1.8 shows the Demographic Transition Model.

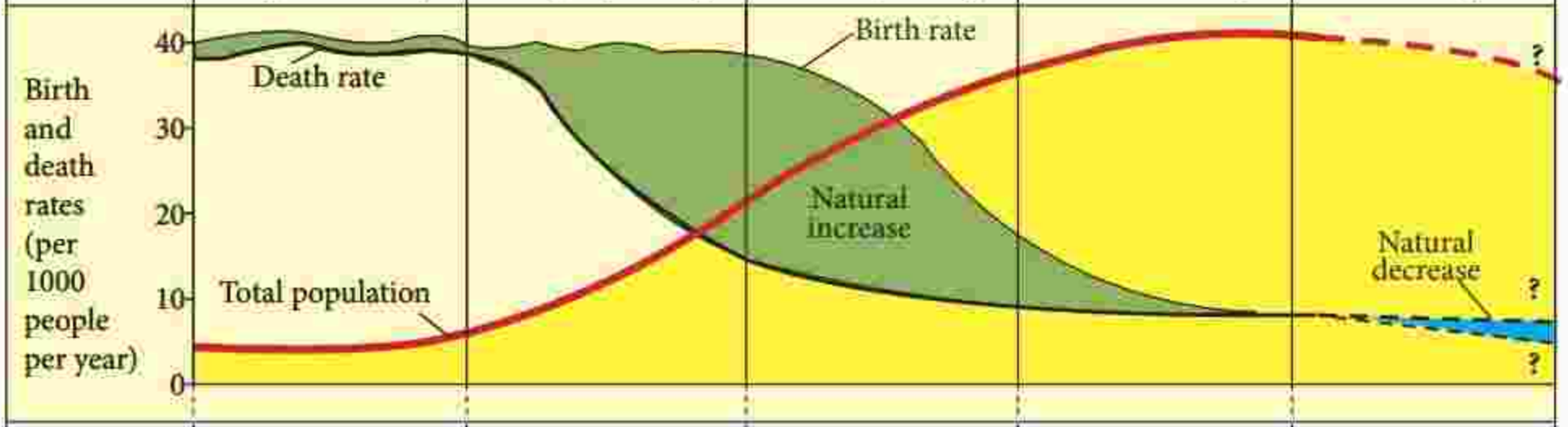
Stage	1 High stationary	2 Early expanding	3 Late expanding	4 Low stationary	5? Declining?
Birth and death rates (per 1000 people per year)					
Examples	A few remote groups	Egypt. Kenya, India	Brazil	USE, Japan, France, UK	Germany
Birth rate	High	High	Falling	Low	Very low
Death rate	High	Falls rapidly	Falls more slowly	Low	Low
Natural increase	Stable or slow increase	Very rapid increase	Increase slows down	Stable or slow increase	Slow decrease
Reasons for changes in birth rate	Many children needed for farming. Many children die at an early age. Religious/social encouragement. No family planning.		Improved medical care and diet. Fewer children needed.	Family planning. Good health. Improving status of women. Later marriage	
Reasons for changes in death rate	Disease., famine. Poor medical knowledge so many children die.	Improvements in medical care, water supply and sanitation. Fewer children die		Good health care. Reliable food supply.	

Figure 1.8: *Demographic transition model*

Source: file:///C:/Users/user/AppData/Local/Temp/Special_Volume_2015_A_Global_Public_Health_Curricu.pdf

Stages of demographic transition model

Stage 1 - High stationary stage: At this stage birth rates and death rates are both high and the population growth is slow. Reasons for high birth rate include; lack of family planning, high infant mortality rate, need for workers in agriculture, religious beliefs and treating children as economic assets. Reasons for high death rate are; high level of occurrence of diseases, famine, lack of clean water and sanitation, lack of health care, lack of education and frequent wars. Typical examples of countries in this category are currently least economically developed countries (LEDCs). The Britain was in this stage in the 18th Century.

Stage 2 - Early expanding stage: At this stage the birth rate remains high while the death rate start to fall and the population begins to rise steadily. The death rate decreases as a result of factors such as improved health care which controls pandemic and epidemic diseases like smallpox, improved hygiene due to availability of fresh and boiled drinking water, improved sanitation, improved food production and storage, improved transport of food, and decreasing infant mortality rate. Examples of countries in this category are Bangladesh and Nigeria, as Britain was in 19th Century.

Stage 3 - Late expanding stage: At this stage the birth rate starts to fall and the death rate continues to fall, thus causing a rise in population. Reasons for this rise are; availability of family planning measures, lower infant mortality rate, an increase in mechanisation which in turn reduces the need for workers, improvement of standards of living and change of the status of women. Examples of countries in this category include; Britain in the late 19th and early 20th Centuries, China and Brazil.

Stage 4 - Low stationary stage: At this stage both birth and death rate are low and population is steady. Countries in this category include: the USA, Sweden, Japan and Britain.

Stage 5 - Declining or negative growth rate: This stage is still questionable as it indicates that birth rate will continue to be low and the death rate will maintain a constant low rate. The population will start to fall.

Weaknesses of the demographic transition model

Like all models, DTM is not without limitations. First, the model has failed to predict, factors and events causing birth rates in several developed countries like Germany and Sweden to fall below death rates. Such a population decline could well be explained if the model had fifth stage.

Second, the model assumes that all countries consistently pass through the same five stages. This however seems unlikely, as some the developing countries, especially in Africa, may probably not become industrialised yet they already are experiencing declined death rates.

The model assumes that a death rate fall in Stage 2 was a consequence of industrialization, while initially death rate in many British cities rose due to the insanitary conditions which resulted from rapid urban growth and it only began to fall after advances were made in medicine and healthcare. Fourth in many countries, birth rate fall in Stage 3 has been less rapid than what the model suggests due to religious and/or political opposition to birth control (Brazil), while in China the fall was much more rapid, and came earlier, following governments introduction of a 'one child' policy.

The timescale of the model, especially in several South-East Asian countries like Hong Kong and Malaysia, is being squashed as such, countries develop at a much faster rate than did the early industrialized countries. In addition, countries that grew as a consequence of emigration from Europe, USA, Canada, and Australia did not pass through the early stages of the model.

Exercise 1.6

1. Describe the three major types of population pyramids.
2. Using diagrams, compare and contrast the population structure of Tanzania and that of China.
3. Using diagrams, compare and contrast the population structure of Tanzania and that of Norway.

4. Using a diagram describe the Demographic Transition Model.

5. Discuss three strengths and three weaknesses of the Demographic Transition Model.

6. Explain five factors contributing to high fertility rates in the developing countries.

7. Discuss five factors that have led to the dramatic decline of maternal mortality in the Western Europe.

8. Explain three measures which have been adopted by the government of Tanzania to address the problem of rapid population growth in the country.

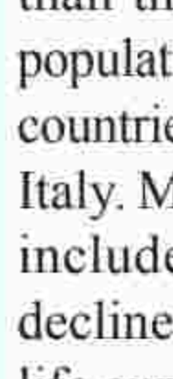
9. Explain how relevant is the Demographic Transition Theory in explaining the demographic changes in developing countries like Tanzania.

Activity 1.9

1. (a) Using the schools registration book, read students information on age and sex, then construct a population pyramid by using the data obtained.

   (b) Describe the population pyramid you have constructed then present in your class.

2. Study the demographic transition model, assess its relevancy and limitations in analysing the population change in countries like Tanzania. Share your understanding with your fellow students in the class.



Activity 1.10

In a group, use textbooks and web resources to explain the characteristics of the early expanding stage.

Ageing population

This is a population in which the number of old people (above 64 years) is larger than that of other age groups. Ageing population occurs mostly in the developed countries such as UK, USA, Germany and Italy. Major causes of ageing population include; a decline in fertility rate, a decline in mortality rate thus increased life expectancy.

Fertility rate normally declines due to strict population policies aiming at reducing the number of children. There are countries that have tried to limit the number of children born per woman. For example, China has for some decades implemented a one-child policy which has resulted into a decline in the number of births in China.

A decline in mortality or death rate occurs due to improvement in health services, nutrition and sanitation services. This reduces the number of deaths. An increased life expectancy contributes greatly to the growth of ageing population. In Europe, for example, life expectancy is above 70 years for both men and women. The UN predicts that the increase in the number of old people in the world will have impacts on development.

Impacts of ageing population on development

Reduced labour force: Ageing population will result into a decline of manpower since there will be fewer youths, adults, and children. This will reduce the number of people to work in different sectors of the economy such as agriculture, mining and industry. Decline of man power will consequently have detrimental effect to the economy of a country.

Change in population consumption patterns: Ageing population triggers changes in the pattern of consumption. A country with a big aged population emphasises on the production and consumption of goods for the elderly people. Goods such as hats, and walking sticks become of high demand. This on the other hand, causes a decline in the demand for goods such as dolls, toys and clothes consumed by young people.

Rising dependency ratio: When a number of old people becomes larger than that of the working people, it results into higher numbers of dependants. This also means a low number of producers and an increase in the costs for taking care of the dependants. As a result, industrial and business sectors may shrink. This problem may occur mostly in countries where industries depend more on human labour than on highly advanced and improved science and technology.

Labour immobility: Labour immobility occurs because the old people are immobile compared to the young people who easily migrate from one place to another. This has a negative impact on the economy since it affects brain gain and transfer of skills and knowledge from one area to another. An area dominated by ageing population is likely to be static in terms of skills and knowledge.

Decline in the market for goods and services: Market for luxurious and modern products and services is affected by ageing population due to decline in demand. Youths are dynamic and up to date, thus they prefer modern goods but ageing populations has very low or no demand for new and modern products and services.

Reduced innovation: Innovation becomes reduced and development processes retard due to conservativeness of the old people. Old people are less innovative and usually very resistant to change than the young. A population dominated by old people is not dynamic and it hardly adopts new changes. Countries like Japan, Greece, Italy, China, Serbia, Slovenia and Finland are examples of countries with large ageing population.

Rising expenses: Ageing population leads to greater demands for services such as pensions, medical care and residential homes. The situation will cause an increase in expenses and the services will have to be provided for by a small percentage of working people.

Challenges facing old people in Tanzania

In Tanzania, challenges facing old people are increasingly recognised. The national Aging policy of 2003 has identified various areas or challenges which need to be addressed. These challenges include access to health care, poverty, diseases, shelter, and weakening of traditional life and income. These challenges are important issues to be addressed so as to improve the wellbeing of old people.

Population dynamics (change) and quality of life

Population dynamics or change refers to changes occurring in the population characteristics. It involves an increase or a decrease in the number of people in a geographical area for a specified period of time. Population characteristics such as population size, density, distribution, structure and trend change over time and the changes could be positive or negative. A positive change entails an increase in population size and it is also known as population growth, while a negative change refers to a decrease in population size. It is important to understand factors contributing to population change for the development planning. For example, deaths and births of people affect development. Migration also has a positive and a negative impact on development. Generally, population change is caused by fertility (birth rate), mortality (death rates) and migration.

An equation of population that summarises these three factors is as follows: Population change = (birth + immigration) – (death + emigration). OR, Population Change = P2 – P1 = (B – D) + (I – E) where: P2 = current population, P1 = previous population, B = Birth, D = Death, I = Immigration and E = Emigration.

If the population change is positive, then more individuals will have been added to the population than being taken out. Consequently, the population will increase in size. If the population change is negative, more individuals will have been lost, which means the population will decrease in size. If population change is exactly zero, it means the population size is stable and it does not change, and it is known as *equilibrium population* or zero population growth.

Zero population growth is a condition in which the population neither grows nor declines, because the number of births in a year is equal to the number of deaths. This occurs in some industrialised countries which have relatively low birth and death rates like, the USA and Canada. Moreover, population change is an example of an open system as shown in Figure 1.9, where there are inputs, processes and outputs. Inputs include births and immigration; processes include natural change, migration, and total population; while outputs include deaths and emigration. These are schematically presented in the model as follows;

The total population of an area is the balance between the two forces of change: natural change (birth and death) and artificial change (migration). The natural increase is the difference between birth rates and death rates. The rate of natural increase is the difference between Crude Birth Rate (CBR) and Crude Death Rate (CDR). This may be obtained by using a formula (natural growth rate = (CBR-CDR), which can be expressed in percentage.

The Rate of Natural Increase (RNI) for Africa is 3.0 which is higher than the world average of 1.7. The RNI for Asia is 1.8, for North America is 0.7, and for Europe is 0.2. This means that the population in Africa is growing at a higher rate than that of other continents. High natural increase rates are largely contributed by low child mortality rates, although other factors such as improved health services also extend the average life expectancy.

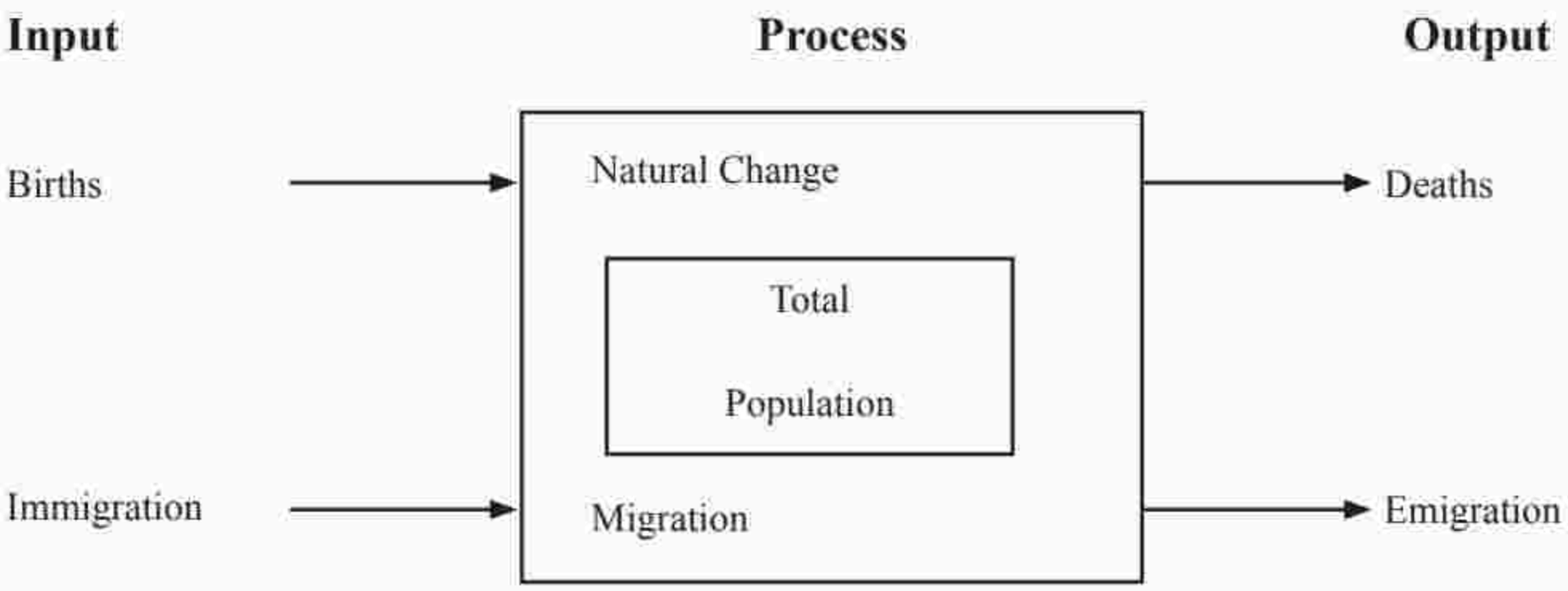


Figure 1.9: *Model of population change*

Factors contributing to population change

Fertility rate: The fertility rate is the average number of children a woman is likely to have if she lives to the end of her child bearing age. A woman is able to bear more than 15 children in her reproductive period, that is, between 15-49 years. If births are not regulated, they can result into rapid population growth, leading to rapid increase in population size. At an individual level, excessive births might affect the health of a mother and a child. The inability of a woman to conceive is called infertility (infecundity) while fecundity is the physiological capacity of a woman to conceive and give birth to a child regardless of whether it is a still or alive birth. Fertility of a population can be indicated by using different measurements which include Crude Birth Rate (CBR), General Fertility Rate (GFR), Age Specific Fertility Rate (ASFR), Gross Reproductive Rate (GRR), and Total Fertility Rate (TFR).

Crude Birth Rate (CBR): The crude Birth Rate (CBR) refers to the number of live births per thousand over total population in a year. It is calculated by taking the total number of live births divided by the total population in a given year, then multiplied by 1 000. It is called Crude Birth Rate because it includes all ages and both sexes in the population. It also includes those who do not give birth (males and children). It is calculated through the following formula;

$$CBR = \frac{\text{Number of live births}}{\text{Total population}} \times 1\,000$$

Example: If the total population for Kihwele community was 500 people in 2012 and the number of registered live births for a given year was 30, the CBR can be calculated as follows;

$$CBR = \frac{30}{500} \times 1\,000$$

$$CBR = 60$$

Therefore, the crude birth rate (CBR) of the Kihwele community is 60 births per 1 000 Births. The result means that 60 children could be born out of 1 000 live births in 2012. The strengths of CBR is that, it presents the number of children who are likely to be born, which makes it useful for social service planning. Its weakness, however, is that it is too general. It does not show clearly how female and male children are likely to

be born. This affect plans that are sex oriented. CBR is, therefore, thought not to be an accurate measure of fertility in some aspects.

General Fertility Rate (GFR): The GFR refers to the proportion of children born alive per thousand women of the reproductive age (15 - 49 years) in a year. It is calculated using the following formula;

$$\text{GFR} = \frac{\text{Number of live births in a year}}{\text{Mid-year population of women aged } 15-49} \times 1\,000$$

The reproductive age is a child bearing age for women (15 - 49 years).

Example: If the number of live births for country X in 2020 was 20 000 and the number of reproductive aged women (15 - 49 years) was 280 000 in the same year, GFR would be;

$$\text{GFR} = \frac{20\,000}{280\,000} \times 1\,000$$

$$\text{GFR} = 71.4$$

This means that, out of 1 000 women aged 15-49 years, 71.4 children were likely to be born in 2020. This has an implication, on planning and services delivery. It means that, the government must establish plans for the provision of services such as health, education, and sanitation. The advantages for GFR is that, it is simple to calculate and it is specific on a reproductive age population.

Child Women Ratio (CWR): The Child Women Ratio (CWR) refers to the number of children of 0 - 4 years of age per 1 000 women of child-bearing age. The CWR is computed from the number of children aged 0 - 4 divided by the number of women of a child bearing age (15 - 49 years), and is usually expressed per 1 000.

$$\text{CWR} = \frac{\text{Children aged } 0-4}{\text{Total number of women}(15 - 49)} \times 1\,000$$

Example: If the number of children under 5 years of age (0 - 4) in 2012 in country X was 3 200 000 and; the number of women of reproductive age was 3 500 000, the CWR would be:

$$\text{CWR} = \frac{3\,200\,00}{3\,500\,000} \times 1\,000$$

$$\text{CWR} = 914.3$$

The result shows that 914.3 children of the age of under five years were likely to be born per 1 000 reproductive aged women. This is a very high CWR and it

shows that this population has women with high fertility rate. It also suggests that the government must be prepared to establish some policies for services provision and regulation of some population characteristics such as distribution and density.

Age Specific Fertility Rate (ASFR): The Age Specific Fertility Rate (ASFR) is the number of births by women of a given age group per 1 000 women in that age group. It is calculated by using the following formula;

$$\text{ASFR} = \frac{\text{Total number of births by women in age group x}}{\text{Total number of women in age group x}} \times 1\,000$$

Example: If the population of women aged 20-24 years was 300 in 2015 and the total live births were 50 for the same age group in that year, the ASFR would be;

$$\text{ASFR} = \frac{50}{300} \times 1\,000$$

ASFR = 166.7

This means that, for every 1 000 women aged 20-24, there were 166.7 live births. This ASFR is also high and it causes an increase in service provision costs and budgeting. Their effect (increasing budget and service provision) however, is only directed to a specific age group. The advantage of ASFR is that it can be used for a specific age group.

Total Fertility Rate (TFR): The Total Fertility Rate (TFR) refers to the average number of children a woman is likely to have if she lives to the end of her child-bearing age based on current birth rates. The present world average is 2.6. Specifically, this average varies from 1.6 in developed countries to 3.2 in developing countries to 4.7 in the least developed countries. TFR is the sum of ASFRs multiplied by 5 (age interval within age groups is 5 years). Consider the hypothetical information in Table 1.3 regarding population data for region A, and use the data to compute the TFR.

Table 1.3: *Population data for region A for computation of TFR*

Age Group	Women	Births	ASFR
10-14	57 478	37	0.6
15 – 19	54 945	3 382	61.6
20-24	48 056	8 632	179.6
25-29	40 433	7 102	175.6
30-34	29 034	3 317	114.2
35-39	20 672	1 279	61.9
40-44	20 649	446	21.6
45-49	17 010	39	2.3
Total			**617.4**

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Steps:

(i) Calculate the ASFR for each group (see the steps above)

(ii) Sum up the ASFR

(iii) Use the ASFR to calculate the TFR

$$\Sigma ASFR = 617.4$$

$$TFR = \frac{\Sigma ASFR}{1\,000} \times 5$$

$$TFR = \frac{617.4}{1\,000} \times 5 = 3.087$$

$$TFR \approx 3.087 \approx 3.1$$

This means that on average, each woman in this case gave birth to 3.1 children. The TFR is one of the best indicators of future population growth.

Gross Reproductive Rate (GRR): This is the average number of daughters that a woman would have during her life time of child bearing age (15- 49 years). This is calculated by multiplying the TFR by the proportion of female births (sex ratio at birth).

$$GRR = \frac{\text{Female births}}{\text{Total births}} \times TFR$$

Where, the total births = male + female births.

Example: If the TFR of an area is 3.1 and the sex ratio at birth is 100 females for every 105 males, the GRR will be;

$$GRR = \frac{100}{100 + 105} \times 3.1$$

$$GRR = 1.5$$

A GRR of 1.0 indicates that the population is just replacing itself, while a GRR of 2.0 suggests that the population is doubling itself with one generation.

Fecundity: The fecundity refers to the ability of a woman to conceive. It is estimated that the maximum number of children an average woman can produce is 15 if she starts bearing children soon after menarche, which occurs between 12 and 14 years. That continues till menopause in her 40's (15-49 years). This is also a factor for change in the population because; the more you have fertile women, the more the population and the opposite is also true. The world average CBR is 26 per 1 000 but North America has 15.44, Asia has 17.94, Europe has 9.3 per 1 000 and Africa has the largest CBR of 32.4 per 1 000.

The birth rate ranges from 10% in developed countries and 50% in developing countries. Normally, high fertility rate is caused by several factors, including improved health diagnostic and medical services. The percentage of women married at younger age is higher in the Sub-Saharan Africa compared to North Africa. Some communities in Africa recognise high fertility as an important requirement for a successful family. Moreover, they consider having many children as a potential source of labour and social security for their aged parents.

The population structure changes with time as it has already been stated. Throughout the history, until a couple of years ago, birth rates in some of the most economically developed countries have always nearly exceeded the death rates. The exceptions, however, have been in areas which have experienced major outbreaks of diseases (the bubonic plague and AIDS) or wars (as it was in Rwanda). Any natural change in the population, either an increase or a decrease, it is usually expressed in percentage and it is referred to as an annual growth rate.

Factors responsible for the decline in fertility

A decline in fertility can be contributed by several factors including improvement in family planning programmes, improved education opportunities for women and changes of their economic status, which prevents them from getting married early and force them to have manageable families. Additionally economic hardships make women to automatically reduce the rate of giving birth. Other factors include the major world movement of children by choice rather than chance. It goal was giving women reproductive measures and options: safe abortion was promoted to reduce the number of children being born in the world.

Factors that influence high birth rates in the developing countries

High birth rates in developing countries are attributed to the following:

Security at old age: Some of the parents treat children as a security or insurance at old age. Giving birth to a large number of children is thought to assure them of assistance at old age. Some also tend to believe that to have many children assured them good services in the future.

Early marriages: Some countries allow children to be married at a very early age. Consequently, , such children end up giving birth to many children before they reach menopause. In Tanzania, the age accepted by the government, based on the law of Marriage Act (1971), for a girl to be married is 15 years under parental concert and 14 years under the court consent, whereas, the minimum for a boy to marry is 18 years.

Naming of children: Some of the tribes prefer names their children after their ancestors or some senior family member to many children as the tradition requires. Now a days, religious names like Yusuf and Daudi predominate.

Forced marriages: In the developing countries, some of the tribes force girls to

marry at a very early age. This motivates couples to have as many children as possible. Nonetheless, has recently been on a remarkable decline.

Polygamy: This is a tendency of a man to get married to more than one woman. This can also lead to an increased birth rate as each woman married to the same man would want to have children. In some polygamous society, women who are marry one man would compete to give birth to many children as possible to prove their womanhood, and for acknowledgment in the family.

Inadequate knowledge about contraceptives: Some of people in the developing countries have little or no knowledge about the use of contraceptives as a means to reduce birth rate/fertility. The knowledge on various contraceptive methods; their application, difference and efficiency is vital, as it can help reduce high birth rates.

Limited access to family planning services: Some of people reside in very remote areas in such a way that they can not access the family planning services aesily. This is often the case for rural women. In such a context, they are encouraged to use Natural Family Planning Methods (NFP).

Low education about family life: In the developing countries, women are the most marginalised group in education. Many have little on knowledge about family life, hence are involved in unexpected pregnancies. They thus, often fail to make informed decisions on fertility and family planning methods.

Religious teachings: Some religious teachings discourage the use of contraceptives as they believe that their uses is against the teachings of God. For example, the Roman Catholic and Muslims strictly prohibit the use of condoms and family planning pills. Their teachings encourage the use of natural methods of which the majority do not have proper understanding of its proper use.

Desire for more children: In some areas, families would like to have more than one child and at times, of a particular sex. Some people would keep giving births until they get a child of a particular sex.

Labour supply: Some families in some of the developing countries treat children as a source of labour. Giving birth to many children thus would mean assurance of adequate manpower for the family.

Mortality

Mortality rate refers to the number of deaths in a population in a given period to a given number of people. Deaths reduce the number of people in a population. High mortality rate reduces human capacity to participate in the socio-economic development.

Deaths can be caused by the internal and external factors. Internal factors are caused by genetic make-up of an individual, and circumstances associated with pre-natal life and birth process. Usually, these deaths are difficult to prevent even by using the scientific methods. Examples of internal causes of deaths include degenerative diseases like heart diseases, cancer, and diabetes. The external causes of death are brought about by external factors

and are influenced by the environment. These include accidents and infectious diseases such as tuberculosis, HIV/AIDS, cancer, malaria, and COVID-19, among others. The mortality rate has declined substantially in Tanzania over the decades. The main contributing factors to this decline include improved access to the health care and better environmental sanitation. In 2015, the natural increase was positive, as the number of births exceeded the number of deaths by 1 042 107. However, due to external migration, the population declined by 26 877.

Factors that influence mortality rate

The mortality rate of a given population is influenced by a number of factors. These factors include age group, sex, occupation, health status, and socio-cultural practices or behaviours of the population that put people at health risk. A substantial proportion of deaths in Tanzania, like in other developing countries, occur among the infants and children of less than 5 years of age. These infant deaths are contributed by such factors as prevalence of infectious diseases, malnutrition, and absence of proper care for children at early age. The mortality rate also differs among female population. Pregnant women are at a higher risk of dying than non-pregnant women because of the maternal complications and inadequate provision of reproductive health services. Women with short child spacing intervals are at higher risk of dying than women with normal and recommended interval of birth spacing. Early, frequent, too close and late child-bearing also account for high risk of dying among fecund women.

Health status of the population is another important factor which influences occurrence and prevalence of deaths. Poor health status resulting from inadequate provision of appropriate, accessible, and affordable health services increases the risk of dying. The mortality rates are indicated by different measures, which include Crude Death Rate (CDR), Infant Mortality Rate (IMR), Child Mortality Rate (CMR), Maternal Mortality Rate (MMR), and Life Expectancy (LE)

Crude Death Rate (CDR): Crude death rate is the number of deaths per thousand people in a population within a given year. CDR can be calculated by using the following formula;

$$\text{CDR} = \frac{\text{Number of deaths in a year}}{\text{Total number of population}} \times 1\,000$$

Example: Assume the population in Ikombe village in 2000 was 40 000 people while the number of deaths registered in that year was 600. The Crude Death Rate therefore was:

$$\text{CDR} = \frac{600}{40\,000} \times 1\,000$$

$$\text{CDR} = 15$$

This means that out of 1 000 people, 15 people were likely to die. CDR is higher in the developing countries than for the developed countries. It is called crude death rate because it includes all people of different age and sex and it is not specific to sex or age. The developing countries have poor social services, poor health and sanitation services, and low number of competent health staff, leading to higher death rates.

Child Mortality Rate (CMR): Child mortality rate refers to the number of deaths occurring among children aged between 1-4 years in a given year per 1 000 children in that age group. CMR can be calculated by using the following formula;

$$\text{CMR} = \frac{\text{Number of deaths of children (1- 4years)}}{\text{Total number of children aged (1- 4years)}} \times 1\,000$$

Example: In Chidachi village, the number of children aged 1- 4 in 2001 was 1 500. Out of these, 100 children died before reaching age 5. The CMR of Chidachi village was therefore;

$$\text{CMR} = \frac{100}{1500} \times 1\,000 = 66.7$$

$$\text{CMR} \approx 67$$

This means that the CMR for Chidachi village was about 67 per 1 000 children. This CMR is very high and quite reflective of CMR occurring in the developing countries. The reasons for high child mortality rates in developing countries include poor social services, poor health and sanitation services, and low number of competent health staff.

Infant Mortality Rate (IMR): Infant mortality rate refers to the number of deaths of infants (0 – 1years) in a given year per thousand live births. It can be calculated by using the following formula;

$$\text{IMR} = \frac{\text{Number of infants (0-1 year) deaths}}{\text{Number of registered live births per year}} \times 1\,000$$

Example: Sinjilili village recorded a total of 2 000 live births in 1999 and it also registered 100 deaths of children below 1 year. The IMR therefore was;

$$\text{IMR} = \frac{100}{2\,000} \times 1\,000 = 50$$

$$\text{IMR} = 50$$

This means that the IMR of Sinjilili village was 50 infants deaths per 1 000 live births. This IMR is higher than those in the developed countries where it usually ranges between 10 and 15 deaths. It also suggests that infants are at higher risks of dying before reaching one year of age. The higher deaths in the developing countries are due to poor health and sanitation services, and shortage of competent staff to offer health services. Higher IMR is an obstacle to development because it increases costs of protecting children, thus affecting investments for the economic growth.

Maternal Mortality Rate (MMR): The maternal death is defined as any death that occurs to a woman during pregnancy, childbirth or within forty two days (six weeks) after the birth or termination of a pregnancy. Maternal Mortality Rate (MMR) is expressed by the number of maternal deaths to women aged 15- 49 years divided by live births in a year, multiplied by 100 000. This rate can be calculated by using the following formula;

$$\text{MMR} = \frac{\text{Total number of maternal deaths}}{\text{Total number of live births in a year}} \times 100\,000$$

Example: In 2002, 1 000 live births were recorded in Ipinda ward. About 20 deaths of women due to pregnancy related complications were also registered. Therefore, the MMR in Ipunda village can be calculated as follows;

$$\text{MMR} = \frac{20}{1\,000} \times 100\,000$$

$$\text{MMR} = 2\,000$$

This means that the MMR for Ipinda ward was 2 000 women deaths per 100 000 live births. Pregnant women in poor developing countries are at higher risk of death especially in rural areas possibly due to the following factors. First, there is poor access to health services. Second, health facilities are located far from their residences. Third, there is a low number of competent health staff and too much reliance on traditional birth attendants (TBAs). Fourth, haemorrhage sepsis, obstructed labour, HIV/AIDS, anaemia and malaria which are a common threat to women at birth. Over one-third of women bear children at a very early age (below 20) or before they are physically mature. These have higher risks of maternal complications which may result into death.

Factors contributing to the decline of mortality

There are several factors which contribute to the decline of mortality. They include the following;

Education: Provision of broad-based education creates awareness about risks of death, personal hygiene, consumption pattern, as well as the importance of health services. Moreover, education helps to improve mother and child's health, alleviate poverty, and improve the nutrition status of the people.

Health services: Improved health services result in the decline of mortality. Easy accessibility and availability of improved health services have a direct effect on the decline in mortality among the population. Improved health services strengthens control of diseases that would have caused deaths of people.

Nutrition: Good nutrition reduces occurrences of nutrient-deficiency diseases such as malnutrition, anaemia and scurvy. It also provides body immunity against diseases happening due to external causes.

Immunisation: Vaccination (inoculation) results in mortality decline because it makes the body develop immunity against certain diseases. Implementation of vaccination and other immunisation programmes against killer diseases such as measles, TB, polio, COVID-19, cholera and whooping cough, lead to reduced infant and child mortality rates.

Good sanitation: Good sanitation enables people to live in a healthy environment, thus reducing the risk of contracting diseases like cholera, typhoid, dysentery, diarrhea and parasitic diseases.

Life Expectancy (LE)

Life expectancy refers to the average number of years that a person born in a given area may expect to live (the average age at which people die). The expectation of life index is inversely related to infant mortality rate. High infant mortality rate is associated with low life expectancy while low infant mortality rate is associated with high life expectancy. This explains why life expectancy in the developed countries is higher than that of developing countries. The life expectancy also differs between sex groups; women have higher life expectancy than men.

High life expectancy implies good quality of life. Where there are good socio-economic facilities such as education, health services, increased use of vaccines, clean water, and sanitation services, the life expectancy is high. On the contrary, lack of adequate supply of such facilities will possibly result in low life expectancy.

High life expectancy for the developed countries is due to; advancement in the economy and industrialisation, improved health services, good nutrition services, high life skills, advanced sanitation services, and high income that enhances access to basic and reliable social services.

Likewise their Human Development Index (HDI) in developed countries is high; they have improved standard of living, high GDP, high child welfare, health care, good medical, transportation, communication and education facilities, and better housing and living conditions. They have also modern industrial, technological infrastructural, and higher per capital income. All of these factors contribute to the increase in their life expectancy.

In developing countries, life expectancy is low because of factors such as poor socio-economic status; unemployment, poor income, in equitable education opportunities, health care facilities, nutrition, clean and safe water, sanitation, and housing conditions.

Migration

Migration is the movement of people or groups of people that involves permanent or seasonal change of residence. For example, seasonal movements, like transhumance in the Alps and Himalaya areas, and movements to other places for labour and employment, are examples of

migrations cases. Migration affects the population distribution and population structure of a country or a city. Population change is also affected by migration. Although the migration does not affect world population totals, it does affect spatial distribution of people across the world. It increases the population at a destination points and decreases population at their places of origin.

Causes of migration

Migration can occur due to either *push* or *pull* factors. The *push* factors are conditions that force people or a person to move out of a place to another place. People in this movement might not be satisfied with the conditions prevailing in their places of origin. They, thus, may decide to relocate. The *pull* factors are opportunities that attract people to move into the area. Push and Pull factors can be environmental, economic, social, or political.

Environmental Factors

The environmental factors include climate, relief, soil, availability of natural resources, natural hazards and presence of pests and diseases.

Climate: Favourable climate with adequate rainfall and moderate temperature attracts people to a particular place. For example, the climate of Southern highland regions of Tanzania (Mbeya, Songwe, Rukwa and Iringa) attracts people for agricultural activities. Poor climatic conditions like shortage of rainfall, extremely high and low temperatures as in the polar regions, force people to move away from certain areas. Dry areas with arid and semi-arid characteristics such as Sahara desert, also push people away from these areas. In Tanzania, the semi-arid areas include some parts of Dodoma, Singida and Shinyanga regions.

Relief: Areas which are free from floods, such as highlands, attract people, while areas which experience floods such as river valleys, force people to move away. Moreover, people are attracted by places with gentle slopes for easy cultivation, and the leave places with steep slopes because they are prone to the soil erosion.

Edaphic factors (soil): Areas with good soils attract people while areas with poor soils force people to move away, especially people engaging in crop production. For example, in Tanzania, slopes of mount Kilimanjaro, Kilombero in Morogoro, and Rungwe in Mbeya. Elsewhere valleys of the Ganges River, Yangtze Kiang, Hwang Ho and the Nile have attracted a lot of people who engage themselves in crop cultivation.

Availability of natural resources: Areas with adequate natural resources like minerals attract migrants such as the Rand in South Africa, while the absence of natural resources forces people to move away from those places. Similarly, areas endowed with forests, rivers, and wildlife are highly inhabited. An example is the Sao Hill Forest which led to the growth of Mafinga town in Iringa, Tanzania.

Natural hazards: Natural hazards such as earthquakes, volcanic eruptions, floods and storms force people to move away from a particular places while their absence attracts people to certain places.

Presence of pests and diseases: Areas that are free from pests and diseases attract people but where pests and diseases are common people are forced to move away to other places. For example, there have been movements of people from the central parts of Tanzania due to tsetse fly infestation, to other areas especially the Southern Highlands of Tanzania. People, especially farmers, can also migrate from areas which have been invaded by destructive weeds, crop pests and diseases to areas which are less affected.

Economic Factors

Lack of income opportunities is likely to force people out of one place to other while availability of income and employment opportunities attracts people. This is manifested by the rural-urban migration, whereby industries in towns and cities attract people from rural areas. In general trade centres, industries, and large scale farms attract people. Hence areas with these activities are highly inhabited.

Social factors

Presence of related people in a certain place can attract more people related to them. Brother, sister, cousin, work mate, can influence others close to them to go and live in the same area. Furthermore, land inheritance system force people to live together in one area, as it is the case of Kagera (dominated by the Haya) and Kilimanjaro (dominated by the Chagga) regions. Moreover, lack of social amenities in some places can force people to move away while the presence of social amenities attracts people into a place. For example, the availability of better education, electricity, medical services, transport network and entertainment attracts people in towns and absence of these aspects in the areas forces people to move out of rural areas. Additionally, factors such as social conflicts, enemity, unrest and overpopulation also force people to move away from a place to a favourable other.

Political factors

Peaceful areas due to stable political system attract more people while places with political tensions force people to move away or avoid them. For example, people move away from areas with civil unrest, ethnic and religious wars such as Burundi, Somalia, Syria, Iraq, Guinea Myanmar and Sudan, to more peaceful places like Tanzania. Also, peaceful countries like Tanzania attract more tourists than countries with political and ethnic clashes.

Classification of migration

Migration can be classified based on three criteria, namely duration of stay, motivation and boundary.

Classification according to duration of stay

According to duration or time of stay in a place of destination, migration can be categorized as either temporary or permanent.

Temporary migration: This involves the movements of people to a destination for a short time stay. This type of migration is exemplified by students going for studies outside a country or to other

places within a country, as well as the seasonal movements of pastoralists with their domestic animals (transhumance).

Permanent migration: This involves total change of residence. For example, people going to urban areas from rural areas or going to rural areas from urban areas as many do after retirement. Permanent migration can be international or local.

Classification according to motive for migration

Voluntary migration: The voluntary migration is caused by someone's desire to move from one place to another. Examples of this include; when a skilled person goes to another country for better salaries, to open new areas of investment or going to a town for better social amenities like medical services, schools, and entertainment.

Forced migration: Forced migration occurs due to political conflicts. Examples of forced migration include movement of refugees from Rwanda to Tanzania, and movement of slaves from Africa to America during the slave trade. Forced migration can also be triggered by overpopulation and environmental problems.

Planned migration: Planned migration happens due to an attempt by a government to reduce uneven development and solve the problem of overpopulation as well as to speed up development of people. It can also be done to promote smoother and more efficient provision of social services to people. A good example of planned migration is the movement of people to rural Tanzania during the establishment of *Ujamaa* villages in the 1970s. The recent relocation of most Ministry headquarters to Dodoma, the capital of Tanzania is another practical example of planned migration in recent years. Planned migration is also exemplified by resettlement schemes adopted in different parts of the world for solving the problem of overpopulation. New areas are also opened for economic investment purposes.

Classification according to boundary

According to the boundary, migration can be termed as either *international* or *internal*.

International (external) migration: International migration involves the movement of people from one country to another either permanently or temporarily. Short term migration has increased due to expansion of tourism, as millions of holiday makers, especially from North America, Japan and Europe, spend their holidays abroad. Movement from one's country is called *emigration* while movement into another country is called *immigration*.

International migration can be either voluntary or involuntary. Voluntary international migration involves job seekers moving to different countries; students going for further studies in another country; and tourists visiting different countries. On the other hand, involuntary international migration is exemplified by such events as movement of slaves from Africa to North and South America; movement of refugees from Rwanda to neighbouring countries following the 1994 genocide; movement of refugees from Afghanistan to Pakistan following the American attack in 2001; and fleeing

of a large number of people from Ethiopia due to famine. International migration can be caused by economic, political, religious, cultural and environmental factors.

Internal migration

This is the movement of people from one place to another within the country. A distinction can be made between in-migration and out-migration as far as internal migration is concerned. In-migration is a movement into a particular place such as a region or a district within the country while out-migration is the movement away from a district or region to another place within the country.

In Africa, people normally move from areas with poor living conditions to areas with relatively better living conditions in order to increase their income. Some, however, people move to avoid punishment due to crimes they have committed while others escape from their enemies and witchcraft. There are four categories of internal migration; rural-urban, rural-rural, urban-urban and urban-rural. However, of the four categories, rural-urban migration is of greater interest because; it has a great impact on development.

Types of internal migration

Rural-urban migration

This involves people moving from rural areas to urban areas in search of non-agricultural employment (which is regarded as more paying); and better social amenities such as medical services, education, reliable water supply, efficient transport and entertainment. Most of the migrants involved in this type of migration are young and energetic people, especially males. The main centres of attraction are ports, industrial zones, and national or regional capital cities. For example, in Nigeria, school leavers and apprentices migrate to Ibadan, Abuja and Lagos with the expectation of getting jobs. In Tanzania, the majority of people migrate from rural areas to cities like Dar es Salaam, Dodoma, Arusha, Mbeya and Tanga. Others move to urban centres in samee region.

Causes of rural-urban migration

Rural-urban migration is driven by pull factors that attract people to urban areas and push factors that drive people away from the countryside. Employment opportunities in cities are one of the main pull factors. Many industries are located in cities and offer opportunities with relatively high wages. There are also more educational institutions providing a wide range of both academic and professional courses and skills training. People are also attracted to urban areas because of the urban lifestyle.

These factors, combined with opportunities for businesses, result in both temporary and permanent migration to urban areas. Poor living conditions and lack of opportunities for paid employment in rural areas are push factors. People move away from rural areas because of poor health services, limited educational and economic opportunities as well as environmental challenges such as droughts, floods, and inadequate productive land, and other pressures on rural livelihood.

Impacts of rural-urban migration

In the place of origin (rural areas) the following negative impacts can occur: First, rural-urban migration can cause rural depopulation and shortage of labour force. Rural depopulation occurs due to the movement of young people to urban areas. As young people leave rural areas, old people, women and children are left behind. This creates labour shortage, consequently, causing inefficient production. This problem also results into loss of skilled people in rural areas. Second, it can result into economic decline and low productivity in rural areas because resources are not utilised due to the shortage of labour force. For example, most land is left idle leading to agrarian crisis or agricultural failure which is responsible for shortage of food supply (food crisis) hence, starvation or famine, health deterioration and deaths. Rural-urban migration can result into family disintegration and divorce in rural areas some men move to town and abandon their spouses and families. This causes separation and divorce.

In some other instances, rural-urban migration has some positive impact on rural livelihood. It can lead to environmental conservation in the rural areas and reduce the problem of overpopulation or population pressure. Moreover, reduced population size minimises the burden of social services provision in rural areas. The rural-urban migrants may also support the development of their rural homes through the remittances and investments in development activities.

In the area of destination (urban areas) rural-urban migration causes overpopulation and overcrowding. These in turn bring about problems of poor housing coupled with development of shanty-towns or slums, congestion in transport facilities and land degradation. Rural-ubarn migration also increases the problem of unemployment since the number of job seekers becomes too large compared to the available job opportunities. This has been a cause of some labour-related conflicts, for example, conflicts of this nature have been occurring in South Africa. Rural-urban migration increases pressure on allocation and use of social service such as water supply, medical services, and food supply. It also causes environmental pollution due to poor waste management, poor sewage disposal, and excessive generation of wastes. Furthermore, it brings about cultural deterioration due to a mixture of people from different areas with different cultural backgrounds. It leads to the emergence of immoral activities and different vices such as prostitution, corruption, and burglary.

Rural-urban migration can contribute to industrial decline since rural areas may decrease supply of raw materials for the industries in towns. It can also lead to the emergence of unregulated informal sector activities like food vending, and peddling done by hawkers (for example, the *Machingas* in Tanzania, and the *Jua Kali* in Kenya). In addition, it leads to the emergence of street children in towns caused by prostitution or weak marriage bonds as a result of economic crisis in town. It also leads to the introduction of

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rural culture in towns, such as cultivation of crops and rearing of animals.

Rural-urban migration can have some positive effects as well to the urban or places of destination. It can increase the supply of labour in the industrial sectors, thus stimulating industrial development. In Tanzania, most of housekeepers and gardeners are from rural areas. Rural-urban migration also leads to the expansion of market for goods produced in different economic sectors. It facilitates transfer of technology to rural areas.

Strategies to address the problems of rural-urban migration

Reduction of income differences between urban and rural areas: This can be done by investing capital in rural areas in the form of micro-credit loans through Village Community Banking (VICOBA), agricultural bank and cooperative societies. This in turn will attract people in rural areas to seek loans and engage in different economic activities

Establishment of small and medium-size satellite towns: These can reduce overpopulation in one town or one town area and stimulate economic development as well as environmental conservation. Satellite towns will also be market centres for goods and services. Towns such as Kibaha, Chalinze, Segera and Makambako also act as a bridge to major towns and cities like Dar es salaam. Tanga and Mbeya.

Control of rural-urban migration through policies and regulations: Enacting of favourable policies that reduce migration through establishment of investments in rural areas will reduce rural-urban migration. Rural-urban migration should not be treated as a bad thing; it has various contributions to the development of the place of origin and that of destination. It has to be properly managed through accommodative and anti-accommodative policies such as repatriation of beggars and loitering people from towns, detention and jailing of loiters. In this case town dwellers need carry an identity card showing their occupation and place of residence. Improvement of the agricultural sector through mechanisation, improvement of seeds, subsidisation of agricultural inputs and reactions of markets for agricultural produce is another strategy suitable for reducing rural- urban migration.

Increase the provision of social services in rural areas: Most of the basic social services are found in urban areas. People, especially the youths, are pulled by these social services to move to urban centres. In order to encourage young people to remain in rural areas, a balance in the provision of social services needs to be emphasised.

Improving access to markets and better prices for rural crops: Improving access to markets through cooperative societies, and other marketing strategies will encourage rural people to remain in rural areas. Moreover, prices for crops should be monitored and improved to motivate young people to engage in agriculture.

Improving transport and communication in rural areas: Improvement of transport and communication system so as to facilitate movement of goods, people and information is an important strategy to reduce rural-urban migration. Meanwhile,

there is still a bias of improving roads, bridges and communication facilities in urban areas while ignoring rural areas.

Programmes for population control: Introduction of appropriate programmes to control population growth in some areas is important. In some rural areas, fertility rates are higher and household sizes are bigger than resources available. These have been among the push factors for migration. Education programmes to inform people the need to balance between population size at household and available resources is, therefore, important.

Urban-rural migration

Urban-rural migration involves people moving from urban areas to rural areas. This type of migration is also called counter urbanisation. It is rare in Africa but more common in the developed countries where many people prefer to stay in the country side and in urbanised villages. This movement is also done by people who prefer moving to their places of origin, mostly rural areas after retirement. This type of migration is triggered by a number of factors.

Causes of urban-rural migration

People go to rural areas to avoid air and noise pollution in the urban centres. Other people go back to rural areas after retirement since they find it difficult to cope with fancies of the urban life. Unskilled people from rural areas can also find it difficult to secure jobs in towns. They, hence, may decide to return to rural areas. In some countries, people are encouraged to go to rural areas through the supply of necessary social and economic amenities which are also available in towns. In some cases, governments encourage or force people to go to rural areas to open up the potential land for economic activities or to solve the problem of population pressure in towns. The outbreak of terrible and moribund diseases in towns, like meningitis, cholera, HIV/AIDS and COVID-19 can force people to move to rural areas. In addition, lack of safety due to vandalism or hooliganism and burglary as well as frequent conflicts, social tensions and life hardship can force people to run away from urban to rural areas. Moreover, lack of space to setup industries and other large-scale economic sectors can lead to urban-rural migration since these need large spaces.

Impacts of Urban-rural migration

Negative impacts in the places of destination (rural areas) includes outbreak of conflicts with the old residents because of encroaching on their pieces of land or land deprivation, the rise in the prices of houses in rural areas leading to the problem of housing and the increase in traffic in the rural areas which can cause problems of delays in different social and economic activities. Other impacts are related to land degradation caused by soil erosion and deforestation, interference with culture in the rural areas leading to moral deterioration such as prostitution. It may also cause decline in agricultural activities since most of the arable land turns into residential areas and industrial centres. It can also cause an increase in environmental pollution such as air pollution, noise pollution, and water pollution. Crimes and other vices

which are common in urban areas, may also increase. For the case of positive impacts in the places of destination (rural areas), urban-rural migration stimulates utilisation of resources. People can provide labour to work on the exploitation of minerals, cultivation (for example in the Rufiji basin), and other related activities.

Urban-rural migration can also impact the place of origin (urban areas) negatively. Migration of people from urban to rural areas tends to reduce cheap labours who work in urban households and some industries. Also , when retired people who have experience in governance, administration and industrial activities move into rural areas because of retirements. Urban areas, thus, lose potential resources fulness of experienced people. In the case of positive impacts on places of origin (urban areas), urban-rural migration reduces population pressure in towns and leads to the environmental improvement, especially hygienic conditions. It also reduces the burden facing the government in terms of provision of social services even to people who are idle. Furthermore, it reduces the problem of beggars in urban centres, facilitates the general economic development in rural areas and reduces the economic gap between rural and urban areas.

Urban-urban Migration

This is the movement of people from one town, which is less developed, to another town, which is more developed. For example, one can move from Kibaha to Morogoro or from Bagamoyo to Dar es Salaam.

Impact of urban-urban migration

Urban-urban migration can result in either negative or positive impacts. These impacts can be witnessed in, both the area of origin (where people or migrants come from) and place of destination (where people or migrants go). The negative impacts of urban-urban migration in the place of origin include depopulation and labour shortage as people move to different locations. The tendency can also cause decline in the production process since resources are not fully utilised due to the shortage of labour following the exodus of the young and energetic people. Decline in production process can be seen in urban agriculture and animal keeping in urban centres.

Urban-urban migration can also impact areas of origin (urban areas). Migration can bring about redistribution of population and solve the problem of overpopulation. In this aspect, the government can decide to move people from overpopulated areas or places with population pressure to areas of under populated by establishing resettlement schemes. Planned migration can facilitate the provision of services and mobilisation of manpower. Migration also creates room for industrial expansion, particularly if the industries in question are supposed to be located in areas which are not overpopulated.

In places of destination, urban-urban migration can negatively affect town areas through overpopulation and overcrowding

which bring about competition over the resources. Relocation of migrants increases the number of people in areas of destination. Some urban centres in cities like Dar es Salaam, Arusha, Dodoma, Tanga and Mbeya are overcrowded due to relocation of people from some intermediate and small towns. The shortage of food and increase in commodities and services expenses and prices, unemployment, social crimes, spread of diseases, destruction of the environment, shortage of social services, transport challenges, and growth of informal activities and sectors are also evident challenges resulting from urban-urban migration.

Urban-urban migration can promote supply of labour that can be used in exploiting or harnessing the idly lying resources like minerals, land, and water bodies. It can also encourage or stimulate transfer of technology which is essential to development and life advancement. Moreover, people who migrate possess different skills which can be made of use. Urban-urban migration can also lead to market expansion for local goods in the place of destination and accelerate urban growth.

Rural-rural migration

Rural-rural migration is a movement of people from one village to another village which is more economically advanced, advantaged or more peaceful. People may shift to different villages to avoid conflicts, diseases, witchcrafts, and enemies. They may also shift to follow their relatives or they may be forced to move because of government plans. The establishment of *Ujamaa* villages in Tanzania (1976-1986) is a good example of rural-rural migration. As a planned rural-rural migration, people were made to settle in identified new areas to facilitate provision of social services.

Exercise 1.7

1. Discuss four factors influencing rapid urban population growth.
2. Explain four effects of rapid urban population growth on socio-economic development.
3. Outline four causes of rural-urban migration in Tanzania.
4. Describe four negative impacts of rural-urban migration.
5. List four negative impacts of urban-rural migration.
6. Table 1.4 provides in-migration and out-migration data for the selected regions in Tanzania for 2002 and 2012 censuses. Read the data and answer the following questions;
   (a) Mention regions which experienced population increase due to migration.
   (b) Explain three reasons for the population gain.
   (c) Mention the regions which experienced population loss due to migration.
   (d) Explain reasons for the loss of population.
   (e) Calculate the net migration for Morogoro Region in the census 2002.

Table 1.4: *Number of in-migrants, out-migrants and net-migrants for the selected regions in Tanzania.*

Region	2002			2012		
	In-Migrants	Out-Migrants	Net Migrants	In-Migrants	Out-Migrants	Net Migrants
Tanzania	5 304 209	5 304 209	0	7 354 920	7 354 920	0
Tanzania Mainland	5 044 080	5 050 913	-6 833	7 067 909	7 077 211	-9 302
Dodoma	139 808	321 276	-181 468	163 320	506 471	-343 151
Arusha	264 978	183 250	81 728	309 834	241 974	67 860
Kilimanjaro	148 238	411 735	-263 497	155 328	559 922	- 404 594
Tanga	132 087	294 130	-162 043	165 301	462 644	-297 343
Morogoro	284 542	210 282		397 682	372 219	25 463
Pwani	189 204	245 454	74 260	276 965	342 639	-65 674

Source: *Population and Housing Census, 2002-2012*

Activity 1.11

1. In a group, use web resources and textbooks to plan five measures that can be used to reduce rural to urban migration.
2. Using the 2012 population census data of Tanzania, identify three impacts of migration on the place of origin and three on the place of destination.

Activity 1.12

Individually, use web resources and textbooks to assess the effects of rapid growth of urban population in Tanzania. Discuss your assessment with your fellows in class

Population growth and socio-economic planning

The relationship between population growth and economic development is very complex and, the net effect of population factors on sustainable economy is sometimes ambiguous. It has already been described in the earlier stages of this chapter that population growth may be a resource, and a cause of and an engine for development. This occurs when there is proper planning and management of resources. Contrary to this,

population growth might be an obstacle to development; as it may cause various negative impacts. Although planning for population management might be part of the country's or national priorities, vision, and macro-economics, there must be a specific plan and intervention on the ways of controlling, managing and utilising the available population characteristics. Population characteristics such as fertility, mortality, density, migration, trends should be influenced by a specific policy.

Contribution of population policy on population management

Definition of population policy

Population policy refers to the statement, laws or regulations enacted so as to attain some demographic goals. It is a deliberate effort by the government to influence the demographic factors (population dynamics) like fertility, mortality, and migration. The ultimate goal of the population policy is to influence population outcomes such as population size, composition, distribution, and growth. The policy also tends to take into consideration, the relationship between population and development, as well as its impact on the environment. Population policy can either be explicit (direct) or implicit (indirect). These two types of population policy are further explained as follows;

Explicit (direct) population policy

This refers to a document or a clear statement issued by the governmental department and its commissions for the purpose of controlling population growth and raising the standards of living of people in a country. Explicit population policies can also stem from laws, policy declarations by a party, or directives issued by the President of a country. Explicit population policies are well stipulated and strictly followed or reinforced by elaborative statements, which spell out their rationale, objective, goals, targets, policy programmes, and implementation procedures. Examples of explicit population policies include provision of free family planning services, restriction on immigration (for example, UK and USA), raising the age of marriage, and increasing taxes/penalties for each additional child (for example penalties on those who violated the one child policy in China).

Implicit (indirect) population policy

These refer to government actions that indirectly have some demographic effects, for example promotion of female education. Implicit population policies include: compulsory secondary education, restriction of child labour, raising status of women and promoting female education, and providing old age security.

Case studies of population policies

Population policy in Tanzania

In 1992, Tanzania adopted its explicit population policy which replaced the previous implicit policies. This policy was revised in 2006 to accommodate new changes. It recognises the linkage between population parameters and development and provides the framework and guidelines for the management of population issues and development. The policy is part and parcel of the

implementation of the development vision 2025. The vision expected to have a high quality population which is also well educated.

The policy indicates that the country's population growth rate is 2.8% per annum which has an adverse effect on development. The policy outlines that rapid population growth has increased outlays on consumption by drawing resources away from savings for productive investments and, therefore, retarding growth in national output through slow capital formation. Figure 1.10 shows the population dynamics in Tanzania between 1967 and 2012. It indicates that the population grew from 12.3 million in 1967 to 17.5 million in 1978, from 23.1 million in 1988 to 34.4 millions in 2002 and to 44.9 millions in 2012. By 2021, NBS (2021), projected that the population had reached 59 441 988 people. Essentially, rapid population growth has aggravated problems of poverty, environmental degradation and poor social services. Furthermore, the problems of sexually transmitted diseases including HIV/AIDS and those facing specific segments of the population like children, youths, the elderly, and the persons with disabilities have become widespread too.

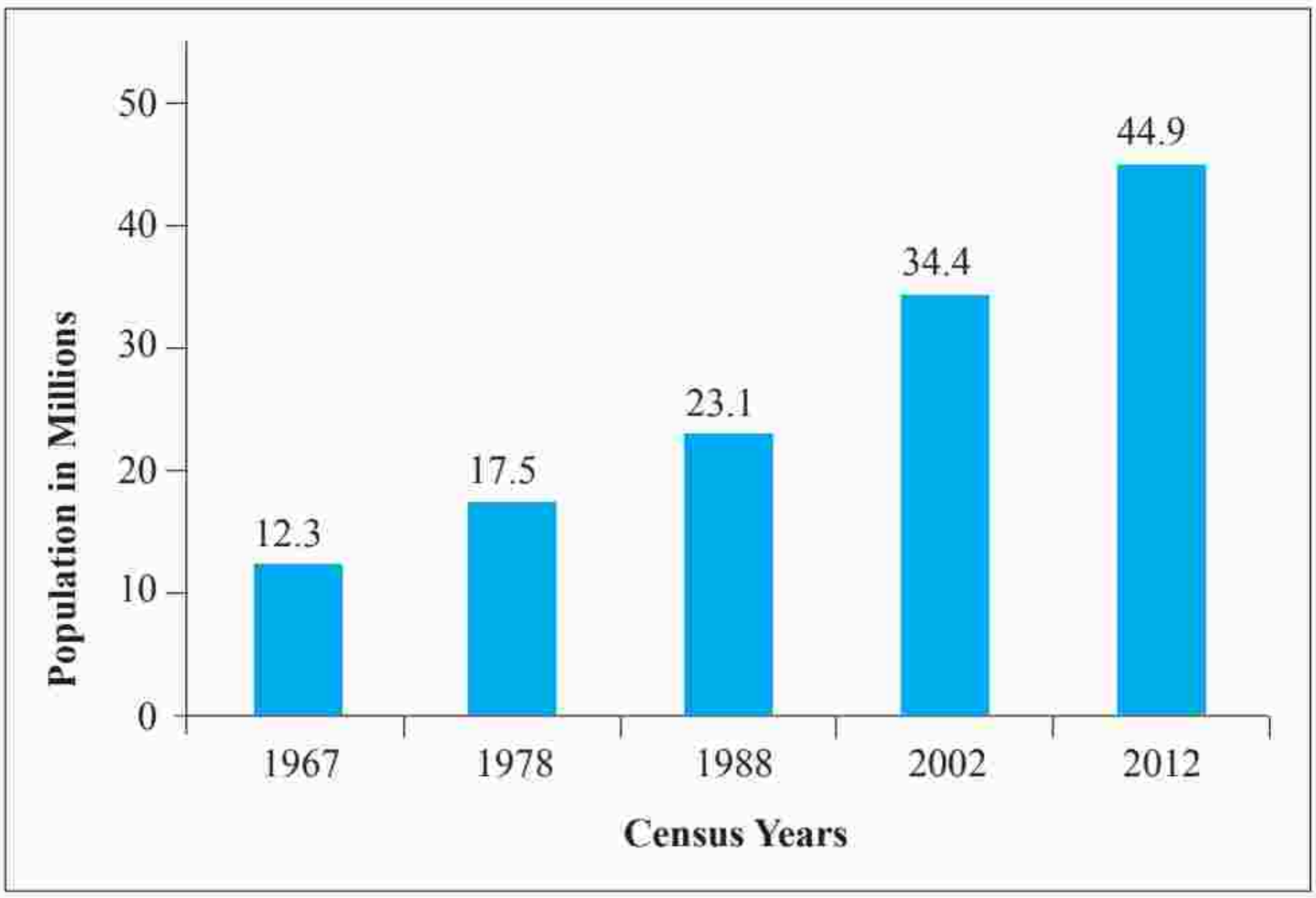


Figure 1.10: *Population trend in Tanzania from 1967 to 2012*

Source: TBS, 2020

Policy goal

The policy has the goal of influencing other policies, strategies and programmes that ensure sustainable development of the people and promote gender equality and empowerment of women. The overriding concern of the population policy is to enable Tanzania to achieve an improved standard of living and quality of life for its people. The important

aspects of quality of life include good health and education, adequate food and housing, stable environment, equity, gender equality and security for individuals. The specific goals of this policy are to contribute to the sustainable development and eradication of poverty, increased and improved availability of high quality social services, attainment of gender equity, women empowerment, social justice, and development for all individuals. Moreover, it aims to ensure harmonious interrelationships between population, resources utilisation and the environment.

The policy is implemented through a multi-sectoral and multi- dimensional integrated approach. In this regard, the government collaborates with Non-Governmental Organisations (NGOs), the private sector, communities and other agencies within and outside Tanzania implementing the policy. Moreover, individuals, political parties and other organised groups in the civil society are expected to play an active role to ensure attainment of policy goals and objectives. It is expected that with full support and participation of people, implementation of this policy will yield positive results.

Policy Achievements

Achievement of the past population policies both implicitly and explicitly include the following;

Increased awareness on population matters: There is considerable mass awareness of population issues, particularly those related to reproductive health and child survival. Due to the increase in awareness, fertility, and infant and child mortality have declined overtime. For example, infant mortality per 1 000 live births in 2004 was 68, 51 in 2010, 46 in 2012, and 43 in 2015. These data show a declining trend of infant mortality.

Adoption of the population policy in 1992 and its revision in 2006: The adoption of an explicit population policy in 1992 which recognises the links and interrelationships between population, resources, the environment and development, is an indicator of success. Review of the policy in 2006 is a further demonstration of improvement towards the success.

Promotion of studies on population: Expansion and/or introduction of population studies in higher learning institutions in the country, is another indicator of success. Universities, colleges and other institutions have increased provision of education courses related to the population issues. Various campaigns are also introduced and run in communities, hence skills and knowledge on child spacing and family planning are easily accessed by people.

Growing role of NGOs and CBOs on population related matters: There is an increase in number and capacity of NGOs engaging in population related activities including advocacy and social mobilisation, service delivery, and capacity building. These have contributed to the spread of education on population related issues.

Growing use of contraceptives: High knowledge and a wider use of

contraceptive methods among men and women is also a demonstration of success. To date, use of condoms, and other methods of family planning is common because of the implementation of population policies. These instruments are often easily available in dispensaries, health centres, and hospitals. Condoms are readily available in shops and places such as bars and clubs.

Challenges and limitations

Despite the above achievements, the implementation of the policy encounters various challenges such as inadequate human and financial resources, poor information communications system, non-establishment of planned institutional arrangements, and overreliance on the government for implementation of these policies. Other challenges include placing more emphasis on meeting demographic targets rather than meeting the needs of individual males and females, inadequate recognition of the causal relationship between poverty, population, environment, gender and development, and insufficient capacity and resources of NGOs engaged in population related activities.

Population policy in China

The population of China was 1 439 323 776 people in 2020 and this population is equivalent to 18.47% of the total world population, which makes China the most populous country in the world followed by India. People in China frequently suffer from natural disasters such as drought, floods, and famine, as well as diseases.

The influence of high birth rates in China in 1950's

In 1950's China had a high birth rate. This was influenced by the government as it encouraged births under the vision that "a large population gives a strong nation". People were, therefore, encouraged to have as many children as possible and the government was confident that China could feed her population regardless of its rapid increase. At the same time death rates were falling due to improved food supplies and medical care. Because of this scenario the fertility rate went high.

Population Control in China

During the 1960's the population increased by 55 million after every three years. Between 1950 and 1970 therefore, the population had increased from 540 million to more than 800 million people. The state family planning programmes were introduced in the 1970s through which the government encouraged family planning services, to promote maternal and child health benefits as well as economic and ecological advantages. The slogan *'Later, longer, fewer'* was introduced and this implied 'late marriage, longer interval between births and fewer children'. Family planning services were community based and in 1975 the average family size had fallen to three children. The government, however still considered the size to be too big. Therefore, in 1979 the anti-natalist-one child-per family policy was introduced by the government. With this policy the government hoped to reduce natural increase to zero by the year 2000 and hence, avoid population growth beyond 1.2 billion.

Specific measures taken by China in controlling population

A single-child policy offered specific incentives to parents having one child only and penalties to those having more than one child. Glory certificates were introduced and these entitled a couple and their child to various financial, employment, educational and other benefits in exchange for a promise to have no more children after their first-born. A child could have free education, and priority to housing and pension. In an attempt to make this policy work abortion became compulsory and marriage entrance age for males was set at 22 and 20 for females. Couples were pressured to accept officially promoted norms and those who wanted to marry or to have children had to apply to the government.

Alarmed by the projection of the growth of an ageing population and the shrinking workforce in 2016, the government of China ended the controversial one-child policy and allowed couples to have two children. The reform, however failed to reverse the country's falling birth rate. In 2017, China recorded 17.2 million babies born compared to 17.9 in 2016. Although the number of families having a second child rose, the overall number of births continued to drop. In 2018, the total number of births fell to 15.2 million, a drop of nearly 12% nationally from the 2017 record. Some cities and provinces have reported declines in local birth rates of as much as 35 percent. One of the reasons for the declining birth rate is reported to be the country's economic expansion which has created a society where many young couples struggle with economic pressures including rising education and housing costs making it difficult for them to have even one child, let alone two.

Constraints to the population policy in China

In rural areas, the policy faced resistance since some people feared that by accepting the policy there would come a time when the society would have many dependants (old people) and few working people (young people). Due to this reason, in many rural localities the single-child policy was never strongly enforced. Following the resistance, as from 1987 people in the rural areas were allowed to have two children while urban dwellers were still forced to observe the single child policy. As it has been reported early, a two-child policy was introduced formally in 2016, but adherence to it failed to meet the government objectives. In 2021, the government of China adopted a three-child policy as a need to curb low fertility rate and growth of ageing population.

Population policy in Norway

Norway does not have a distinct population policy but it has a special ministry responsible for policy on children, gender and family issues. Family policies in Norway include parental leave, formal childcare and the childcare cash benefit. To date, Norway is characterised by low fertility rate and low mortalities. Prior to the first world war, it experienced a relatively high fertility. It experienced a "baby boom" after the Second World

War. The "boom" was, however, more long lasting, whereby, in 1960s the total fertility rate was still as high as 2.5. Since 1970s, the fertility was declining and in early 1980s, fertility in Norway stabilised around 1.6-1.7, but hit a historic bottom of just below 1.4 in 1983.

Throughout 1990s, the fertility rate in Norway remained at 1.8. This was possibly a result of measures which aimed at reconciling family responsibilities and work outside the home. To date, Norway is one of the countries with low fertility rates globally. Currently, the total fertility rate is at the average of 1.86 births per woman. The birth rates fell to 2.9% in 2020, and annual births declined from 6 000 in 2000 to 4 000 in 2020. Women born in 1968, who by 2013 were 45 years old, had only 2.03 children on average while 13% of these woman remained childless and 83% had two children only. This has resulted into what is called "a two-child norm" in Norway. The general trend in Norway shows that the fertility rate is declining and the ageing population is growing.

Factors for low fertility rate in Norway

One of the factors for low fertility rate in Norway is said to be a delayed first-time bearing. On average, most women get children in their 30s. There is also a norm (two-child-boom) that a family is able to provide basic needs to two children only. There is an increasing number of men who delay to get married and others who marry but decide not to have children. The proportion of men without children increased reaching 25% in 2019. In addition, there is a high rate of divorce cases and growing gender based rights campaigns, which have contributed to low fertility rates in Norway.

Measures to increase fertility in Norway

Low fertility and ageing population is bad for the economy of any country. It reduces manpower, human resources and productivity. To address the challenges of low fertility and the ageing population, the government of Norway has been adopting different strategies;

Investment in education for children:
The government has invested in early child education by establishing child care centres and encouraging the private sector to establish more education centres. Because of this, 80% of children aged 1-2 and 97% of children aged 3-5 are in the public and private schools. This aims to reduce mortality and ensure that the working population increases.

Enhancement of parental leave at birth:
Parents giving birth are motivated by being offered a long maternity leave. Leave days are 49 weeks with full monetary compensation and 59 weeks with 80% compensation. This aims at encouraging parents with a newborn baby to consider adding another child in the future. Men are also encouraged to take a leave of up to four weeks after their wives have given birth.

Payment of annual child allowance:
In Norway the government also pays an annual allowance of $USD 1 500 per child in the family. Again, the aim is to motivate parents to bear or have

more children. The government gives support for daily education expenses for children in schools. Schools for children are supported by the government in terms of daily breakfast, and lunch. Children get free food financed by the government.

Financing tertiary and advanced education: Up to University level, education is freely provided and loans are readily available. It is assumed that if someone has to finance his or her education career, they are likely to delay bearing children. This is because they would be giving priority to improving their life quality. Financing someone's education, gives them motivation to have children earlier. These strategies from Norway, one of the most developed countries in Europe, provides more lessons for countries with ageing populations and low fertility rates. Nevertheless, some of these policies may or may not be relevant to the developing countries. It depends on the nature, characteristics and structure of the population in relation to the country's economy.

Exercise 1.8

1. There is a thinking that developing countries need to control their population. Explain the usefulness of this practice.
2. Explain the reasons for the one - child, two-child and three-child policies in China.
3. Discuss the role of population policy to the social economic context of Norway.
4. African countries have to learn a lot from Norway. What are the five lessons that Tanzania can learn from the population policy of Norway?
5. Compare and contrast the population policies for China and Tanzania.

Activity: 1.13

Read textbooks or use web-based materials and do the following;

(a) Identify four specific goals of the population policy in Tanzania.

(b) Identify five strengths of the Tanzania population policy.

(c) With a colleague, discuss five challenges facing Tanzania in the implementation of its population policy.

Activity: 1.14

In a group, visit a nearby health facility in your locality and do the followings;

(a) Talk to the health personnel to identify major family planning programs/services offered there.

(b) Provide five advantages of family planning for population control.

(c) Write a report about your visit and present it in the class.

Relationship between population growth and environment

The global rate of human population growth peaked at around 1963, but the number of people living on Earth and who share finite resources like water and food has grown by more than two thirds since then, topping out at over 7.8 billion in 2020. Human population is expected to exceed nine billion by 2050. Environmentalists do not dispute that many if not all of the environmental problems from climate change to species loss to over utilisation of resources, are exacerbated by the high population growth.

The environment is the provider of resources for development. It provides opportunities as well as limitations to population existence and survival. It is the provider of natural resources (fresh water, clean air, forests and grasslands, marine resources, agro-ecosystems, biodiversity, energy resources); habitat for flora and fauna and it is a sink that absorbs wastes (solid, liquid and gaseous wastes). In the course of using and managing the resources, population interacts with the environment. Thus relying on the environment for resources, and in that way the environment is affected by the way the population uses and manages natural resources.

Trends such as loss of half of the planets forests, depletion of its most major fisheries, and the alteration of its atmosphere and climate are closely related to the fact that human population expanded from mere millions in prehistoric times to nearly eight billion today. Moreover, it has been further realised that population growth has caused multiple environmental problems as from 1950's whereby, 80% of rainforests and tens of thousands of plants and wildlife species have been lost. There is also an increase in greenhouse gas emission of some 4% and development or commercialisation of as much as half of the Earth's surface land.

Industrialised countries contribute to climate change, ozone depletion and overfishing far more than developing countries. Ocean water covers more than 70% of the Earth's surface, but thirsty humans rely on finite supplies of freshwater to stay alive. With exploding human population growth, these finite supplies get quickly exhausted. According to the World Bank, as many as two billion people lack adequate sanitation facilities to protect them from water-borne diseases, while a billion people lack access to clean water altogether. According to the United Nations, 95% of the world's cities still dump raw sewage into their water supplies. Thus it should come as no surprise to know that 80% of all the health maladies in developing countries can be traced back to unsanitary water.

On the side of immigration, migrants stress the environment. Some environmental organisations and world leaders fear that the ongoing influx of migrants into their countries is forcing nations to exceed their 'carrying capacity' and exert stress on an already over-burdened physical infrastructure.

Exercise 1.9

1. Briefly, describe how population interacts with the environment.
2. In five points, describe how migration affects the environment.
3. In many developing countries, population pressure is evident. Examine the causes of this situation.
4. Examine impacts of population pressure on the environment in Tanzania.

Activity 1.15

Using web resources and textbooks, suggest six measures for managing and conserving the environment in populated areas.

Revision questions

1. Write short notes on the following;
   (a) Population distribution
   (b) Population density
   (c) Dependency ratio
2. Several factors influence the population growth worldwide. Discuss four factors influencing population trends?
3. Why is population an important topic?
4. Why are the developing countries experiencing more rapid population growth compared to the developed countries?
5. How does improvement of the status of women affect population growth?
6. What is the most effective family planning policy? (Answer this question in relation to the Tanzania population policy).
7. What are the socio-economic impacts of rapid population growth in developing countries?
8. Describe the relationship between population and environment.
9. Explain measures used to control population growth.
10. What measures have been adopted by Tanzania to control its rapid population growth?
11. What are the indicators of development?
12. 'Census enumeration is very essential for socio-economic development'. Do you agree? Give reasons for your answer.
13. Examine six population problems in underdeveloped countries.
14. Explain three achievements and three constrains of population policy in China.
15. Describe impacts of rapid population growth to the environment.

16. Examine measures for regulating the fertility rate.

17. Suggest ways that can be used to control rural to urban migration.

18. What are the impacts of rural to urban migration to the area of origin?

19. With the aid of a diagram, compare the population pyramids of Tanzania and Norway.

20. "Population policy in Tanzania is not effective". Justify this contention.

21. "Population is never static". Discuss

22. "Population census is the core element for country economic development" of a country. Justify.

Chapter

Two

Agricultural development

Introduction

Agriculture as an applied science, encompasses all aspects of crop production and livestock rearing for providing food and other products. In this chapter, you will learn the concepts of agriculture and development, and their application in diverse contexts of the world. You will also learn about the role of agriculture and factors that influence its development. Through case studies, you will make comparative analyse of diverse crop farming and animal keeping systems. You will identify the potentials and challenges of organic farming in the developing world. You will also examine characteristics and uses of rangelands. The competencies developed will enable you to engage in agriculture which is among the key sectors that contribute to the development of nation's economy.

The concept of agriculture

The word "agriculture" is derived from two Latin words; 'ager', which means 'field' and 'colo', which means 'cultivate'. Therefore, when combined, agriculture means 'land tillage'. Broadly, agriculture is defined as the growing of plants (crops and trees) and rearing of livestock either for subsistence or commercial purposes. Over the centuries, the growth of agriculture has contributed to the rise of civilisations.

Before agriculture became widespread, people spent most of their lives searching for food through hunting wild animals and gathering wild plants. About 11 500 years ago, people gradually learned how to grow cereals, trees and root crops, rear animals and settled down to a life based on farming. About 2 000 years ago, much of the Earth's population had become dependent on agriculture. Scholars are not sure why this shift to farming took place, but it is thought that it may have occurred because of climate change.

When people began growing crops, they also began herding and breeding wild animals. Adapting wild plants and animals for people to use is called domestication. Currently, livestock occupy almost one-third of the Earth's land surface and is an integral part of human history, providing multiple benefits beyond the obvious supply of food.

Agricultural development

Agricultural development is defined as a process that creates conditions for the fulfilment of agricultural potentials. Those conditions include, accumulation

of knowledge, availability of technology as well as allocation of inputs and outputs. Agricultural development is a multi-sectoral activity that supports and promotes positive changes in rural and urban areas. It is a sub-set of rural development, whose main objective is to improve material and social welfare of the people.

Agricultural development and rural development are different but inherently related. The term 'rural development' refers to a distinct approach to interventions by the state in the rural economies which is broader than agricultural development. Rural development is broader because it entails much more than the development of agricultural production. It is a distinct approach to the development of the economy as a whole and the agricultural development is just part of rural development. About, 90% of the rural dwellers are engaged in agricultural activities as their major source of income. Therefore, rural development can not be attained without agricultural development.

The role of agriculture in social economic development:

Historically, agriculture developed to meet human needs of food and other consumer goods. Agriculture is themost widespread activity found all over the world in areas where environmental circumstances permit. Generally, agriculture provides vital human necessities including food and income. In other areas, agriculture is highly specialised to the level that it leads to advanced economies. Agriculture is therefore, a sector that provides benefits for development through the following:

Employment opportunities: Agriculture provides employment opportunities to large population particularly in rural areas of developing countries. It employs a large proportion of the economically active world population (between 35% and 40%). But the proportions vary greatly from one country to another. In the developed countries, less than 10% of the active population work in agriculture. In developing countries like India, about 70.6% of total labour force works in agriculture while in Tanzania, agriculture employs, 75% of the total manpower. Agriculture therefore, steers most countries development and improves people's livelihoods.

Source of food supply: Worldwide, agriculture is the basic source of food supply to all countries both, developing and the developed. High population growth experienced in developing countries increases demand for food at a fast rate. Failure of agriculture to meet the ever rising demand for food affects adversely the growth rate of the economy. Stable supply of food by the agricultural sector has a great importance for economic growth of a country. In Tanzania, agriculture provides 95% of food requirements.

Source of national income: Economic history of many advanced countries such as the USA shows that agricultural prosperity contributed considerably to fostering economic advancement. For example, the now industrialised countries

were once predominated by agriculture. The currently developing economies are considered to be largely dependent on agriculture. Agriculture contributes to the national income of different countries of the world. For example, in 2020, the agriculture sector in Tanzania contributed 24.74% of the GDP and 20% of traditional export earnings. In India 28% of national income comes from the agricultural sector.

Source of raw materials: `Agriculture is an important source of raw materials for the agro-based industries, especially in the developing countries. Inadequate raw materials may increase the price of goods and hamper the growth of countries' economies. Industries which depend on agricultural products include flour milling, juice making, textile, cooking oil making, bakery, meat and dairy products making, sugar, wineries, and others. Apart from being a major source of raw materials, agriculture has other contributions including: being a source of foreign exchange, improving rural welfare and a market for some industrial output such as fertilizer.

Exercise 2.1

1. What do you understand by the statement "agriculture is the backbone of our livelihoods"?
2. Explain the relationship between agriculture development and rural development.
3. In six points, explain the contribution of agriculture to the growth of the industrial sector.
4. Agriculture is the core unit for industrial development in Tanzania. Substantiate.

Activity 2.1

(a) Conduct a study in your neighbourhood to observe and document various agricultural activities.

(b) Use text books and web resources to document the contribution of agriculture to socio-economic development in Tanzania. Present your work in the class with an assistance of your subject teacher and discuss it with your fellow students.

Activity 2.2

Write an essay to convince one of your parent or guardian to practice agriculture and present your answer in the class.

Factors influencing agricultural development

Distribution of crops and farm activities in different regions of the world is influenced by various conditions. These conditions may either facilitate or impede farm activities or production and can be categorised into a number of factors including; climatic, physical, biological, socio-cultural, economic, and political factors, as well as science and technology.

Climatic factors

Climate exerts the greatest control on agriculture all over the world. It is the role of climate that determines certain types of crops to be grown in a certain region. The major climatic factors influencing agriculture are as follows:

Amount of rainfall: Water, mainly from rainfall is absolutely essential to plant growth. When there is little or unreliable rainfall, crop growth becomes limited, and irrigation may be essential. Changes in rain seasons affect crop cultivation. Regular rainfall patterns are vital for the type of crops grown because some crops such as tea, coffee, and banana need high rainfall while other, crops such as cassava, need moderate amount of rainfall.

Temperature: The degree and duration of warmth and the intensity of sunshine affect crop maturity to a certain extent. For example, many fruits are not able to withstand extreme temperature. Night frosts may damage the plants tender leaves. The rate of evaporation (evapotranspiration) and the conditions of relative humidity also influence crop growth.

Wind: Wind influences the pollination of certain plants. Some plants are affected by strong winds because it can accelerate evaporation or physically cause damage to such plants. For example, sea breezes and light winds are often advantageous to plants like coconut and coffee, while the typhoons of northern Luzon Philippines destruct tall tree crops, leaving low-growing plants such as paddy and tobacco.

Biotic/Biological Factors

Biotic or biological factors include weeds, parasitic plants, diseases, insects, pests and animals. These influence crop farming in several ways. Weeds either compete with crops for plant nutrients or destroy crops before they can be harvested. Infections diseases or insects may hinder production in both, animals and crop farming. Pests, such as boll-weevil in the cotton belt, or fungus disease like coffee blight, and army worms may affect crop production as shown in Figure 2.1(a). Example of animal diseases include Foot and Mouth Disease (FMD), and Rift Valle Fever (RVF) that are common in the Sub Saharan Africa affect livestock keeping. Similarly, rust affects the growth of wheat. Farmers can prevent the above problems by spraying crops with selected insecticides, fungicide and pesticides, and by employing organic farming methods such as crop rotation in order to get healthier crops as shown in Figure 2.1(b).

Figure 2.1(a): *Maize crop affected by armyworms*

Source: https://pbs.twimg.com/media/C4uxJbQXUAA39aQ.jpg

Figure 2.1(b): *Healthier maize crop*
Source: https://www.healthbenefitstimes.com/9/gallery/corn/Corn-farm.jpg

Physical factors:

Agriculture largely depends on the physical factors of natural environment. Topography and soil are the major physical factors affecting agriculture.

Topography or relief: The world map of relief features reveals that the most intensively cultivated parts of the earth are the lowlands. A levelled ground eases cultivation and use of machinery. Some crops grow well in lowland regions. These include rice (grown in Kyela-Tanzania) and coconuts (grown along the coast). However, other crops such as coffee and tea grow best on hill slopes, as seen in Kilimanjaro and Rungwe. The hills are terraced to prevent soil erosion and to create artificial flooded lowland conditions for wet cultivation. Furthermore, soil water retention in the highlands is difficult compared to the lowland areas.

Soil: Soil is composed of a variety of minerals and organic substances that determine its fertility. Crop production potential is greatly influenced by the physical and chemical properties of soils. These properties also influence related activities such as tillage, erosion, drainage, and irrigation. Different crops require different nutrients from the soil. For instance, cotton requires soil rich in nitrates, rubber does best on deep slightly acidic soils, and cocoa grows well on soils rich in iron and potassium. Important agronomic soil properties therefore, include: soil water-holding capacity, infiltration rate, aggregation, temperature, organic matter content, and nutrient availability

Socio-cultural factors

Agriculture is affected by a wide range of socio and cultural factors such as ownership, inheritance of land, preferences of types of farming and crops grown, and types of animals kept. Socio-cultural factors can be described in five parameters as follow;

Types of farming practices: Some traditional systems of farming, such as shifting cultivation, subsistence farming, extensive and mixed farming, can negatively affect crop yield performance. On the other hand, machines such as harvesters are usually used to maximise agricultural production. For example, wheat production in Europe is highly mechanised compared to Africa. Wheat production is thus, higher in Europe than in Africa.

Types of crops grown: Cultural factors can also influence crop selection and gender roles in agricultural activities. For example, in West Africa, men grow crops like yams while vegetables are

grown by women. In addition, most of the farm works are done by women than men. Moreover, food preference may also influence types of crops grown. For example, banana cultivation is highly preferred by most of the farmers in the Northern and Southern highlands in Tanzania. Agricultural commercialisation may also dictate growth of other non-traditional crops like coffee, tea, and cocoa because of the market forces and needs for cash income.

Population growth and land ownership: In most African societies, land ownership is by inheritance whereby land is divided to members of a household. A good example is the practice among the Chagga in Kilimanjaro to divide family piece of land popularly known as "kihamba". The sub-division of the agricultural land the farm size to be small. This leads to the process known as land fragmentation. Increase in population and land fragmentation affect crop production because land owned becomes very small and non-contiguous. In some areas, the priority is given to settlement rather than agriculture.

Land scarcity and land use conflicts: In some areas land scarcity has led to many conflicts especially between the farmers and the pastoralists. For example, on 8th December 2000, 38 villagers in Rudew, Mbuyuni village in Kilosa district were killed and others were wounded after the pastoral Maasai warriors attacked them. There are also records showing some pastoral tribes like the Fulani of West Africa and Masai of East Africa where several times were involved in conflict with farmers over land use.

Religious influence: Religious influences have profound effects on animal rearing. The belief that pigs are unclean held by Muslims, Jews, Seventh Day Adventist and Hindus limits rearing of pigs in many parts of Asia and Africa. Similarly, the Hindu veneration of cattle or the prestige associated with large herds of cattle in many parts of Africa, limits full utilisation of animals for food.

Economic factors

Economic factors play a significant role in sustaining agriculture. Adequate capital is needed to purchase farm inputs such as fertilisers, seeds, machinery, pesticides, storage facilities and labour. Many African farmers lack capital to advance their agricultural activities. They also face the problem of marketing which is associated with price fluctuations of agricultural products, particularly primary products and agricultural raw materials. Moreover, when it comes to transporting farm products to markets, farmers encounter high transport costs and taxes as well as poor transport infrastructure which discourage them and pose a great threat to agriculture. There is also a challenge of handling perishable goods such as fruits, vegetables, flowers, and milk. These farm products need refrigerated trucks or wagons to keep them fresh and edible, but the facilities are expensive.

Science and technology

Application of advanced methods of agriculture, mechanisation and research and development enhances agricultural yields. In many parts of the world, growth in agricultural productivity

has been rapid, largely because of the intensive adoption of new agricultural technologies. Technology affects many areas of agriculture, such as fertilisation, diseases and pest control, tillage, harvesting, milking, transportation, storage and mechanisation. Moreover, technological application must be nurtured and controlled to avoid its excessive use which may affect soil and animal breeds and lead to poor agricultural production.

Political factors

Political stability, favourable agricultural policies, and government support through extension services contribute to agricultural development. The government may create an enabling environment for agriculture such as farmers access to favourable markets, conducive transportation networks, subsidies, pesticides, loans and other farm inputs.

Types of farming systems

Farming systems can be classified according to a number of characteristics such as;

Extent of land and inputs used – (intensive and extensive farming)

Intensive farming

It is a system of farming based on use of small areas with high technology to get more products with high quality. Intensive farming includes large amount of capital applied to the small piece of land. It is applied in both cash and food crops. It is mainly practiced in the populated areas such as India, Japan, and Korea. People in populated areas prefer to conduct intensive farming systems due to shortage of land because of settlement, advancement in technology, and labour competition.

Extensive farming

Extensive farming is the system that takes place where large areas of land are worked by a small number of labour force, apply modern machines, and produce high yields on large areas.

Economic motive

The economic motive includes two systems; commercial farming where crop production is for sale, and subsistence farming is basically for use of the family level.

Mobility

The farming system can be identified on the bases of mobility as nomadic, semi-nomadic and sedentary farming:

Nomadic farming: People move from one place to another in search of water and pasture. It includes transhumance, a seasonal movement of people with their animals in search of water and pasture.

Semi-nomadic farming/semi-sedentary: This is the system of farming which is between sedentary and normadic farming in which a farmer has started to settle and does not move for long distance.

Sedentary farming: The type of farming where the farmers establish permanent settlement. They do not move.

Methods of cultivation and production

On the bases of the methods of production,farming system include shifting cultivation, bush fallowing,

and plantation. In shifting cultivation, peasants move from one area to another due to availability of virgin land and use of simple tools with few crops and some animals. The family does not permanently settle and, the production is for subsistence. In bush fallowing, a farmer divides the land into pieces and cultivates a piece of land for certain years till it is exhausted. After, that the farmer moves to another piece of land. The system takes place where there is low population density.

Plantation agriculture is a farming system based on single crop cultivation on large areas of land between 100 – 1 000 hectares, advanced science and technology, government ownership, and large size of labour. Africa, Asia and parts of America are famous in practicing this system. Single cash crop like tea, tobacco, sisal, coffee, wheat, cocoa, palm oil, and sugar cane are grown in the plantation farming.

Importance of plantation farming

The use of large land with modern technology may result into high quality and great quantity of products. This facilitates supply of raw materials for development of industries that stimulate development of areas like Morogoro (sisal plantation). It also enables adoption of modern technology by the local people who are nearby the plantation. There is a great control of pests and diseases. Many people are employed.

Challenges facing plantations

Continuous use of large pieces of land may lead to loss of soil infertility. In plantation economy, there is often exploitation of local people, and social problems occur due to labour migration. Where mechanisation is used, a large numbers of people remain unemployed.

Exercise 2.2

1. Explain five socio-economic factors which influence agricultural development.
2. In four points, discuss the contribution of agriculture to the rural economy.
3. Briefly explain how science and technology is responsible for the development of agriculture. Limit your response to four points
4. With examples, explain six roles of agriculture in your community.
5. Conducive environment contributes to successful agriculture development. Explain.

Activity 2.3

1. In a group, use library and web resources to identify the following;
   (a) Six challenges that farmers face in Tanzania.
   (b) Five roles of government institutions in agricultural development.
2. In a group, develop a plan that would help the villages around you be successful in agriculture.

Activity 2.4

Write an essay to convince your fellow students that money is not the only factor to consider when establishing a maize farm.

Contribution of agriculture to economic development

Fruit farming in South Africa

South Africa is a country located at the southern tip of Africa. It has 2 798 kilometres of coastline that stretches along Indian and South Atlantic oceans. South Africa is the 25th largest country in the world and it is the 25th world's most populated nation. It practices both, commercial and subsistence farming. South Africa is an important producer and exporter of a wide variety of fruits as shown in Figure 2.2. Fruit farming in South Africa consists of a wide variety of fruits including oranges, apples, grapes, and dragon fruits. More than 50% of her agricultural exports is fruits, which contributes 2.5% in the country's Growth Domestic Product (GDP). South Africa is therefore, one of the main fruit producing countries in the world.

Types of fruits produced in South Africa

Citrus fruits: Citrus fruits grow on flowering trees and shrubs. They are characterised by a leathery rind and white pith that encases juicy segments. Examples of citrus fruits include oranges, lemons and limes. They are grown in Olifants Rift Valley along the coast of Western Cape province, Limpopo, Mpumalanga, KwaZulu-Natal, and Eastern Cape Province.

Tropical fruits: They are known as tree fruits. They include avocado, mangoes, pawpaws, bananas, and guavas. They are grown in the North eastern and in some coastal areas. Others are subtropical fruits like pineapples. These are grown in different areas especially the Eastern Cape and KwaZulu-Natal. These fruits require warm conditions and are sensitive to high fluctuations in temperature.

Deciduous fruits: Deciduous fruits are grown in the Western and Eastern Cape, where cold winter and dry summer conditions favour their growth. Others are grown in the interior parts of the Free State province. These fruits include grapes, apples, pears, plums peaches, and apricots.

Dried fruits: They are produced in the Western and Southern parts of the Western Cape Province and low or upper Orange River areas in the Northern Cape Province. These include thompson seedless raisin, golden sultanas unbleached honey pot raisin, and prune peaches.

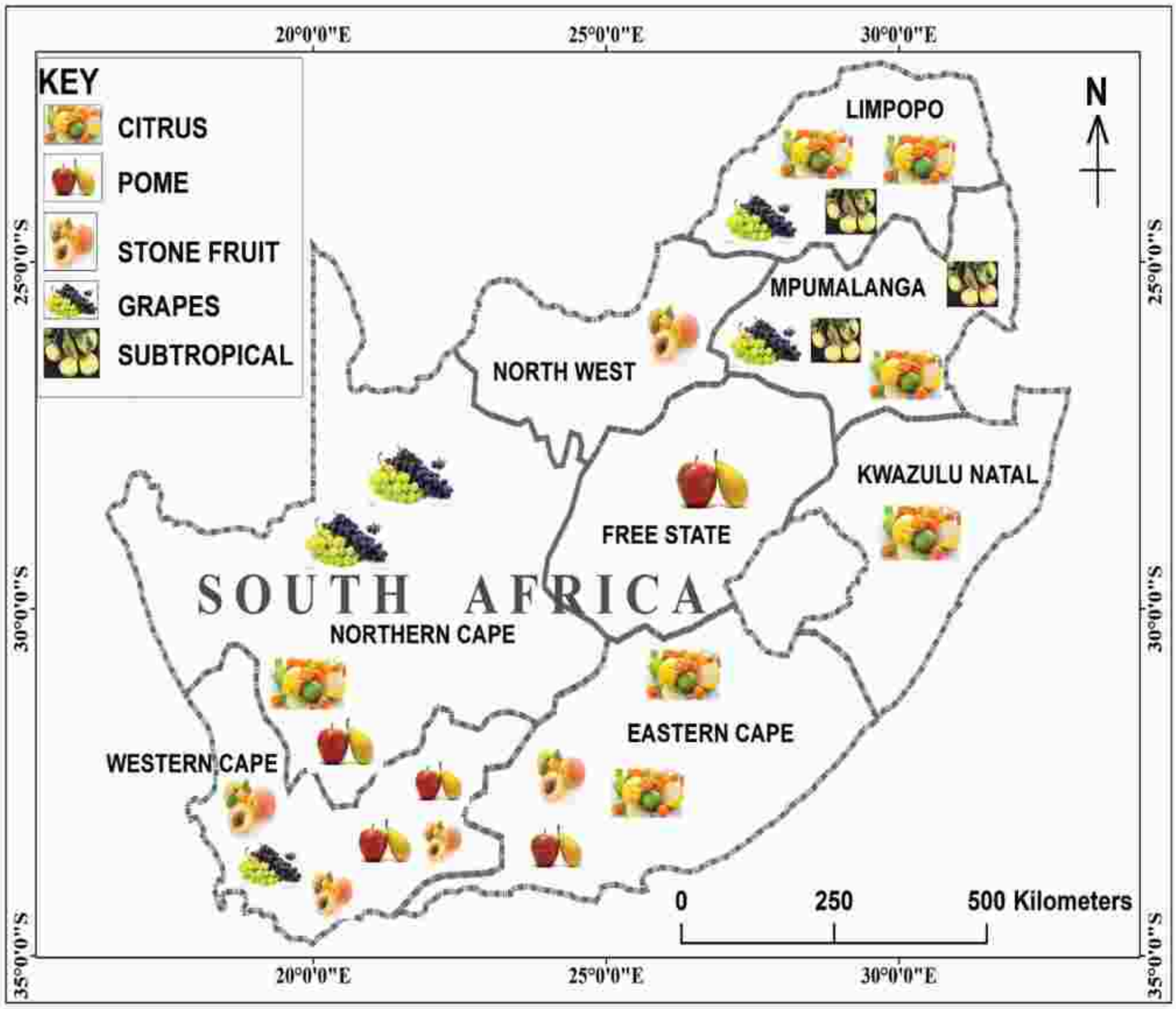


Figure 2.2: *Fruits growing areas in South Africa*

Source: Fruit SA,2015

Factors influencing successful fruit farming in South Africa

Factors influencing successful fruits farming in South Africa include:

Climatic conditions: The best climatic conditions for viticulture is found in the south western part of the Cape-Province. This area has a Mediterranean type of climate, similar to that experienced in many famous growing regions in Europe. Summers are hot and dry, while winters are mild with some rain. The dry summers are good for ripening of grapes and for drying the fruits. In general, South Africa has different types of climate due to its location, which favour growth of many varieties of fruits. The climate varies due to different latitudes and altitudes, which all together have influence on the growth of different fruits.

Market demand: The demand for fruits all over the world gives South Africa a reliable market for fruits and fruit products. In South Africa, there are

different companies dealing with fruit processing and export. For example, South Africa Fruit Juice Association (SAFJA) produces juice and wine for both local and international markets.

Advanced technologies: Technology has largely promoted fruit production in South Africa through the use of modern machines and technologies from farm preparation to the harvesting. Growth of the fruit processing industries in South Africa have led to the production of quality fruit products that can compete in the world market.

Good infrastructure: Reliable transport facilities and good transportation networks are essential for fruits production and distribution because fruits are perishable. Interconnectedness through roads and railways to the coast, presence of good natural harbours, and reliable air transport facilitate the exportation of fruit products to external markets.

Availability of capital and good government policy: These help to put in place conducive environment for production which in general supports farmers, companies, and investors to produce and transport fruits and their products successfully.

Farming organisation: South Africa has nearly 10 million citrus trees cared for by 4 200 growers. Many of these growers are under the citrus fruits cooperatives and there are about 45 such cooperatives in the country. The presence of cooperative societies enable farmers to easily access farm input and markets.

Socio-economic contribution of fruit production/farming in South Africa

Among the benefits of fruit production in South Africa are;

Foreign currency: Fruits industry is one of the main contributors to South African agricultural exports. Citrus fruits contribute 10% of total fruits export while deciduous including wine exports ,contribute 20% of all fruits. About 90% of income derived from fruit earnings is from foreign exchange which is a huge boost to the country's economy.

Employment opportunities: Fruit production provides massive employment opportunities. Many people are employed in farm activities, fruit processing industries, and marketing companies. The industry has a high job-multiplier effect and it creates over 400 000 jobs throughout the value chain. Citrus industry is agriculture's largest agricultural employer in South Africa, employing a total of 85 200 workers.

Health benefits: Fruit consumption improves people's health as they are an excellent source of essential vitamins and minerals, and they are rich in fiber. Fruits also provide a wide range of health-boosting antioxidants, including flavonoids. Eating a diet rich in fruits and vegetables can reduce a person's risk of developing heart diseases, cancer, inflammation, and diabetes.

Maintenance of trade links: Fruits facilitate domestic and foreign trade between South Africa and the outside

world such as western Europe and other African countries. Fruit production thus, helps maintain trade links between South Africa and the rest of the world.

Infrastructure development: Fruit accelerate development of infrastructure systems such as roads, railway lines, modern airports and harbours, and they advance telecommunication systems because fruits are perishable goods which need careful handling and speedy transportation to ensure their freshness and edibility.

Industrial development: Fruit farming has stimulated development of the industrial sector in general, particularly the beverage and juice industries. South Africa has a highly diversified, market-oriented agricultural economy that extends across various products, including all major grains (except rice), oilseeds, deciduous and subtropical fruits, sugar, citrus, wine, most vegetables, livestock, and a well-developed poultry and egg industry. Value-added activities include the processing and preservation of fruits and vegetables, dairy products, livestock, and grain mill products, amongst others.

Exercise 2.3

1. Describe the contribution of fruit farming to socio-economic development in South Africa. Limit your response to six points.
2. Draw a map of South Africa and highlight fruit farming areas.
3. Explain six factors for successful fruits farming in South Africa.
4. Examine the conditions favouring fruits farming in South Africa.
5. Identify four fruits produced in large quantities in South Africa and show how they contribute to the national development.

Activity 2.5

In a group, examine the contribution of fruit cooperatives to the development of fruit farming in South Africa and present your work in the class.

Activity 2.6

With the help of people around you, identify five fruits grown in Tanzania and which are also grown in South Africa and assess the differences existing in their production and consumption in the two countries.

Cereal production in USA

USA is bordered by Canada to the north, the Atlantic ocean to the east, Mexico to the south and Pacific ocean to the west. The country produces a variety of cereal crop, including corn, wheat, barley, rice, oats, and rye.

Corn/maize production in USA

Maize (*zea mays*) is often known as Indian corn or simply corn. USA is the world's largest corn producer, accounting for almost a half of the world's total production. The country is also the largest exporter of corn, mainly to areas where

climate does not favour its growth but where much livestock is kept such as Japan and North-western Europe.

Maize originated in Mexico and has for a long time been cultivated by the American Indians and it is still the staple food for many Latin American people. Its cultivation has spread to many parts of Europe, Africa, and Asia as it is adaptable to a wide range of climatic types, inside and outside the tropics.

Areas which produce maize in USA

Maize is greatly cultivated in the Gulf coast of Midwest and South of the Great Lakes. The largest concentration of maize farming is found in the Corn Belt, which is also known as feed-grains. This is a distinctive agricultural region where corn growing is dominant and it accounts for a quarter (¼) of USA annual farm output. This region includes the states of Ohio, Indiana, Illinois, Iowa and Minnesota as shown in Figure 2.3.

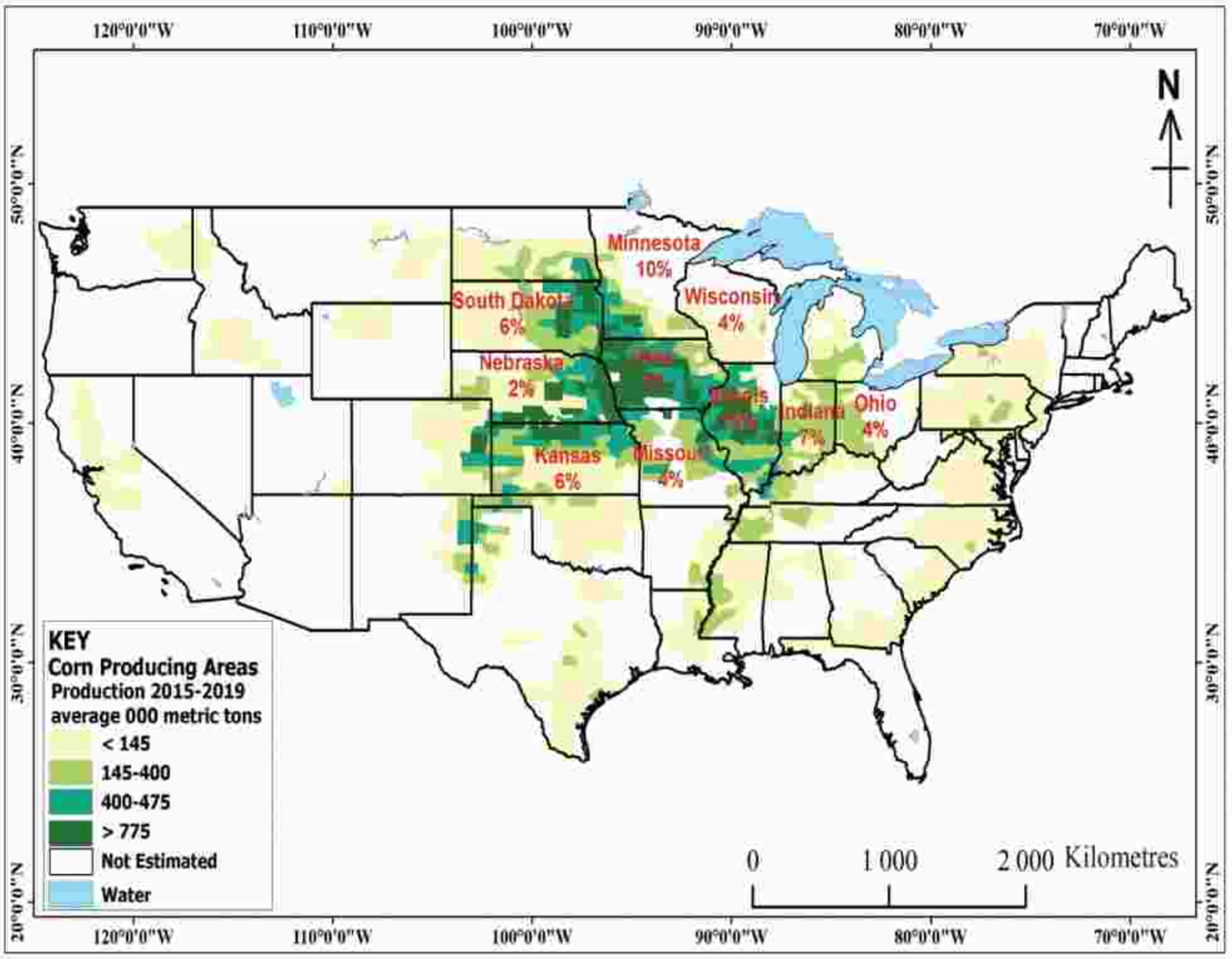


Figure 2.3: *Corn Producing Areas (Corn Belt) in USA,*

Source: U.S. Department of Agriculture, National Agricultural Statistics Service

Prosperity of the corn belt

The region has for a long time enjoyed a high standard of living and is one of the most prosperous agricultural regions of the world. The land is maintained at a high level of soil fertility, and maize, which occupies two thirds of the land area, is grown either in rotation or mixed with other cereals and nitrogen-fixing crops such as soya beans, peas and clover. Maize, which gives very high yields, is used mainly for feeding livestock, especially pigs, cattle and horses. Traditionally, the animals are left free in the fields to eat the standing corn.

This benefits farmers and animal raisers as it saves them the costs of feeding and harvesting, and animal dung is useful in enriching the soil. The maize stumps also add to the organic content of the earth. Maize and animals have helped in the development of large cities around the belt such as Chicago, St Louis, Omaha, Cincinnati, and Kansas City. Moreover, there is a development of industries such as slaughtering and processing centres of meat, canning, bacon-curing, sausage making, flour-milling, and the manufacture of a wide range of maize or meat based food products. The region is prosperous because it has a thoroughly mixed economy with several important crops, an important livestock rearing industry, and a wide range of industrial development.

Uses of corn/maize in USA

About 40% of the corn/maize produced in USA is used to feed animals such as horses, pigs and cattle. Maize leaves, stalks and green maize are stored until winter period when they are used as fodder or silage for dairy cattle. The maize is also used as human food in Southern USA, Central and Southern America, Africa, Europe, and in some parts of Asia. It is used as a staple food in Africa, India, and Mexico. Maize may be used while fresh, boiled or mixed with other food or as cornflakes. In addition, corn/maize is used as an industrial raw material to produce vegetable oil, starch, glucose, packing materials, and alcohol. Corn/maize stalks can be used to make rayon, paper and plastics. Corn residual can also be used as farm manures. In addition, corn/maize product generates income to the majority of people.

Factors that favour successful corn/maize cultivation in USA

Conducive climatic conditions: Climatic conditions, particularly in the Corn Belt are conducive for corn/maize growing. The area experiences summer temperatures of over 23°C and adequate rainfall of above 635mm annually. The Corn Belt also experiences long growing season of about 150 days. The rolling topography, that is, vast gentle slope landscape is also advantageous to USA corn/maize production as it favours smooth mechanisation. Conducive fertile soil of prairie type is favourable for corn/maize growth in the belt. The soil is well drained, aerated and maintains favourable moisture content.

Proper farming methods: Proper farming methods are employed to ensure high yields. Although the Corn Belt practices

monoculture, it has developed mixed farming with other crops such as wheat, oats, soya beans, hay, and clover. This allows crop rotation, nitrogen fixing, and soil nutrients circulation. At the same time, livestock is kept in the belt. The application of machinery for tillage, sowing, weeding, and harvesting is also advantageous as shown in Figure 2.4(a). The manual work is minimal, which leads to high corn/maize crop production as seen in Figure 2.4(b). Intensive pests and diseases control due to research and development leads to high maize production. The presence of internal and international market also promotes sustainable corn/maize production. Corn/maize is used to feed livestock in the USA, North-western Europe and Japan.

Figure 2.4(a): *Corn harvesting in the USA*

Source: httpswww.google.comsearchq=corn+harvesting+in+usa&sxsrf=AOaemvL6YuVLUZHBkrk_VYpG4lWB_w4SOg1631439630669&sour

Figure 2.4(b): *Corn harvesting in USA*

Source: httpsunclerave.wordpress.com20191010jumble-spoiler-10-10-19

Wheat farming in USA

USA is one of the largest wheat producers and exporters; with total wheat area of more than 27 million hectares (66 million acres) and an annual production of around 40 million tonnes. The leading wheat producing states are Kansas, North Dakota, Nebraska, and Montana as shown in Figure 2.5, each of which produces about 3 million tonnes annually.

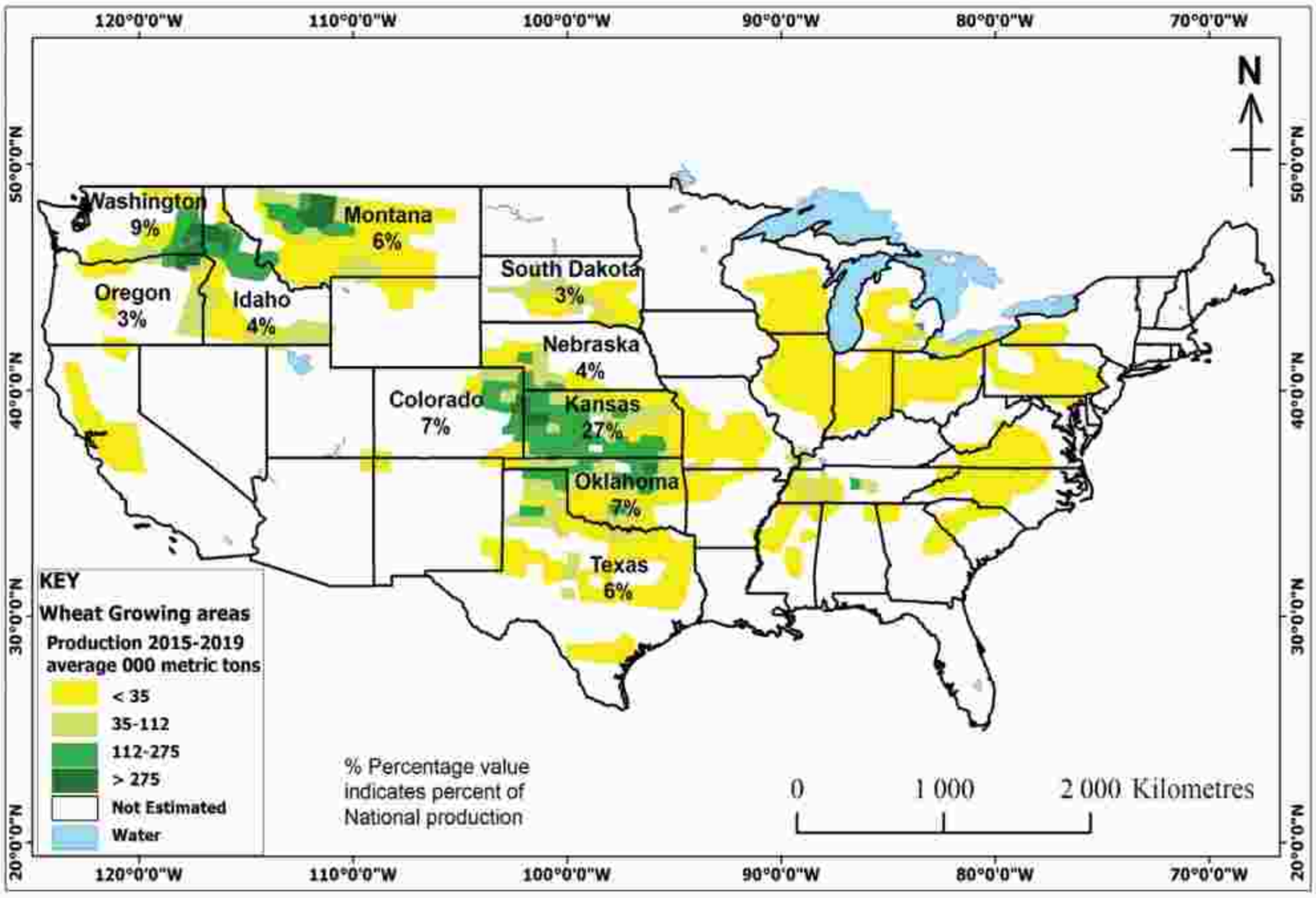


Figure 2.5: *Wheat growing areas in USA*

Source: U.S. Department of Agriculture, National Agricultural Statistics service

There are four major wheat growing regions in the USA;

The hard red spring wheat region

This region is a continuation of the Canadian prairies. It is the leading commercial wheat region of America. North and South Dakota, Montana and Minnesota states are found in this region. The hard red spring wheat is a standard wheat for bread making and is grown in the colder and drier regions.

The hard red winter wheat region

This region covers south of Minnesota and South of Dakota. It also embraces the states of Nebraska, Kansas, Missouri, Oklahoma and northern Texas. The hard red winter wheat is also used for bread-making.

The soft red winter wheat region

This region extends eastwards from central USA to the Atlantic seaboard. The states of Illinois, Indiana, Ohio, Pennsylvania and most of the mid-Atlantic are included in this region. The soft red winter wheat has soft-texture and low protein content, and it is very suitable for making cakes, biscuits, breakfast cereals, ice-cream cones and pie-crust. It can be used to make bread flour only when blended with the hard red wheat varieties.

The soft white wheat region

The soft white wheat is grown around lakes Michigan and Huron in the west coast which includes California and the Columbia Plateau of Washington, Oregon and Idaho. This type of wheat is consumed

mainly in a form of pastry or breakfast cereals.

Factors for successful wheat cultivation in the USA.

Conducive climatic condition: Conducive climatic conditions foster wheat cultivation in the country. Wheat is grown in spring and winter seasons. Though the annual precipitation is low, between 380 and 635mm, the rain comes mainly in summer. The average high temperature is conducive during the harvesting period.

Science and technology: The gentle undulating grassland with its deep, rich chernozem soil was cleared to make way for large-scale mechanised grain cultivation. The advanced use of science and technology, for example, the use of machinery in cultivation and combine harvesters, ensure high yields during harvesting period. For instance, an average yield of wheat in USA is 2 000 kg per hectare. Moreover, the application of some manure (farmyard wastes) or nitrate and phosphate fertilisers at or before the time of sowing ensures good harvest.

Reliable markets: Availability of both internal and external markets for wheat promotes wheat production in USA. Most of the wheat is consumed as food by local people and some is exported to Asian countries especially Japan. Other factors include fertile soil which is rich in nutrients, development of railways, roads, harbours and ports such as Port Arthur and Port William on Lake Superior and Great Lakes-St.Lawrance waterway. Huge capital invested in the production, topography of the area characterised by a flat or undulating surface for mechanisation of farming, research and development programme on the use of improved seed and the presence of milling and distillation industries in wheat growing regions, have also made the country successful in wheat production. Figure 2.6 shows a wheat processing plant in the USA.

Figure 2.6: *Wheat processing plant in the Eastern Washington State, USA*

Source: https://ak.picdn.net/shutterstock/videos/2464376/thumb/1.jpg

Uses of wheat

Generally, wheat products have many domestic and industrial uses including the distillation of alcohol, preparation of glues and adhesives, the preparation of baking and food-flavouring materials, and the preparation of gluten-flour for diabetic patients. Wheat straw is used in the straw-plaiting industry, for instance, in Livorno-Italy. It is also useful for making paper and straw-board and it is commonly used as bedding in cowsheds or stables. The products of wheat are equally useful. The bran, which is rich in niacin, phosphorus, and iron makes an excellent livestock feed, especially for poultry. The shorts,

comprising mainly the coarser particles of the endosperm, and the white middlings, consisting of low-grade flour, also make valuable dairy feeds.

Challenges facing wheat production in the USA

Despite its success, wheat production in USA faces some inevitable challenges which include summer droughts, frosts, strong winds, hailstones, plagues of grasshoppers, and plant diseases such as rusts, smuts, mosaic, and fungus, as well as market competition with Canada and others countries. Some of these challenges are resolved by employing crop rotation and mixed farming, particularly in the soft red winter wheat region.

Barley production in the USA

Barley (*Hordeum vulgare*) is believed to be one of the most ancient crops which started to be cultivated on the Stone Age by the Chinese, Egyptians and Mediterraneans. Barley is extensively cultivated and it is the fourth most important cereal in the world. It is grown in a wide range of climatic, topographical and soil environments and in particular; where wheat or other cereals fail to survive. It is less tolerant of excessive moisture but more tolerant to dry conditions and it ripes at lower temperatures. Barley can tolerate harsh conditions of sub-arctic and semi-arid regions, high altitudes, steep slopes and light, limey soils.

Barley is grown in many regions throughout the USA. About 27 states are known to grow barley. The major producing states include Idaho, Montana, North and South Dakota, Washington, Colorado, Wyoming, Virginia, Minnesota, Maryland, Oregon, and Utah.

Uses of barley

Barley has several important uses, which include the following;

Human food: Barley is used to make bread in places where wheat cannot be grown. Its quality is improved when blended with wheat flour, resulting in cheaper bread that is not markedly different from other types of wheat bread.

Animal feed: Large quantities of barley are used to feed livestock. It is often cut when green and then fed to cattle, pigs and poultry. Six-row barleys (a variety of barley) which have higher protein content, are valuable feed ingredients.

Malting: Barley is significantly used for making whisky and beer. Whisky is made by distilling, and beer by fermenting the malted barley.

Exercise 2.4

1. Identify ten states which produce maize in the USA.
2. Analyse eight reasons for the prosperity of maize production in the USA.
3. Examine the lessons that Tanzania can learn from USA to improve its corn/maize production in the country. Limit your responses to five points.

4. What are the major four wheat producing areas in the USA?
5. Examine six factors for the successful wheat production in the USA.
6. Describe three uses of barley crop.
7. Discuss the contribution of cereal crop production to the livelihood of people in local communities.

Activity 2.7

In a group, study the map of the USA and do the following:

(a) Compare the performance of wheat and corn production.

(b) Investigate the causes for variation of corn and wheat production in the area.

Tree crop farming

Cocoa production

Cocoa is obtained from beans or seeds of a tropical tree whose botanical name is *Theobroma cacao*. Cocoa is used to make drinks and chocolate. The cacao tree is indigenous to tropical America and was first found growing wild in lowland Central America from Panama to the Yucatan peninsula and in the river basins of the Amazon and the Orinoco. The cacao tree is an evergreen tropical plant which thrives to a height of 4.5 to 9 metres. It bears flowers in the third year after planting but only comes into fruit bearing after five to eight years. Figure 2.7 shows a cocoa tree farm.

Figure 2.7: *A Cocoa tree farm*

Source: https//www.google.comsearchq=cocoa+tree&sxsrf=AOaemvIL_

Conditions necessary for cocoa growth

Cocoa thrives in tropical lowland environment, a condition that suits banana too. The two crops are often grown together. High rainfall of about 1 420 mm and high temperature of about 23°C are favourable for cocoa growth. The crop requires shade (especially when young), and a strong-wind-free atmosphere. It also requires fairly deep and well-drained soil, but it thrives in a wide range of soils which are loamy, rich in iron and potassium. The crop is labour intensive, particularly during cultivation and processing.

Cocoa in Nigeria

In Nigeria, the leading cocoa region is the south-west, around Ibadan. The crop covers over 200 000 hectares. Cocoa is Nigeria's second largest export crop after palm oil. Nigeria ranks fourth in the world cocoa trade.

Factors for successful cocoa production in Nigeria

Plenty of rain supply in the cocoa growing area ranging from 1 145 to 1 525 mm and a distinct dry season largely favour the growth of cocoa in Nigeria, although such areas with favourable climatic conditions are fewer in the country. The Nigerian government has put much effort into expanding the cocoa growing by introducing policies to favour cocoa production. Farmers are ensured of their livelihood and food crop producers are encouraged to grow cash crops in order to boost exports. The national marketing board guarantees minimum cocoa prices and new croplands are developed by using the profit made by the board in cocoa production. The profit is also used in improving agricultural and marketing facilities in the country. Both internal and international markets also improve cocoa production in Nigeria. The cocoa from Nigeria is exported to the United Kingdom, the United States, Japan, Netherlands and Germany. Well-developed roads, railways and canoes also allow transportation of cocoa from the interior parts of Nigeria to Lagos and Port Harcourt for export.

Challenges facing cocoa production in Nigeria

Despite its achievements, cocoa production in Nigeria faces some challenges. First, there is competition from other West African countries which grow cocoa, including Ghana, Ivory Coast, Liberia, Sierra Leone and Equatorial Guinea. Second, the small scale farmers involved in the crop cultivation often use crude tools, and do not plough the soil which minimises production of cocoa. Third, there is shortage of capital to facilitate occasional weeding and application of fertiliser which are essential requirements for improvement of the quality of beans and lengthening of the life-span of cocoa trees. Discovery of oil in Nigeria created competition with cocoa production as attention greatly shifted to oil production.

Contribution of cocoa production to the socio-economic development of Nigeria

Despite the challenges explained early, cocoa has continued to play a vital role in the socio-economic development of Nigeria. First, being the second largest export crop, cocoa earns the country foreign currency and increases government revenues. Second, cocoa as a cash crop, has contributed to the improvement of infrastructure and development of towns, such as Ibadan and Lagos. Third, it has facilitated the social wellbeing of the people of Nigeria by becoming the source of income and by contributing to the development and improvement of social services. Fourth, it has contributed greatly in combating unemployment problem in the country, for example, each cocoa processing factory employs directly about 200 - 1 000 people.

Oil palm production in Nigeria

Oil palm, whose botanical name is *Elaeis guineensis*, is a tropical tree as shown in Figure 2.8, which originated in West Africa. This crop requires heavy and well-distributed rainfall of about 1 500 mm and constant high temperature, with plenty of sunlight. Soil factors are not particularly important since the tree tolerates a variety of soils.

Nigeria is the original home of the oil palm. It is the first export crop in Nigeria and it is grown on small farms around Port Harcourt in the south-east forest belt and as semi-wild trees in forest groves, and on Sapele and Calabar estates. The estates account for less than 10% of the total produce. Nigeria is the world's second largest palm oil producer, after Malaysia.

Figure 2.8: *Palm oil trees*

Source: https://www.dailyexpress.com.my/uploads/news/palmoilduhuhww.jpg

Factors for successful palm oil production in Nigeria

Nigeria has conducive climatic condition for growing palm oil trees. The area has rain that exceeds 1 500 mm annually and an average temperature of about 21°C. Soils are favourable, well drained, maintaining sufficient moisture for smooth palm oil growth. There is also a good organisation of farms with both smallholding and plantation farming. Smallholders contribute about 90% while plantations contribute to about 10% of the total farm output. Palm oil products have been improved in both quantity and quality due to the use of modern milling machines used to crash the palm oil fruits. The paying of bonus to farmers has favoured improved milling. Improved transport and communication systems have also contributed to improvement in crop yield. Palm oil fruits are easily transported from the farmers to the centralised mills. Lastly, there is availability of both internal and external markets.

Uses of palm oil and palm kernel oil

The palm fruit consists of a large clump of small oval fruits which are red or black in colour. These individual fruits consist of a thick pulpy pericarp, surrounding a hard kernel. The pulp is separated from the kernel in the cooking process. Therefore, the pulp is pressed to extract oil and the kernel is crushed to remove the shell so that oil can be extracted. Palm oil from pericarp is used as cooking fat, and for manufacturing of margarine, soap, candles and cleaning agents in the tin plate industries. Waste materials from the strippers may be used as fuel in the mills and oil residues may be used as fertilisers or animal feeds.

Rubber production

Rubber is the latex of the tree scientifically known as *Hevea brasiliensis* as shown in Figure 2.9 (a). It is a kind of natural plastic with many invaluable qualities such as elasticity, water resistance, and non-conduction of electricity as shown in Figure 2.9 (b). Other plants that produce latex capable of making rubber include various tropical trees such as *Gutta balata, Funtumia elastica* and *Gutta percha*, as well as plants of dandelion family in the

temperate regions, such as *guayule* from Mexico and *kok-saghyz* from Russia.

Figure 2.9 (a): *A Rubber trees*
Source: https://world-crops.com/wp-content/uploads/Rubber-plantation-01.jpg

Figure 2.9 (b): *Rubber harvesting*
Source: https://www.wastewiseproductsinc.com/wp-content/uploads/2017/05/Have-Rubber-Trees-Become-A-Zero-Waste-Equation.jpg

Geographical requirements for rubber cultivation

Temperature: Rubber requires constant high temperature of around 27^{0}C and should not fall below 21^{0}C since it is a tree of tropical forests.

Rainfall: Rubber requires a plentiful supply of moisture, therefore the rainfall should be adequate enough and evenly distributed throughout the year.

Soil: Rubber does well on a wide variety of soils but most preferably, deep, well-drained and friable soils as they promote roots development. Acidic soils are also suitable.

Land: Gently sloping land is ideal. This is important for facilitating mechanization and reducing costs during establishment of rubber plantation.

Labour: Rubber plantations are labour intensive. They need large, efficient and fairly skilful labour force for every tree in an area and for several thousands of hectares.

Cover crops and shade: Cover crops help to reduce soil erosion in the early stages of tree growth before the root system of the rubber trees can adequately bound with the soil. Moreover, cultivation of rubber also gives room for some few other types of plants to grow under the shade of rubber trees.

World rubber producers

South East Asia has maintained its dominant position in rubber production. The leading country is Malaysia followed by Indonesia and Thailand. Other countries include Sri Lanka and India.

West African major producers of rubber include Liberia, Nigeria and Ivory Coast. Ghana and Democratic Republic of Congo (DRC) are minor producers in Africa. In Tanzania, rubber is grown in Tanga and North Pemba regions.

The major importers of natural rubber

The major importers of rubber are the industrialised countries such as USA, UK, Germany and France. Other important buyers of natural rubber include Japan, Russia and China.

Uses of rubber

Rubber is used as raw material for manufacturing of a wide range of goods because it has useful properties such as elasticity, water resistance, and electrical non-conductivity. It is used as raw material for manufacturing rubberised waterproof materials such as rubber shoes, boots, and rubber soles; insulating materials in cables and wires, washers, and trims. It is also used to manufacture conveyor belts, and other forms of belting, hoses and pipes, cushions and mattresses, carpet backings, erasers and tyres for automobiles.

Synthetic rubber

Synthetic rubber is a special kind of plastic derived from the petrochemicals industry as shown in Figure 2.10. Synthetic rubber is produced by industrialised countries in order to reduce imports of natural rubber. Synthetic rubber is mainly composed of hydrocarbon and petroleum. It has many hydrocarbons which, when combined can be used to make rubber very similar to the natural one. The major producers of synthetic rubber are USA, Japan, Germany, France, UK, Italy, and Russia.

Figure 2.10: *Synthetic rubber plant in Chiba, Japan*

Source: https://www.ube-ind.co.jp/ube/en/news/img/2010/2010_11.jpg

The future of natural and synthetic rubber

Synthetic rubber accounts for about 60% of the world rubber. Demand for rubber and its market share is bound to rise.

Advantages of synthetic rubber over natural rubber

Synthetic rubber has the following advantages over natural rubber. It is produced in the industrialised countries and is readily available to consumers. By making their own rubber, consuming countries can cut down on imports of natural rubber. Synthetic rubber is produced in large capital intensive plants hence the cost of production is likely to be stable. Moreover, the output of synthetic rubber can be varied more easily in response to changes in the pattern of demand than the output of natural rubber.

Disadvantages of synthetic rubber

Synthetic rubber is increasingly expensive to produce because it is dependent on the oil industry for raw materials. It also uses diminishing supplies of oil which is irreplaceable (non-renewable), which makes it unfriendly to the environment.

Advantages of natural rubber over synthetic rubber

Natural rubber is a replaceable resource, because it is renewable. It has highly desirable properties which make it durable as it doesn't break or weaken easily. This also makes it harder with a high stretch rate and resilience than synthetic rubber.

Disadvantages of natural rubber

Natural rubber is produced in countries which are far from major markets and through labour intensive methods which attract rising wage rates and price fluctuation in the market.

Coconut production in Nigeria

Coconut trees (*Cocos nucifera*) are regarded as one of the most important and useful palms in the world, particularly in the agrarian economy of many developing countries located in the tropics. This is because they provide food, drink, shelter, and raw materials for industries. Unlike many tropical fruits, coconuts are still largely grown by small landholders. Coconuts are of two distinctive types simply referred to as "dwarf" and "tall" cultivars.

Coconut palm is not indigenous to Nigeria, but it grows in diverse types of climate. In Nigeria, the coconut belt is the continuation of the plantations along the West African coast; running from Ivory Coast and south east towards Ghana, Togo and Benin to Lagos. This belt continues in a 1km wide strip along some 200 km of coastline of Lagos.

Conditions for growth of coconut palms/ trees

The growth of coconut palms requires a mean annual temperature of between 25^{0}C to 38^{0}C and a mean annual rainfall of 200 mm; sandy soils of the beaches and immediate inland areas; and maritime conditions like those around the shores of the Indian and Pacific oceans.

Production of coconut

The main variety of coconut grown in Nigeria is the West African Tall (WAT) variety, scattered in groves in the rainforest of Nigeria. The coconut tree or palm may grow to a height of 15 to 18 metres tall. The tree takes about 6 to 7 years to produce a large size coconut of good quality. Their life span is usually 60 to 75 years and they continue to yield fruits throughout their lifespan.

Harvesting

The oval coconuts are harvested by climbing up the tree. Harvesting takes place after every 1 to 2 months and about fifty coconuts may be obtained from one tree per year, giving an equivalent of about 4.5 litres of oil. (See Figure 2.11).

Processing

Once harvested, coconuts are husked to obtain the copra. Husking is usually done by splitting a coconut on a sharp spike planted in the ground, thereafter, the

coconuts are cracked and the fresh inside of the coconut is then dried, either in the sun or in kilns. In kilns, the copra is dried on a metal grill over a slow burning fire for three or four days. The dry copra is then taken to a factory where it is disintegrated, cooked and then pressed twice to ensure that all the oil is extracted. The oil is then filtered and separated from residual materials. This process produces crude oil which is further processed to get rid of the distinctive smell.

Figure 2.11: *A coconut farm*
Source: https//dailynews.co.tznews2019-06-015cf237de992a3.aspx (2)

Uses of coconut and its by-products

The main commercial product of coconut is its copra, which is used to make margarine, soap, cooking oil, and candles. The milling residue (poonac) is used as a livestock feed, the husks can be used to obtain coir, and a hard fibre is used in rope-making and malting. The shells can be used as fuel, making excellent charcoal, or it can be grounded up to make powder which can be used in making fiberboards and mosquito coils. The nut itself can be used as food instead of drying it to get copra. In this case, it may be used when fresh in cooking or as desiccated coconut for confectionary and cakes. Coconut palm flowers can be cut to obtain coconut bear while the stalks of the fronds are used to make brushes and brooms. The stem and stalks can also be used to make furniture and for building purpose as timber can be made from it.

The contribution of coconut production in Nigeria

Being part of the agricultural industry, coconut has the potential to contribute to the national economy through a wide range of applications of the produce (the coconut trees and fruits). Coconut plantations create employment and income to the people living in the coconut belt who engage in planting, harvesting and processing activities. It also contributes to the foreign exchange earnings through export of the produce. Generally, coconut production offers a wide range of investments for the people both, inside and outside Nigeria.

Challenges facing coconut production in Nigeria

Some of the challenges that face coconut production in Nigeria include low prices of coconut produce, competition from other *oleaginous* plants, ageing coconut trees, and disease infestations such as lethal yellowing diseases. Other challenges are related to inadequate rainfall and inappropriate agricultural policies that stifle the production.

Coconut production in Tanzania

Coconuts support the livelihoods of majority of the coastal and isles people in Tanzania. About 75% of the coastal belt agri-economy comes from the coconut palm with more than 50% of the smallholder farmers being the major producers. About 95% of the coconut farmers in the country are small scale producers while only 5% is formed by large scale farmers. There are three major varieties of coconut palms grown in Tanzania, namely the East African Tall (EAT), Dwarfs, and Improved Varieties (IV). The East African Tall is the most predominant coconut variety in Tanzania with a production capacity of 40 to 80 coconuts per year. The improved variety of East African Tall can produce 80 to 120 coconuts per year, while the Dwarf, commonly known as the Pemba Red Dwarf (PRD) can produce 30 to 70 coconuts per year.

In 1997, the Government of Tanzania made efforts to promote coconut production by establishing a project called the National Coconut Development Program (NCDP). The program lasted from 1997 to 2001 and it aimed to increase household income by increasing production and productivity of coconuts in the recommended areas. Through the NCDP, several improved agricultural practices were recommended and introduced to farmers. These include increasing the palm population per unit area from 125 to 160 trees/ hectors, weeding 1-3 times per year, as well as applying pests control and fertilisers. Moreover, biological control, hooking, and cultural methods through field sanitation were recommended to farmers as effective methods to control pests. Generally, extension services were essential in providing farmers with knowledge, important information, experiences, and production skills.

Despite all these efforts, the coconut production sub-sector is still marginalized and its contribution to the economy at household level is very minimal. For example, in 2014, coconut production contributed about 27.7% only of the total household income per year. This means that, about 77.3% of the household income in coconut producing areas was generated from other farm activities like cultivation of citrus fruits, mangoes, banana, cassava, maize, cowpeas, and from off-farm activities, including fishing, livestock keeping and petty trade.

The scale of processing coconut oil in Tanzania is still very low compared to its production in the country. Moreover, coconut production in the country is facing a number of challenges, including coconut pests and fungal diseases, which cause the drying up of coconut trees. Other factors that hinder coconut production include climate change, which affects the resilience of the crop and poor practices. In Tanzania, coconut palms and their products are mainly used to provide timber, oil, thatches, brooms, mats, chairs, and liquor.

Exercise 2.5

1. Explain eight conditions necessary for the growth of cocoa.
2. Briefly explain five reasons for the success of cocoa production in Nigeria.

3. Identify five challenges facing coconut production in Tanzania.
4. Describe the differences between natural rubber and synthetic rubber.
5. Mention five rubber materials that you see or use daily.
6. Compare and contrast three varieties of coconut palms grown in Tanzania.
7. Analyse four challenges and four factors for successful tree crop farming in Nigeria.
8. Describe the challenges of using synthetic rubber as an alternative to natural rubber.

Activity 2.8

Visit any tree crop farm near your school area, then write a report on its growth, care, harvest and its contribution to the standard of living of the surrounding community.

Activity 2.9

In a group,
Identify five practical strategies for the development of coconut production in Tanzania by drawing a lesson from Nigeria then, present your work in class.

Cereal crops in Tanzania

Tanzania is endowed with fertile arable land, diverse climatic zones and plenty of water resources. However, only 24% out of about 44 million hectares of the total land area suitable for agriculture is utilised. Most of the land is used by smallholder farmers who cultivate an average farm sizes of between 0.9 hectares and 3.0 hectares by using traditional cultivation methods. Although about 75% of Tanzania's population is involved in agriculture, only 10% of the arable land is cultivated by a tractor, and the production is largely determined by rainfall. The small scale farmers lack capital and skills and they largely cultivate for subsistence. Irrigation covers only 326 492 hectares out of 2.3 million hectares of high-potential land for irrigation. The cereal crops grown in Tanzania include maize, sorghum, millet, rice and wheat and these are major staple food in Tanzania.

Maize

Maize production is higher than any other cereals in Tanzania with a total production of over 75% of total cereal produced. It is a major staple food crop grown in diverse agro-ecological zones and farming systems. It is consumed by people with varying food preferences and socio-economic backgrounds. Maize is adopted to agro-ecologies ranging from near sea level to 2 400 metres above sea level, depending on the variety. The main agro-ecologies, however, fall within 500 - 1 500 m. The Southern Highlands Zone and the Lake Zone occupy approximately 26% and 25%, respectively, of the total maize production area in Tanzania. These are followed by the Eastern zone (13%), Northern zone (12%), Western zone (10%), Southern zone (8%), and Central zone (6%) zones.

White maize is the main staple grain consumed in Tanzania. It is also a major source of income for the majority of smallholder farmers. Maize is produced both for food and for sell whereby about 40% of maize produced is sold, mostly locally. The small-scale farmers sell the maize to local traders and millers, mainly in the rural areas and in nearby towns and cities as shown in Figure 2.12. Institutional buyers include the National Food Reserve Agency (NFRA), the World Food Programme (WFP), prisons, the armed forces, and schools.

Figure 2.12: *Mlale maize millers plant in Songea, southern Tanzania*

Source: https://1.bp.blogspot.com/-HfAaqgb 8Nfg/ XKtP4TvcEuI/ AAAAAAACudw/qJg NYMIBp6c1mzjhnXksika SBF78lkjMwCLcBGAs/ s1600/010.jpg

Rice

Rice is grown in most parts of the country, especially in Morogoro, Tabora, Mbeya, Mwanza, Shinyanga, and Arusha regions. Each region produces an excess of 100 000 tonnes. Almost 20% of the farmers in the country are involved in rice production. Most of the rice is grown by smallholder farmers under rain-fed agriculture. Some farmers grow and irrigate 2-2.5 hectares under schemes that are often initiated and controlled by the government. Large-scale commercial rice farming is limited to a few private firms which bought their land when the large scale National Agricultural and Food Corporation (NAFCO) schemes were privatised. The government has prioritised rice through its National Rice Development Strategy. This programme sought to double rice production in order to improve food security and provide a potential surplus for export. The strategy aimed to improve seed cultivation and input supply, availability of irrigation, marketing, Research and Development (R&D), and credit service.

There are active markets for rice throughout the year. Rice is mostly sold to consumers as polished husked rice. It is a staple food consumed in both urban and rural areas. Mbeya and Morogoro are the main sources of rice supply. Rice consumption is growing faster than the consumption of any other major staple food in Tanzania because of high population growth, rapid urbanisation and changes in eating habits.

Wheat

Wheat in Tanzania is grown almost exclusively as a commercial crop, on a large scale basis in the northern highlands and by small and medium scale farmers in the southern highlands. Less than 1% of the farmers grow wheat country wide. Wheat consumption is increasing due to rapid population growth, urbanisation, rising income and changes in food preferences.

Due to this increase in consumption, wheat demand in Tanzania has become higher than the local production capacity. It is on the basis of this fact that about 91% of wheat consumed in the country is imported.

Sorghum and millet

These two terms cover a wide variety of cereals. Sorghum usually refers to those species which have larger grains, while millet include those species which have very small grains (peal and finger). They are grown in areas with low or seasonal rainfall of less than 760 mm, but also as dry season crops in rotation because they can withstand high temperatures and long periods of drought. Poor soils or difficult terrains also support millet, especially where such factors do not favour the cultivation of major cereals such as rice and wheat. In Tanzania, they are grown in almost all the semi-arid areas by smallholder farmers for food, feed, and beer. A total of 6.2 million hectares are used for cereal crop production, of which 0.9 million hectares (15%) are under sorghum cultivation. Sorghum and millet growing regions include Dodoma, Singida, Tabora, Shinyanga, and Manyara.

Contribution of cereals to the national economy

Cereal crops contribute substantially to the GDP as they form part of the backbone of Tanzania's economy. Cereal production enhances income earnings and supports livelihoods of more than two thirds of the population. Cereals have forward linkages with the non-farm sector through agro-processing, consumption and export. They also provide raw materials to industries, and creates market for manufactured goods. Cereal crops are major staple foods in Tanzania and their by-products are used as animal feed.

Challenges facing cereal production in Tanzania

Production of the five major cereals in Tanzania is experiencing a number of challenges, including low productivity of land, insufficient labour, inadequate use of inputs and underdeveloped irrigation schemes. There is also limited capital and limited access to financial services, inadequate agricultural technical support services and poor rural infrastructures which hinder effective rural-urban linkages. Other challenges include climate change, and infections and outbreak of crop pests and diseases. Moreover, poor mechanisation, environmental degradation and rapid population growth pose difficulties in meeting projected food demands.

Exercise 2.6

1. Identify eight cereal producing areas and their potentials in Tanzania.
2. Assess the contribution of cereal production to the economy of Tanzania. Limit your response to six points.
3. Describe the six main challenges facing maize production in Tanzania?
4. Explain the contribution of cereal production to poverty reduction in Tanzania. Limit your answer to five points.

5. Suggest six ways of solving/addressing challenges that hinder effective production of cereals in Tanzania.

Activity 2.10

1. Carry out a visit to your community and identify the type of cereal crops grown. Give reasons for the farmers preference of the cereal. Write a report and submit to your teacher for grading.
2. Prepare a farming plan/programme you will use to generate high yields from cereal cultivation.

Root and tuber crops in Tanzania

Cassava, sweet potato, round potato and yam are the most important root and tuber crops for direct human consumption in Tanzania. These four crops are grown in varied agro-ecologies. Tuber crops are cultivated and produced in almost all regions in Tanzania, but the main producing areas are Mwanza, Mtwara, Lindi, Shinyanga, Tanga, Ruvuma, Mara, Kigoma, and the Coast regions and most of the regions in Zanzibar. Majority of cassava producers use traditional production methods with a hand hoe being the main tool used for land preparation, planting, weeding and harvesting. In the final stage of processing the crops for consumption, the main tool used is a knife. Some processing machines (hands and power operated) have recently been introduced as shown in Figure 2.13.

Figure 2.13: *Cassava processing factory in Lindi region, Tanzania*

Source: http://www.iita.org/wp-content/uploads/2019/05/CSTC-operational-demonstration.jpg

Factors influencing the growth of tuber crops in Tanzania

Global demand for the commodity has been growing significantly from 2013 because of their appeal in food security for the growing population and emerging markets. There has been also a growing demand for industrially processed cassava products, of which Tanzania accounts for less than 1% of total exports. Virtually, all tuber crops (90%) produced in Tanzania are used as staple food, providing calories to 45 million people, and constituting 37% of the population's dietary energy requirements.

There is a strong political support by the government leaders to make tuber crops an engine of economic growth. For example, formulation of the National Cassava Development Strategy (NCDS), aims at transforming cassava production into a modernised, commercialized and profitable sub-sector for food, nutrition security, and income generation.

Significance of tuber and root crops in Tanzania

Root and tuber crops are very significant to the economy and welfare of the people of Tanzania. They are versatile staples to address food and nutrition security and they produce more food per unit area of land compared to many other crops. Round potatoes and sweet potatoes are short cycle crops (3 to 4 months) and thus well suited to double cropping seasons, particularly under the rain-fed system. Yams and cassavas, though longer in their cropping cycle, are vital in the annual cycle of food availability due to their broader agro-ecological adaptation, diverse maturity period and in-ground storage capability. They also permit flexibility in harvesting period for sustainable availability of food. These crops are also capable of efficiently converting natural resources into a more usable product in the growing season (calorific energy), which is higher in these crops than in all other major arable crops. Calorific energy in tuber and roots crops is almost double of that of wheat and rice.

Root and tuber crops are also cheap but nutritionally rich staple foods that contribute protein, vitamin C, vitamin A, zinc, and iron to meet the body dietary demands. People in fast-growing towns and cities present high demand on them in local and national markets. Roots and tubers are far less susceptible to large-scale market shocks and price fluctuations experienced by more widely traded staple food, such as grains, during the international market crises. Thus tuber and root crops contribute to a more stable food system and a predictable source of income.

Challenges facing tuber and root crops in Tanzania

The major challenges facing the development of the root and tuber crops sub-sector in Tanzania include the following;

Low yields: The yields of African tuber crops ranges between 37- 64% below the global value of 90%. This can be due to drought, diseases and loss of soil fertility, but also due to low status accorded to roots and tuber crops by Tanzanians as

many ignore growing them on the ground that they are not very important compared to cereal crops.

Fragmented and small-sized farms: In Tanzania, tuber crops production is carried out in predominantly small-sized and fragmented farms with rudimentary technologies which brings about low yields.

Limited adoption of improved seeds: Small-scale farmers rarely use improved seeds (clean and healthy seeds), which makes the sub-sector to be dominated by disease-prone local varieties with long maturation periods and low potential yields.

Low use of herbicides and pesticides: Most farmers have inadequate knowledge about the use of herbicides and pesticides, lack of technical skills to use them or they are not able to afford them. In the southern zone (Lindi and Mtwara), for example, only 3% of the farmers use herbicides. Given this situation, there are farmers who use insufficient amount of herbicides in order to save cost which in reality is not the case. Proper use of herbicide would minimise the need for weeding and free up labour force which can be used elsewhere.

Limited use of fertilisers and irrigation: Fertilisers are used infrequently and even when used, the amount is below the recommended levels because of the costs. The use of irrigation techniques is also minimal as the majority of the farmers practice rain-fed farming of root and tuber crops.

High labour demand: Tuber crops farming is highly labour-intensive. It is also cost-full, accounting to about 60% of the total production costs. The cost of developing and preparing land is also quite high. For example, in Mtwara and Bagamoyo, cassava production involves costs in ridging, planting, weeding, and harvesting. Inputs (seeds) account for 10% of the total cost, which means 30% is accounted as surplus/profit in the end.

Low use of mechanisation: Small-scale cultivation is characterised by low level of mechanisation. For example, tractors are used for just 10% of Tanzania cassava cultivation. Harvesting is done manually and it is therefore, time-consuming and expensive. In both small-scale and commercial farming of root and tuber crops, 8-12% of crops are lost due to sub-optimal harvesting method.

High price volatility: Prices for cassava, potatoes, and yams vary greatly from country to country as there is no global commodity market. Similarly, the production costs differ vastly due to varying levels of implement availability as well.

Poor transportation network: Poor transportation network makes access to markets by the tuber crop growers difficult. Without access to roads, rural community's ability to take advantage of surplus crop production is severely reduced. As a result, harvested root crops are normally transported in large synthetic sacks which provide little protection and can cause root skinning during loading, transporting and offloading.

Exercise 2.7

1. Identify ten potential areas for root and tuber crop production in Tanzania.
2. Explain four factors that influence tuber crops production in Tanzania.
3. Examine the significance of root and tuber crops in Tanzania. Limit your answers to seven points.
4. Explain eight challenges facing root and tuber crop producers in Tanzania.
5. Suggest five measures to address challenges that face tuber and root crops production in Tanzania.

Activity 2.11

In a group, describe the future of root and tuber crop production in Tanzania and present your work in the class.

Activity 2.12

Visit a nearby farm and identify any three root and tuber crops grown. For each root and tuber crop, explain its use other than being for food.

Cash crop production in Tanzania

Cash crops production refers to a type of farming where agricultural crops especially commercial crops like sisal, cotton, coffee, tea, sugar cane and cloves are grown for the purpose of selling to make profit and earn foreign currency instead of producing for the subsistence. Cash crop production is called commercial farming or cash cropping because its major objective is selling. Most crops grown under this system are those which mostly provide raw-materials for processing or manufacturing industries. However, there is no clear cut distinction between cash and food crops. Many food crops are also grown for selling to the internal and international markets.

In simple terms, cash crops are those crops produced mostly in large scale farms and plantations to provide raw materials, and generate income and profits. The production system involves high capital investment and technologies from the production phase to the last phase of finished goods. Cotton, for example, would need heavy investment from planting to the finished goods (clothes).

Farming methods and techniques vary depending on the type of crops grown and the scale of production. For example, in most developing countries, traditional cash crops farming methods are used while in the developed countries, large scale cash crops production methods, which are highly mechanised are used. Furthermore, the price of cash crops in most cases depends on the global market as well as demand forces in developed countries which are the primary consumers. The least developing countries like Tanzania are the suppliers of cash crops as raw materials to the developed countries' industries. Cash crops are largely determined by commodity markets with a global scope, or fluctuation of costs due to transport costs, and supply and demand in the market. Cash crop

production is highly dependent on the nature of the climate as well. For example, coconut, cocoa, sugar cane, coffee, cotton, and tea are dominant crops in the sub-tropical and tropical climates.

Coffee

Coffee as shown in Figure 2.14 is a Tanzania's largest export crop. In 2003, coffee brought export earnings of about USD 63 million, which accounts for approximately 6% of the country's total merchandise export earnings. Around 10% of the coffee is grown in the estates and 90% is grown in small scale farms of 1-2 hectares. In total, more than 800 000 kgs of coffee are produced annually. The major types of coffee grown in Tanzania are *Arabica* which is grown in Arusha, Kilimanjaro, Mbeya, Mara, and Ruvuma regions, and *Robusta* which is grown in Kagera regions.

Figure 2.14: *A Coffee plant*

Source: https://auction.bestofpanama.org/media/lot/WindyRidge2.jpg

Marketing of coffee

There are three coffee markets in Tanzania. The first is the internal market where farmers sell coffee to the private coffee buyers, and farmers cooperative societies. The second, include auctions which is conducted and controlled by the Tanzania Coffee Board (TCB) and licensed exporters who buy coffee from suppliers. The third, is the direct export in which growers of premium top grade coffee are allowed to by-pass the auction and sell their coffee to the world market directly.

Cashew-nuts

A cashew-nut (Figure 2.15(a), scientifically known as *Anacardium occidentale.* It is an important tropical perennial tree crop, originally grown in coastal areas, but now extending far inland. Tanzania is the 3rd largest cashew-nuts producer in Africa after Mozambique and Ivory Coast, and the 8th largest producer in the world. The Cashew-nuts Board of Tanzania (CBT), reported that Tanzania produced about 158 000 metric tons of cashew-nuts in 2012 alone. Out of these, 88% was exported as raw-nuts while 12% was processed in the country.

Figure 2.15 (a): *Cashew-nut fruit*

Source: https://nutmad.com/wp-content/uploads/2020/07/cashew-apple.jpg

Figure 2.15 (b): *Processed cashew-nuts*

Source: httpswww.grapetree.co.ukhealth-foods

Cashew-nuts production an important source of income for 250 000 smallholder farmers in Tanzania. The main cashew-nuts producing regions are Mtwara, Lindi, Coast Region and Ruvuma, which account for 80-90% of Tanzania's marketed cashew-nut. Cashew-nuts farming provides three quarters ($^3/_4$) of the total cash income of farmers in the mentioned regions.

The cashew-nuts sector contributes about 18% of the Tanzania's merchandise export earnings. The average small cashew-nut farm occupies about 1-2 hectares of cashew-nut trees, sometimes intercropped with other food crops, mainly cassava, grain staples and legumes. Large scale private plantations occupy about 2 000 hectares in Lindi, and Mtwara regions. Currently, majority of the harvested cashew-nuts are purchased raw, exported and processed abroad, mainly in India. After the processing have taken place in India, cashew-nuts are exported to different countries around the world at higher prices than the raw cashew-nuts.

Currently, there are only three working plants located in Mtwara, Dar es Salaam, and Newala which can process not more than 20 000 tons of cashew-nuts per year. The low processing capacity makes it necessary to sell raw cashew-nuts to India . In the last four years, the government has been working towards creating the enabling conditions for farmers which include provision of pesticides and expansion of market opportunities.

Marketing of cashew-nuts

Farmers sell their cashew-nuts under the Warehouse Receipt System (*Stakabadhi Ghalani*), whereby farmers are paid 70% of the value of their cashew-nuts sold through co-operatives. The remaining amount is paid later. The global demand for cashew-nuts increase by 9% per year. Africa produces about 43% of the world's cashew-nuts, making it only region that can supply cashew-nuts to the rest of the world. This increases cashew-nuts demands and reduces market competitions.

Tanzanian cashew-nut is easily marketed due to its high quality and value. It produces high quality cashew-nuts in the world, which are mainly exported to India, and around 85% of the exported cashew-nut is sold in shell.

Sugarcane

Sugarcane is one of the most important commercial crops of Tanzania. Its production is concentrated mainly in three regions, namely Morogoro, Kagera and Kilimanjaro. Figure 2.16 shows a Kilombelo sugarcane farm. Sugarcane production started to increase in 1993/1994 when the Trade Liberalisation Policy was adopted. In Tanzania, about 12 000 small scale farmers and a few large scale farmers grow sugarcane in the central

and north western part of Tanzania. The contribution of small-scale farmers to the industry has gradually increased in the recent years. Currently, Tanzania's annual sugar production ranges between 250 000 and 300 000 tons. In the past, the country used to import about 200 000 tons per year, to offset production shortfall. This figure has decreased as the local production has also increased, following improved rainfall. It was expected that the country's output would increase to 317 000 metric tons in 2009 - 2010.

Figure 2.16: *Kilombelo sugarcane farm*

Source: httpwww.muungwana.co.tz202004kanuni-za-kilimo-bora-cha-miwa.html.jpg

Following the adoption of the Structural Adjustment Programs (SAP), which emphasised the need for the government withdraw from production and marketing, sugar processing industries are currently owned and operated by the private sector. The government's role in the industry is to provide a conducive environment in order to enhance growth of the sector. Since the private sector assumed its new role, some achievements have been seen in the sugar production.

Marketing of sugar cane

In Tanzania, large scale farmers owning sugar processing plants enter into contract with the farmers around the estates to grow and sell cane to the processing plant. The companies usually give farmers technical and sometimes financial support to meet their requirements, where the costs for the support rendered are deducted from what the farmers are paid after they have sold canes to the companies. Despite all these efforts, the supply of sugar in the country is still below the actual national demand, which makes the country to continue depending on the imported sugar. The import of sugar is monitored by the Sugar Board of Tanzania (SBT) which is mandated by the Sugar Industry Act No 26 of 2001. The Act requires the Board to establish a technical advisory committee to monitor and regulate importation of sugar in Mainland Tanzania.

Measures to improve sugar production in Tanzania

First, there is a need to improve the oversight functions of the parliament, district and village council. These are decision making organs which must have a coordinated thinking on how to improve sugar production in the country. Their functions should not ignore the position of farmers in decision making. Second, to increase provision of loans, extension services and training to out growers in order to stimulate production. Third, to establish empowering and participatory systems which will involve all responsible units in planning and implementation. Forth, to enhance accountability, responsibility and transparency for all organs responsible in the sugar production. Fifth, to encourage sufficient public and private investment under strict and transparent management. Sixth, to improve planning management and monitoring out-growers. Seventh, to put in place an effective participatory and

transparent framework for issuing sugar import licenses.

Cotton production

Cotton is both an oil and fibre crop, where the plant is a leafy, green shrub related to the hibiscus species as shown in Figure 2.17. Cotton is a Tanzania's second largest export crop. Nearly 99% of Tanzania's cotton is grown in the northwest, near Lake Victoria by smallholder farmers on farms with an average size of 1.5 hectares. Simiyu, Shinyanga, Mwanza, and Geita are the largest cotton producing regions in Tanzania, with Simiyu region producing over 40% of the national output. The Tanzania Cotton and Seed Board plays an important role in provision of input and extension services. It regulates the industry and inspects the quality of lint and other cotton by-products. Moreover, the board sets guiding prices, and collects and disseminates the statistics.

Marketing of cotton

After liberalisation, the private sector became increasingly engaged in the marketing process of cotton. In the cotton sector, there are four major marketing channels through which producers can sell their products. These include cooperative unions, private salesmen, private gunneries, and the Tanzania Cotton and Seed Board. However, the role of cooperative unions is steadily declining and the trading is mostly done by the private sector. Cotton is sold domestically or exported to Bulgaria, United Arabs Emirates, and Burundi among other countries.

Figure 2.17: *Cotton plants*
Source: httpwww.biosustain.de

Exercise 2.8

1. Draw the map of Tanzania to show regions producing different cash crops.
2. Differentiate between *Arabica* and *Robusta* coffee plants.
3. With examples, describe five conditions that favour the growth of coffee in different areas of Tanzania.
4. Explain four main challenges facing sugarcane, coffee, cotton and cashew-nut production in Tanzania.
5. Briefly describe four marketing channels for each of the crops discussed in question 4.
6. Explain the contribution of the crops studied in this chapter to the socio-economic development in Tanzania. Limit your response to five points.

7. Examine the impacts of liberalisation in the marketing and production of major crops in Tanzania.

Activity 2.13

Use web based and library resources to provide measures taken by the government of Tanzania to develop cashew-nut production.

Activity 2.14

In a group, identify physical and climatic requirements for the production of coffee, cotton, cashew-nut, and sugar cane in Tanzania.

Activity 2.15

Visit cash crops producing areas and identify two other crops which are grown in the same conditions.

Organic farming in Tanzania

Organic farming involves using techniques such as crop rotation, green manure, compost and biological pest control to achieve good crop yields. Organic farming excludes or strictly limits the use of manufactured or chemical fertilisers, pesticides, insecticides, and fungicides. It also excludes plant growth regulators such as hormones, livestock antibiotics, food additives and genetically modified organisms. Usually, organic farming involves mechanical weed control via cultivating or hoeing rather than herbicidal weed control. In Tanzania, organic farming is practiced in several areas including Bagamoyo, Bukoba and Ruvuma. Crops which are commonly grown through this system include tea, coffee, cotton, and vegetables.

Principles of organic farming

Organic farming is based on several principles in order to save life and the environment. The principles are categorised into ecology, health, fairness and care as they are described as follows;

The principle of ecology: It is based on ecological processes and recycling. It should be adapted to the local conditions, ecology, and culture. It aims to attain ecological balance through the design of farming systems, habitats and maintenance of agricultural diversity. It implies that those who produce, process, trade or consume organic products should protect and benefit from the common environment (landscape, climate, habitats, air, biodiversity and water).

The principle of health: Organic farming should sustain and enhance the health of soils, plants, animals, human beings and the planet earth.

The principle of fairness: Organic farming should build the relationship that ensures fairness with regard to the common environment and life. It is based on equity, respect, justice and stewardship of all partners (farmers, workers, distributors, and consumers).

The principle of care: Organic farming should be managed in a precautionary

way and in a responsible manner to protect the health and the well-being of the current and future generation, and the environment. Organic farming combines traditional innovations and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved.

Generally, organic farming is an agricultural production system that aims to sustain the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions rather than the use of agricultural inputs that have adverse effects. Organic agricultural methods are internationally regulated and legally enforced by many nations based on the standards set by the International Federation of Organic Agriculture Movements (IFOAM).

Advantages of organic farming

Organic farming helps in soil management through crop rotation and green manure (cover crops) that help to provide nitrogen through legumes which fix nitrogen from the atmosphere through symbiosis with rhizobia bacteria. Intercropping, which is sometimes used for insect and disease control, can also increase soil nutrients. Organic crop rotations frequently include weed suppressive cover crops, and crops with dissimilar life cycles to discourage weeds associated with a particular crop. Organic farming reduces water contamination which could be caused by the application of chemicals in the agricultural production. It also reduces soil erosion through methods of soil management. Moreover, it reduces carbon emission and consequently increases biodiversity to avoid air pollution. It is also based on productivity and profitability.

Organic farming uses low amount of fertilisers and less or no pesticides at all. Organic crops yield 91% to 95%, compared to conventional agriculture. It provides rural employment throughout the production process, which includes manuring, mulching, and other activities (as it is done in Kagera and Kilimanjaro regions).

Food quality and safety are also guaranteed through organic farming. It has been proved that organic farming products are of high nutrient value. This means that organically grown food is superior in mineral content compared to that grown by modern conventional methods because it fosters the life of the soil. It is poison-free as it has not been contaminated with chemicals such as pesticides and fungicides. Organic farming makes the soil well balanced, which result in production of strong and healthy plants that become nourishing and better tasting food for people and animals.

Organic farming improves plants' tolerance to pests and diseases. A health plant grown organically in proper soils tolerates most diseases, insects and pests. Hand weeding practice and mulching get rid of weeds and insects and guarantee crop quality. The great benefit of biodiversity is protected by employing organic farming, thus a wide range of organisms benefit from organic farming. Studies show that there is a preference for organic farming as it results in abundance and diversity

of all non-crops and naturally occurring species.

On average, 30% or more species inhabit organic farms without being affected. These include birds, butterflies, soil microbes, earth worms, spiders, vegetation and mammals. Restricting or limiting the use of herbicides and pesticides improves biodiversity fitness and population density. Biodiversity from organic farming provides capital and reduces cost. Species found in organic farms enhance sustainability by reducing human inputs. The application of organic principles enables the use of local resources such as local seeds and organic manure.

Challenges to organic farming

Organic farming faces some challenges since the competition between the legume and the other crops can be problematic and wider spacing between crop rows is required. Farms without livestock (stockless) may find it more difficult to maintain fertiliser and may rely more on external inputs such as imported manure as well as grain legumes and green manures. Although grain legumes may fix limited nitrogen because they are harvested, fields with less or no manure display significantly lower yields due to decreased soil microbe community which provides a healthier and a more arable soil system.

Markets for organic products are strong in North America and Europe and they are worth USD$ 20 billion in the global market than in the rest of the world. Organic farming is a labour intensive and increases costs to urban consumers due to high cost of production. It is also difficult to produce fast and large quantity of food to feed the rapidly growing population.

Exercise 2.9

1. What do you understand by the term organic farming?
2. Explain eight advantages of organic farming.
3. Describe four principles of organic farming.
4. What are the four main challenges to organic farming in Tanzania?
5. Explain three advantages of mulching in organic farming.
6. With examples, explain the advantages of organic farming to the environment.
7. With reference to specific areas in Tanzania, discuss six advantages of organic farming over conventional farming.
8. Describe measures which have been adopted by the government of Tanzania to improve organic farming.

Activity 2.16

In a group, do the following and present your response in the class:

(a) Use library and web resources to explore the market opportunities for organic products in Tanzania.

(b) Describe the prospect of organic farming in Tanzania.

(c) Explain why there has been a reversed trend of emphasis on the use of convention to organic farming.

Activity 2.17

Using internet and library resources, identify areas where organic farming is practiced in Tanzania.

Rangelands

A rangeland refers to an uncultivated land that is suitable for grazing and browsing animals (livestock and wildlife). Rangelands include grasslands, woodlands, wetlands, prairies, and shrub lands that are grazed by livestock or wild animals. Rangelands are one of the major types of land in the world, others being forests, farmlands, pasture, and urban/industrial lands. However, rangelands do not include barren deserts, or forests lacking grazable understorey vegetation.

Unlike pasture that may contain vegetation planted by man, and which may require cultivation from time to time, rangelands are dominated by native vegetation. They are not fertilised, seeded, irrigated or harvested with machinery as in farmlands/pasture. Although rangelands are for grazing, not all grazing lands are rangelands.

Rangelands in Tanzania

In Tanzania, rangeland cover approximately 50 million hectares or one third of the country land, and they are used by 20-30% of the population. They cover mostly the central semi-arid zone of the country overlapping to eight regions, including much of Shinyanga, Singida and Dodoma, and some parts of Mwanza, Arusha, Kilimanjaro, Tabora, Iringa and Mbeya, and the north east rangelands stretching to Kenya.

The semi-arid rangeland areas of Tanzania are composed of a variety of landscapes that are typical of undisturbed regions of semi-arid East Africa. The northern arid lands lie between 1 300 - 1 800 m above sea level, while the Maasai steppes constitute rolling plains of 500 to 1 500 m above sea level.

The vegetation of most of the semi-arid rangelands of Tanzania are characterised by grasslands, dense thickets, woodlands, and seasonally flooded grasslands. Most of this natural vegetation has, over the years, been considerably modified by human occupation. The northern Tanzania semi-arid rangelands have a lower density and fewer species of trees that produce fleshy fruits.

Generally, rangelands are characterised by low and erratic rainfall, shallow soils, rough topography and extreme temperatures. For example, in the central zone and north eastern zone the rainfall is uni-modal, and often not reliable (500-800 mm per year) with high rates of evapotranspiration. These characteristics render them unsuitable for rainfed agriculture, and this is the reason why rangelands are sometimes referred to as wastelands or marginal lands.

Importance of rangelands in Tanzania

Rangelands are not wastelands or marginal lands. They are important in many ways as they provide grazing habitat for both livestock and wildlife. The livelihoods of nomadic communities such as the Maasai, and semi nomadic communities such as the Sukuma, depend heavily on the capacity of rangelands to provide for pasture and water for their livestock. Likewise, most of the Tanzania's wildlife is found in the rangelands, which offer excellent habitats for their conservation such as the Maasai steppe within Tarangire and Lake Manyara National Parks, and Serengeti National Park.

Rangelands are ecologically important because they preserve genetic biodiversity by harbouring a significant number of rare, threatened, and endangered species. Furthermore, rangelands contain high species diversity, are areas of ecological and geomorphologic integrity, and are unique ecosystems that attract tourism. Tourism, especially wildlife based tourism, contributes to about 17.5% of Tanzania's Gross Domestic Product (GDP). Rangelands provide opportunities for ranching, thereby contributing to the economic growth of the country. They are important for climate change mitigation through carbon sequestration. They provide open space for human enjoyment and recreation (ecotourism and wildlife based tourism). Rangelands also act as a source of important plant species that can be used to produce industrial chemicals, pharmaceuticals, charcoal and traditional medicine for the local communities. Prevalence of conflicts among actors over various rangeland resources indicates that rangelands are not wastelands.

Challenges facing rangelands in Tanzania

Despite the various economic, social and cultural benefits, rangelands in Tanzania are faced with the problem of overgrazing, including repeated heavy grazing that results in deterioration of the plant community due to large number of livestock units. This does not give sufficient time for the top ground biomass to regenerate after the initial grazing. Consequently, most overgrazed areas in the central semi-arid areas of Tanzania contain heavily degraded soils. As a result of overgrazing, the quality of rangelands has been reduced. Moreover, rangelands are also affected by invasive species. These are plant species that exhibit aggressive growth characteristics. Once established, invasive species will out-compete the native species and often spread and dominate the rangelands. These invasive species are harmful to both wildlife and livestock and can be poisonous as well.

Other challenges include; increased soil erosion, and loss of soil fertility and moisture as a consequence of overgrazing. Un-prescribed and uncontrolled fires during hot dry season and in windy conditions also affect rangelands. This causes plants that are less resistant to fire (elevated meristems) to diminish in terms of both quality and diversity. In addition, shifting cultivation (slash-and-burn), unsustainable mining, human settlements, and charcoal production contribute to

degradation, fragmentation, and loss of rangeland areas.

Exercise 2.10

1. What do you understand by the term rangeland?
2. Identify eight regions with rangeland areas in Tanzania.
3. Describe five characteristics of rangelands.
4. Describe the significance of rangelands in Tanzania. Limit your answer to six points.
5. Explain five challenges facing rangelands in Tanzania.

Activity 2.18

Pay a visit to a nearby rangeland. Based on your observation of the rangelands, show, by using examples, that a rangeland is not wasteland.

Activity 2.19

Use library and web resources to propose measures to promote sustainable management of rangelands in your neighbourhood.

Livestock keeping and management

Livestock keeping (animal husbandry) deals with keeping domesticated animals, birds and insects. It refers to the practice of keeping domesticated animals such as cattle, goats, sheep, pigs and poultry. Generally, domestic animals can be categorised into three major groups. These include mammals such as cattle, sheep, goats, horses, mules, reindeer, camels, yaks, pigs; birds such as ducks, chickens, turkeys, geese, guinea fowl, squabs, peacocks, and ostriches, and insects such as bees and silkworms. In addition to these, wild animals such as tigers, crocodiles, and lions have been tamed for pleasure or recreational purposes.

Social and economic importance of livestock keeping

Livestock sector is a source of employment. People can practice livestock keeping as a fulltime or part time activity. Keeping livestock is of benefit in many ways. Livestock provide clothing in forms of hides, furs, wool and silk. Animals provide important foodstuff to human beings such as meat, milk, eggs and honey. Food security for big cities in the world depends on livestock. For example, many animals and birds are slaughtered daily to feed urban population.

Livestock like donkeys, camels and horses provide a means of transport to people and goods. Some domestic animals are used for farming (ploughing), driving machinery, traction, and pulling carts. The use of domestic animals for ploughing is common in the regions or Dodoma, Mwanza, Singida, Shinyanga, Geita and Tabora. Moreover, animals produce manure which is used as fertiliser (organic manure) for plants. Other domestic animals are used for decoration such as

the ostriches, and peacocks. Decoration can also be done by using feathers of some animals. The feathers can further be used for stuffing mattresses and pillows.

In addition, some livestock are used for security purposes, such as dogs and some for educational and recreational purposes in zoos and game reserves. Examples of recreational events involving animals include horse racing, and cock fighting. Moreover, some animals, such as rats, mice, and guinea pigs are used for scientific experiments. Animals also provide industrial raw materials, such as leather which is used to make suitcases, belts, clothes, footwear and other related products. They also provide raw materials for processing industries like meat and milk. Livestock keeping also serves as a source of food for other animal. For example, herbivores are food for the carnivores.

Types of livestock keeping

Two types of livestock keeping are identified, namely *commercial or modern livestock keeping* and *subsistence or traditional livestock keeping*. Commercial or modern livestock keeping involves beef cattle rearing, dairy cattle rearing, birds, and sheep rearing, while subsistence or traditional livestock keeping (grazing livestock in the natural pastures) includes nomadic pastoralism and semi-nomadic pastoralism. Subsistence livestock keeping can further be categorised into three: nomadic, semi-nomadic and sedentary livestock keeping.

Nomadic pastoralism

This is a system whereby pastoralists specialise in keeping herds of animals on natural pasture. It is a non-enclosure type of animal keeping. Under this system, livestock are not confined to a permanent place because when pastures get finished the herders move with their animals to new fresh pastures. Nomadic herders are found in East and West Africa. In East Africa, the Maasai of Tanzania and Kenya give a good example of a nomadic pastoral societies. Nomadic pastoralism involves a continuous movement of the pastoralists from one place to another in search of water and pasture. This type of livestock keeping has been blamed for fuelling conflicts between farmers and pastoralists in areas such as Kilosa and Mvomero districts (Morogoro) in Tanzania. Under this type of pastoralism, livestock are kept for food and prestige, not for sale. The Maasai of East Africa are classical example of nomadic pastoralists.

Characteristics of nomadic pastoralism

Nomads often move with their livestock in search of new pastures and water. Due to this reason, there is no permanent settlement of nomads. They normally live in simple temporary houses or tents. The main source of food for nomads is their livestock. Their animal keeping is mainly for prestige (a symbol of wealth) rather than for economic purposes. The system is normally practised in sparsely populated areas where grazing lands are communally owned. Consequently, the land is often overgrazed, resulting in soil erosion and compaction, loss of fertility

and growth of invasive plant species. This is so because there is no control on the herd size or grazing periods. The practice is also characterised by frequent occurrence of animal diseases due to lack of appropriate animal health care. In addition, animals kept are of poor quality and low value.

Problems of Nomadic Pastoralism

Due to their nomadic nature, it is difficult to provide social services like education, health services, electricity, and water to to the pastoralists. Moreover, nomadic pastoralism causes overstocking, soil erosion, deforestation, desertification, and pollution, which contribute to climatic change. There are also frequent conflicts between pastoralists and peasants, and between pastoralists and game reserves or national parks.

Semi-nomadic pastoralism (agro-pastoralism)

Semi-nomadic pastoralism involves establishment of a settlement where some seasonal crops such as maize, millet and sorghum are grown. This is a transitional system between total nomadism and permanent animal husbandry or sedentary animal husbandry. In this system the livestock keepers have permanent places of residence where they usually practise cultivation of crops to supplement the pastoral activity.

Normally, livestock keepers travel from their homes with their herds for a long period of time to distant grazing lands in search of pasture and water, especially during the dry season of the year. Examples of semi-nomadic pastoralists in East Africa include the Sukuma, Gogo and Nyamwezi in Tanzania; the Turkana in Kenya; and the Lango in Uganda.

Characteristics of semi-nomadic pastoralism

Semi-nomadic pastoralism is characterised by keeping large numbers of cattle in a large area through communal grazing method. For semi-nomads, the improvement of the soil fertility is not their concern. The practice also takes place in permanent settlements and it usually leads to over grazing and land degradation.

World distribution of subsistence livestock keeping

This type of animal keeping is common in areas where there is vast land. It is well developed in East Africa among the Maasai, Barbaig and Kwavi in Tanzania; Karamajong in Uganda; Maasai in Southern Kenya, and the Tuaregs in North Africa. It is also practised in the Desert Lapps in Scandinavia, the Kirghiz-steppe land in Asia, and among the Fulani in West Africa.

Commercial livestock keeping

Commercial livestock keeping takes place in demarcated areas where large number of cattle, sheep, goats and horses are kept. This system is very common in extensive temperate grasslands and in some parts of the tropics.

Livestock ranching

Ranches are permanent areas where large number of cattle, sheep, goats and

horses are kept. They are large farms that cover extensive land area and carry large number of animals. This system is very common in the extensive temperate grassland and some parts of the tropics. They hire labour for management. Close care of animals is needed and there is a special grown pastures or fodder. Animal breeds are carefully selected to obtain better quality products.

Characteristics of commercial ranching

Commercial ranching is characterised by continuous vegetation cover. The green pastures are either natural grasses or selected grasses or legumes such as alfalfa, lucerne and clovers. Ranches are scientifically managed. For example, cattle and sheep are vaccinated or dipped to safeguard them against diseases. Moreover, infected animals are isolated and treated or removed to prevent the spread of infection. Ranches are also characterised by little or no migration due to the fact that food supplies are permanent and are supplemented by fodder. Moreover, in ranches animals or their products such as meat and wool are for sale. In addition, ranches stimulate the development of transport and communication systems of towns, that are related to activities such as slaughtering, processing and packaging. The main ranches in Tanzania are found in Dodoma, Arusha, Coast, West Kilimanjaro, Tanga, Mwanza and Kagera regions.

Problems of cattle keeping in the tropics

Temperate regions are the traditional areas of commercial cattle rearing, but many cattle are also kept in the tropical grasslands or savannas of Africa, South America and Australia. However, in southern Africa and northern Australia, cattle rearing is generally poorly developed and the financial returns are poor. This is due to the following reasons;

Climate and vegetation: Though savanna lands receive a moderate to heavy rainfall of between 760 and 1 525 mm, twice as much as the temperate grasslands, the rain is very unevenly distributed. The rain season is short, and under tropical conditions of high temperature, rapid evaporation and much run-off, the water does not have lasting value and the vegetation is often poor. A long dry season causes shortage of pasture and water. For example, the Sahelian droughts in West Africa, severely affects cattle-farming in the region. Most of the natural vegetation of the savannas is of the parkland type, with tall, course grass and scattered trees. Many of plants are thorny bushes and scrubs which are not palatable to livestock.

Cattle breeds: High quality temperate cattle breeds cannot be kept in tropical regions because they have no built-in resistance to certain tropical diseases. Yet the Zebu cattle, even when commercially raised, do not yield good beef and the attempts to improve the stock have only improved the quality slightly.

Diseases: Despite some degree of built-in resistance to diseases, cattle in the

tropics are a prey to a wide variety of pests and diseases which makes cattle farming difficult. In some years, locusts may swarm and eat every scrap of green vegetation, depriving the cattle of pasture. Diseases such as anthrax, rinderpest, Rift Valley Fever (RVF), Foot and Mouth Diseases may affect the cattle, or parasitic ticks may be a problem. The presence of tsetse flies which carry a disease called Trypanasomiasis or Sleeping Sickness to men and Nagana disease to cattle has traditionally limited livestock keeping in many parts of Africa.

Traditional farming practices: Many African groups such as the Fulani of West Africa, have not developed the techniques of modern cattle rearing, so they practice nomadic herding. This is partly, a response to difficult physical conditions and partly a traditional way of life. Better pastures are often overgrazed, and thus leading to soil erosion and soil infertility. Savanna areas are often overstocked because cattle are regarded as a sign of wealth or status. The Fulani for instance, keep cattle mainly for milk and occasionally use them for meat.

Insufficient capital for livestock development: In many areas, capital for development of modern commercial ranching, building of storage facilities or provision of veterinary and training services are lacking. In areas where financial resources have been available, for instance, where European settlers are managing ranches as in north Australia and South Africa, commercial cattle rearing has been well established.

Solutions to problems facing cattle keeping in the Tropics

In order to overcome problems of cattle keeping in the tropics, there is a need to construct dams, control water supply and conserve rain water for use during the dry season. There is also a need to ensure availability of high quality pastures and nutritious fodder crops through irrigation schemes and to raise quality cattle breeds through a selective breeding of local cattle. Other measures include provision of appropriate education to cattle farmers to enable them to diagnose diseases quickly. Veterinary services should be improved and introduced widely to ensure quick and reliable service where need arises. Assistance to cattle keepers should be available to enable them to make a critical transition from traditional to commercial farming practices in order to benefit them and the population. This can be achieved through education, training and seminars to the pastoralists. Lastly, destocking and forming groups of pastoralists or cooperatives would help to generate capital which could be used to commercialise cattle rearing.

Exercise 2.11

1. Differentiate between commercial ranching and nomadic herding. Limit your response to six points.
2. Draw a map of Tanzania and show its main ranches.
3. Examine four challenges that face cattle keeping in the tropics and suggest possible solutions.
4. Explain five benefits of livestock ranching in Tanzania.

Activity 2.20

1. In a group, use textbook and web based resources to explore necessary conditions for livestock ranching and present your work in the class.
2. Differentiate between livestock keeping styles done in Argentina and that of your locality.

Beef farming

Cattle are kept for different purposes such as beef, meat and hides. It is estimated that there are about 971.5 million cattle in the world. Most of these cattle are bred for beef, dairy/milk, hides and furs. But in Asia, cattle are kept as draught animals for pulling ploughs and carts. Farm units are known by different names in different regions. They are called *ranches* in North America, *estancia* in South America, and *stations* in Australia.

World distribution of beef cattle

Cattle for beef and dual-purposes make up the bulk of the world's cattle population. The U.S.A. is the leading producer of beef, followed by Russia and Brazil. Many parts of the temperate grasslands of the world; the steppes, the Prairies, the Pampas, the Veld, the Australian Downs and parts of New Zealand have long been used for cattle ranching.

Beef cattle breeds

There are different breeds of cattle which are kept for beef. They include the following;

Aberdeen Angus: This breed originated in Scotland. Cattle of this breed have a smooth black body, small horns, and high quality meat. They grow fast and they are normally kept for commercial purpose. They are capable of adapting to a wide range of physical and climatic conditions.

Hereford: This breed originated in England. Cross-breeds are developed in U.S.A. and Canada. They are red white, have white face and white spots on some parts of their body with short horn, and they thrive in harsh conditions.

Galloway: This breed was first bred in South West Scotland. It is similar to Aberdeen Angus but more strong and capable of withstanding very cold conditions, rugged topography, and rough pastures.

Devon: This breed originated in Devonshire and it is reddish in colour. The North Devon breed is kept for beef or dual-purpose while the South Devon breed is more suited for milking. They do better in the sunny sub-tropics and the tropics.

Zebu: This originated in the tropical areas. It has a small bony body, a big hump above the shoulders, and loose hanging skin under its throat. It has long ears and a reddish or whitish body. Many minor types are bred in different parts of Asia and Africa.

Beef cattle husbandry

Beef cattle are much more widely distributed than dairy cattle. This is because beef cattle are resilient and

can tolerate a wide range of physical and climatic conditions. They can also survive on sparse pasture, and on the coarse grasses of the tropics. Beef cattle ranching is mainly carried out in Argentina, Australia, USA, New Zealand, Russia, England, and France.

Exercise 2.12

1. Differentiate between traditional and commercial livestock keeping. Limit your response to five points.
2. Briefly describe the world distribution of beef cattle.
3. Explain the social economic importance of livestock keeping. Limit your response to eight points.
4. Describe six important breeds of livestock kept for beef in the developed countries.
5. Identify three ways through which subsistence livestock farming is done.

Activity 2.21

1. In a group, use library and web resources to describe the history of animal domestication in the world.
2. With examples from your place of residence or origin, explain different species of livestock keeping.
3. 'In Tanzania commercial livestock keeping contributes considerably to the economic development' By using textbooks and web resources, present six points to justify the statement.

Focal studies

Beef farming in USA

The USA is the greatest beef producer in the world. It has little surplus for export due to high local demand for beef. Every state raises and sells beef cattle, but the top five are Nebraska, Texas, South Dakota, Kansas and Oklahoma which accounted for 43% of sales in 2012. Other states include Montana, Iowa, Missouri, Colorado and North Dakota as shown in Figure 2.18. The USA exports beef to Japan, Mexico, South Korea and Canada. More than 85% of beef cattle ranches and farms are individually or family owned and operated.

Figure 2.18: *Montana cattle ranch in U.S.A.*
Source: https://cdn.tsln.com/wp-content/uploads/sites/13/2018/01/Nicaragua-TSLN-011318-1-2-1240x930.jpg

Stages of beef production

Beef production involves five stages.

Stage 1

Cow-calf producer maintains a breeding herd of cows that revise calves every year. Beef calves are weaned when they reach 6 - 12 months.

Stage 2

Calves leave their ranch or farm of origin between 6 and 12 months of age. Younger or lighter-weight calves may be sent to *a background* or *stocker* who continues to graze on grass or other forages until they are 12 - 16 months old.

Stage 3

After the calves are weaned, some are sold at an auction market, best females are chosen and added to a breeding herd, and some are sent to a feedlot.

Stage 4

Most beef cattle spend approximately 4 to 6 months in the feedlot where they are fed a grain-based diet. The most important grains are corn, soy beans, wheat, sorghum, barley, and oats.

Stage 5

Beef cattle reach market weight after 12-18 months of age. They are then sent to a processing facility to be harvested.

Factors for the success of beef farming in the USA

The USA has been successful in beef cattle farming due to good climatic condition, good cattle breeds, plenty of cattle food supply and application of science and technology. There is also availability of cheap labour supply as well as reliable internal and external markets. Moreover, there is availability of technical experts, including veterinarians and the US Department of Agriculture (USDA) which is responsible for inspecting packing plants and overseeing the implementation of safety and quality measures as well as animal welfare.

Other factors include, research and education; where public supported land grant, university research, education and extension programs have developed technologies to support producers, as well as various USDA entities. Furthermore, corn producers and land owners receive more subsidies than those who are growing other crops which stimulates corn production and lastly corn price ratio in the US is favourable which facilitates production increase. This has a positive contribution because corn production is the major driver in feedlot production and marketing.

Challenges faced by beef farming in the USA

Beef farming industry in the USA is also facing some challenges. There is a decline in a number of calves due to competition for food with other livestock such as poultry and pigs. Utilisation of biofuel in the corn belt, is likely to cause animal feed shortage. Animal rights movement discourage meat consumption by arguing that there is a difference between animal welfare and animal rights.

Exercise 2.13

1. Mention the top five beef farming states in the USA.
2. Describe five stages of beef farming.
3. Account for the development of beef farming in the USA. Limit your answer to five points.
4. With reference to five beef farming states, explain the contribution of beef farming to the USA development.
5. Citing examples from one of the states in the USA, discuss three main challenges facing beef farming.
6. Account for the obstacles to the expansion of beef farming in Sub-Sahara Africa.

Activity 2.22

1. In small groups, visit a nearby local beef farm, observe the difference in beef farming with that of USA. Present your work in the class.
2. Pose a discussion with your fellow students in the class to compare beef farming in USA and Tanzania.

Beef farming in Argentina

Cattle rearing has been the main economic base for the residents of the plain (estancias) on the Pampas. Pampas is an area with very fertile soil extending westward across central Argentina from the Atlantic coast. The area is important for cattle keeping. *Alfalfa grass*, maize and other fodder crops are grown in ranches to be used to fatten cattle as shown in Figure 2.19.

Figure 2.19: *Alfalfa pasture land*

Source: https://static.agriculture.com/s3fs-public/image/2014/12/16/img_5490868b408c7_46707.jpg

Factors influencing beef farming in Argentina

Suitable Soils: The soils of pampas consist of a deep accumulation of loose wind-blown materials which favour the growth of grass used as fodder. The soils also influence the nature of ranching, extending into the Patagonia region.

Availability of enough fodder: The vast cattle farms provide enough fodder to feed the cattle reared in Argentina. The common fodder used include alfalfa and maize. Availability of enough fodder is contributed by favourable maritime climate, which is dominant in the country enabling quality pasture production.

Production systems: Large and well structured farms create favourable conditions for beef production in the country. There are also modern slaughtering plants which meet EU standards making it easier to export meat in European countries.

Internal and external market: Argentina has the highest beef consumption records in the world hence having a reliable domestic market. Moreover, its export shares are between 10 - 15% of production. Most of the meat is exported to EU and USA, there has also been a growing market in Africa and the Far East. Most of the importers prefer fresh and chilled meat.

Infrastructure: The success of beef production sector in Argentina is also a result of infrastructural factors such as the presence of good means of transport and communication, and good storage facilities such as refrigerators.

Exercise 2.14

1. Outline five factors that favour beef farming in Argentina.
2. Explain why the Pampas area in Argentina is potential for cattle keeping.
3. Examine the conditions that favour cattle keeping in Argentina.
4. Describe the contribution of beef farming to the economy of Argentina.

Activity 2.23

1. Organise a study group with the assistance of your subject teacher to study and compare the development of beef farming in Argentina and Tanzania.
2. Using textbook and web sources, explore the contribution of beef farming to industrial development.

Dairy farming

The objective of dairy farming is to raise cattle for milk production. Milk may be used in its original form or turned into butter or cheese, and condensed or powdered milk. People all over the world, use more milk more than beef.

Dairy cattle breeds:

Most of the world's best known breeds of dairy cattle come from Western Europe, especially Britain, the Netherlands, and Switzerland. The best known breeds of dairy cattle in the world include the following;

The Ayrshire breed: This breed is white or red, or mixed in colour and has long, sharp-pointed horns. It originated from Ayrshire in South West Scotland. It yields much milk and it can be milked three to four times a day.

The Guernsey and Alderney breed: The cattle of this breed have spots on their coats, and patches on the legs. They are smaller in size than other dairy breeds. They give deep-yellowish milk with a high butterfat content, useful for the

production of butter and cheese. They were first bred on the isles of Guernsey and Alderney coast of north-west France.

The Jersey breed: This is the smallest type of dairy breeds, weighing not more than 450 kg. It originated from Jersey in the Channel Islands. Its colour varies from light yellowish to dark brown or even black. It gives milk with an extremely high butterfat content.

The Friesian breed: It is the largest type of dairy breeds and it is a heavy feeder, characterised by black and white colours. A mature Friesian cow weighs as much as 675 kg. It was first bred in the low-lying polders of the north-west Netherlands, but now it is used all over the temperate latitudes. Its milk yield is the highest among dairy cattle.

The Swiss Brown breed: This breed is brown in colour with much loose skin under the throat. It adapts itself very well to Swiss Alpine conditions. This breed gives much milk for the creameries and the chocolate making factories.

World distribution of dairy farming

While beef cattle can be kept on relatively poor pastures and at a great distance from markets, dairy cattle are confined to the most favourable conditions such as climate and pasture, and where economic factors are suitable. Lowland areas are more suitable than uplands and the climate should be mild with moderate to heavy rainfall and the ground should be moisture retentive. The greatest dairying areas in the world are in Western Europe, the USA, Japan, South Africa, Korea, and the temperate parts of the southern continents.

Dairy farming in Denmark

Denmark is well-known for its dairy products and cattle. The main types of dairy breeds are Jersey and Friesian which produce much and high quality milk. The most important areas for dairy farming are the northern and eastern flatlands.

Factors influencing the development of dairy farming in Denmark

Dairy farming in Denmark is organized into cooperative societies is among the factors which have influenced dairy farming in Denmark. The cooperatives deal with provision of loans, educating farmers, as well as collecting and marketing milk from members to local and international markets. The cooperatives also provide farmers with farm inputs such as pesticides, milking machines and storage facilities. Dairy farming in Denmark is also influenced by the availability of market and capital, application of science and technology, good transport and communication systems, availability of agricultural officers, livestock keeping expertise, and the presence of good cattle breeds.

Challenges faced by dairy farming in Denmark

High production costs and capital investments is the major challenge facing dairy farming in Denmark. When starting a dairy farm capital requirement is high. Getting loans is not easy because the conditions for borrowing are difficult. High labour costs are also a challenge. High costs for labour forces farmers to minimise costs by contracting only staff for management and cow care.

Dairy farming in the Netherlands

The Netherlands with its lush Polder land pastures is an important producer of dairy goods and has very high milk yields as shown in Figure 2.20. It is the third leading exporter of condensed, evaporated and powdered milk, after Germany and France.

Figure 2.20: *Dairy farm in the Netherlands*
Source:https://www.independent.ie/business/farming/dairy/the-dutch-dairy-dilemma-how-dairy-farmers-in-the-netherlands-are-coping-with-new-phosphates-regulations-37190525.html

Factors favouring dairy farming in Netherlands

Much of the population in the Netherlands deals with dairy farming. There are both smallholder farmers and large associations. The formation of farmers cooperatives have resulted into increased specialisation and investment in mechanisation, which moves production from farm to factory. Dairy production chain in the Netherlands involves several organisations such as the Dutch Federation of Agriculture and Horticulture, which is an organisation for employers and employees in the agricultural sector. The Dutch Dairy Farmers Union is an organisation formed for the interest of dairy farmers while the Farmhouse Artisan Cheese and Dairy Producers is an organisation for on farm processors; active in defending the interests of its members and product promotion. Other organisations include the Dutch Dairy Association, which is an association of the Dutch dairy industry, the Dutch Dairy Traders, which is an umbrella organisation for dairy traders and other affiliated associations, and the Dutch Food Retail Association. The cooperative model is therefore, strongly rooted in the Dutch dairy history and it facilitates capital accumulation and concentration of dairy processing.

Netherlands is endowed with high quality cattle breed since the middle Ages (300 BC). Friesians and Holsteins cow breeds are the world's most highly productive cattle, producing over 26 000 litres of milk in their lifetime. Moreover, there is an abundant flatland in the Netherlands which is ideal for cattle rearing. It provides space for grazing and mechanisation. The polder soil is highly rich in nutrients on and supports suitable environment for grass production.

Netherlands is a well-known organic farming country in Europe. This gives it a market advantage since customers believe that its dairy products are free from farm chemicals. Therefore, good climatic conditions and the geographical location of the Netherlands support the development of dairy farming. In addition, there are reliable internal and

external markets for dairy products. For example, the ageing population in European countries and China pose a high demand for dairy products which benefits the Netherlands. Moreover, support from the government also contributes a lot to the success of the dairy sector in the Netherlands. The government and its affiliated institutions are involved in research and projects for the development of the dairy industry. For example, the Wageningen Agriculture University is responsible for agricultural science and has a specific dairy farming college in Bolsward, which was established in 1904. Other factors include massive application of science and technology in cattle raising, milk processing and storage, as well as good transport network facilities to the markets. On top of that, Dutch food export has a strong worldwide market share of about 11% percent.

Challenges facing dairy farming in the Netherlands

The most notable challenge is stiff competition from other dairy producing countries, such as Germany, France, Denmark, and New Zealand. Moreover, the Netherlands dairy farming industry tends to be overtaken of by the upcoming countries because of an ageing population, social tensions, an export concentration in slowing mature markets, and there have been relatively low public and private investment in research and development in recent years. In order to return to rapid growth in productivity, the nation must improve research and development spending, and must encourage greater private sector investment in the dairy farming.

Exercise 2.15

1. Differentiate between beef farming and dairy farming.
2. Describe five factors for the development of dairy farming in Denmark.
3. Explain eight factors that favour dairy farming in the Netherlands.
4. Explain six challenges facing dairy farming in Netherlands.
5. Briefly explain the contribution of organic farming to the success of dairy farming in the Netherland. Limit your response to five points.

Activity 2.24

Use library and web based resources to identify the contribution of cattle breeds to the development of dairy production.

Activity 2.25

Visit a nearby diary farm and observe the activities involved. Compare the diary farming you have observed with that of Netherlands.

Sheep rearing

Sheep are reared either for wool or meat. Sheep can live in much more rigorous climatic conditions than cattle. They

can live on the scanty pasture of semi-arid regions, in rocky, exposed upland areas and even in very wet regions such as North Wales where the annual rainfall exceeds 5 080 mm. Sheep do not do well in tropical regions. It is economically important to keep sheep in marginal agricultural regions than in well favourable agricultural areas because of huge flocks of sheep which need a large piece of land. Sheep farming is thus associated with regions of sparse population. The common breeds reared includes blackface, and cherist kept for meat. Other sheep breeds including merino and cross breed which are kept for wool.

Sheep breeds

Sheep breeds are categorised either as sheep kept for meat or as sheep kept for wool. Sheep breeds kept for meat originated in the British Isles, and they include the following breeds;

Blackface: This breed originated in the Highland of Scotland. It yields superior meat but poor wool. It is a hardy breed which can live on scanty upland pastures.

The Cheviot: This type of sheep is bred in the Cheviot hills on the border between Scotland and England. It requires slightly better pastures to do well, and it is used either for meat or wool production.

Other breeds include the Leicester from the Midlands and the South-down; and Lincoln and Romney Marsh breeds from the chalk and limestone scarp lands.

Sheep breeds kept for wool

Sheep breeds kept for wool include the following two major types;

Merino: The Merino sheep originated in Spain and North Africa but it has been greatly improved by selective breeding and it yields the finest wool. Merino sheep are kept chiefly in the drier, and warmer regions of temperate latitudes.

Crossbred sheep: They originated in Britain and they are kept for both wool and meat. They yield wool of medium grade. They are kept in areas with higher rainfall and richer pastures.

Sheep farming in Australia

According to the 2019 report of FAO, Australia has the second largest sheep population in the world after China and it is followed by India. Australia keeps both meat and wool sheep. It is the second largest lamb and mutton producer but the world's leading wool producer and exporter. Sheep farming in Australia is highly concentrated in the states of New South Wales and Victoria.

Sheep farming for wool

Wool refers to the animal fibre. It is the long curly hair of a sheep. Sheep may be kept primarily for their wool or for their meat but even sheep kept for meat must be clipped regularly and, thus yield some wool.

Methods of sheep farming

Sheep are reared in farms. Sheep farms in Australia are very large, each containing about 50 000 sheep. They are kept in paddocks which are separated by wire

fences. A paddock may be of many square kilometres in size and sheep may be moved to a new area once a paddock is exhausted. The paddock system has several advantages. The fences serve to keep out other animals, such as kangaroos, rabbits and dingoes which would compete with sheep for food or might harm the sheep. It also helps to reduce overgrazing and to conserve the grasslands because it ensures an even use of the pastures. Paddocks also allow some land to be held in reserve until the period of drought, when other paddocks have been exhausted. In addition, it allows some sown hay to be harvested and stored for emergencies.

Merino sheep are kept on the drier grass and scrub-lands of the hotter interior. Cross-breed sheep are kept on the better watered and improved pasture of small farms. In the interior, sheep rearing is the principal agricultural occupation while in more favoured areas sheep are part of a mixed farming economy. Sheep graze on natural grasslands, though in some cases the pastures are improved by sowing clovers or grass or by applying fertilisers to promote their growth. This work is usually done by aircraft when large areas are involved.

Sheep shearing

Sheep shearing is the process by which the woollen fleece of a sheep is cut off as shown in Figure 2.21. Once or twice a year sheep are rounded up for shearing. Teams of shearers travel from one sheep station to another to do this work. The shearers use electric clippers and can each shear between 100 and 200 sheep in a day. The fleeces, which weigh between 4 and 10 kg are graded and baled and then sent to a nearest wool market.

Figure 2.21: *Sheep shearing in Australia*
Source:https://www.farmtransparency.org/uploads/photos/medium/2612-000018653-49dc4fe91c491fe79ced.jpg

Types of wool

Wool differs in terms of its staple length (the length of individual fibres), thickness of the fibres, durability, lustre, and appearance. On the basis of these features, there are three major types of wool;

Merino wool

This accounts to about one third of the wool produced. It is long and has fine texture and it is used for making high quality worsteds and knitting yarns.

Crossbred wool

This wool is of medium length and it is somewhat coarser than the fine merino wool. It is suitable for clothing. It is mixed with merino wool or used alone to make woollen goods of medium quality.

Carpet wools

They are coarser, thicker and more variable in quality than either merino or cross-bred wools. They are derived from more marginal sheep rearing areas or from areas where wool is only incidental by-product from sheep kept for meat.

Wool processing

Wool from sheep must be processed before use. The first operation/process is cleaning or scouring the wool. Thereafter, the wool undergoes carding or combing in order to separate the fibers, spinning to form one straight yarn and lastly weaving wool yarn into fabrics and finishing which involve fulling, carding and decanting. The methods of carding, spinning and weaving differ depending on the type of material to be made.

Not all wool is processed through the methods outlined above. Some is made into yarn by hand or machine knitting, usually using the higher grades of wool. Through knitting some wool is made into specialised materials, such as tweeds, serge, blankets and flannel while coarser wools are processed to make carpet yarns. The process of wool ends up with the type of yarns which are;

Worsted

Worsted are made from long staple wool of the best quality. The longer fibres are separated from the shorter ones. The longer fibres are spun and twisted tightly to make strong, smooth yarn. The yarn is then dyed before weaving. Weaving produces a smooth, patterned cloth of high quality. The shorter fibres are rejected after carding but are used for woollen manufacture.

Woollen

Woollens can be made from a much wider range of wools. The rejected fibres from worsted carding, shorter staple wools such as cross-bred wools, woollen wastes from spinning, and weaving mills can all be utilised. Other fibres, such as cotton, mohair, or synthetic fibres can be added to the wool in various proportions to produce cloth with special properties.

Factors that favour sheep rearing in Australia

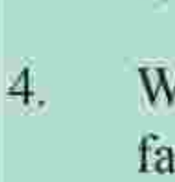
A number of factors favour the development of sheep rearing in Australia. These include favourable climatic conditions such as drier, warmer conditions and favourable rainfall; presence of plentiful supply of pasture as sheep rearing takes place in grasslands; presence of good sheep breeds such as merino which produce wool of high quality; presence of both skilled and unskilled human resource which are responsible for researches and diseases and pests control; the use of high technology such as aircrafts in the application of fertiliser to improve pasture, and electric clippers in sheep shearing; and the availability of both internal and external markets which largely favour the sector. Australia exports about 90% of its wool to Japan, Britain, and other European countries and consume the remaining 10%.

Challenges facing sheep rearing in Australia

Sheep rearing in Australia is affected by drought, which is a recurring problem. For example, successive dry years (1968-1970) resulted into deaths of animals due to lack of food and water. Overstocking is another challenge which causes great loss due to lack of pasture and water. Furthermore, there is a challenge in raising large capital to be invested in order to run farms with large flock of sheep.

Exercise 2.16

1. Describe the meaning and importance of sheep shearing.
2. With examples, describe three types of sheep wool and their uses.
3. Describe the paddock sheep farming method and explain its four advantages.
4. What are the two main sheep farming areas in Australia?
5. Describe four basic processes involved in wool processing.
6. Examine three main challenges that affect sheep farming in Australia.
7. Identify sheep farming practices done in Australia that could also be done in Tanzania.



Activity 2.26

1. In a group, document the competitive advantages of sheep farming in Australia and present your work in the class.
2. Observe sheep farming done in your surroundings and compare the sheep farming system observed with that of Australia.

Livestock keeping in Tanzania

Livestock keeping is one of the major agricultural activities in Tanzania. The sub-sector contributes to the national food supply, converts rangeland resources into suitable products for human consumption, and it is a source of cash income and an inflation-free store of value. Tanzania has the third largest livestock population in Africa; comprising 25 million cattle, 167 million goats, 8 million sheep, 2.4 million pigs, and 36 million chickens. The sector contributes 7.4% to the community Gross Domestic Product and to the annual growth rate of 2.2%. Out of the sub-sector's gained contribution to GDP, about 40% originates from beef production, 30% from milk production and another 30% from poultry and small stock production. Livestock production originates from large resources base composed of the different livestock species, breeds, and types whose ownership and distribution differ from region to region.

The spatial distribution of livestock in Tanzania depends on the agro-ecological zones such as Arid, semi-arid, sub-humid, humid, and the highlands. Pastoralism in which traditional cattle, sheep, and goats predominate is concentrated in the northern (Arusha and Manyara) savannah plains where climatic and soil conditions

do not favour crop production (Figure 2.22). Agro-pastoralism is found in low rainfall areas of Western (Shinyanga and Tabora) and central (Dodoma and Singida) zones where shifting cultivation of sorghum and millet is practiced. Smallholder dairy production include stuffed crossbreed dairy cattle in the Northern and Southern highlands, Kagera, and in Peri-urban areas around major cities and towns.

Figure 2.22: *Pastoralism in Tanzania*
Source: https://elimufeynman.s3.amazonaws.com/media/resources/maasai.jpg

The total livestock population reared by smallholder livestock keepers in Tanzania is 37.06 million, of which 18.8 million are cattle, 13.1 million goats, 3.56 million sheep and 1.6 million pigs. The poultry population is estimated at 33.3 million. Smallholder ruminant production in Tanzania is characterised by most livestock keeping households, having less than 10 herds. However, a relatively high percentage of livestock population are reared by a small number of farmers. Ruminant livestock production is concentrated in the Northern regions of the country and this declines steadily toward the southern regions of the country.

In Tanzania three livestock production systems are commonly distinguished in the rangeland areas; commercial ranching, pastoralism, and agro-pastoralism. Commercial ranching accounts for about 2% of the total cattle herd. It is mainly practiced by the National Ranching Company (NARCO). Livestock industry has maintained a steady annual growth rate of about 2.7% during the last decade. However, human population growth is increasing at a higher rate than the growth of livestock sub-sector; indicating that Tanzania is increasingly unable to meet the internal demands for livestock. This is further compounded by the culture of retaining large cattle herds as a symbol of wealth or status in some of the societies without focusing on the quality of the animals kept.

Factors that favour the development of livestock industry in Tanzania

Policy instruments: The presence of the three instruments namely government, policies, and strategies have contributed to the growth of livestock sector in the country. These include Agriculture and Livestock Policy of 1997, Agriculture Sector Development Strategy (ASDS), and the National Livestock Policy (NLP) of 2006. The strategies have provided avenues and challenges for accelerating the growth and contribution of livestock industry to the poverty reduction and national economy by making more optimal use of available land, animals, and human

resources. A strong and supporting policy environment is key to the growth of the agricultural sector. Policy strategy enables farmers to access and use agricultural knowledge, technologies, marketing systems, infrastructure, and the promotion of private sector investment in agricultural production.

Government support: In recognising the importance and potentials of agriculture as a contributor to the national income and wealth creation, the government has been providing financial support to the sector. For example, in 2009/2010 fiscal year, agriculture sector received about 7% of the national budget to strengthen its operations. This was about 666.9 billion TZS which was an increase of about 30% on the previous year's allocation.

Public and private sectors partnership: Currently, production of livestock in Tanzania is to a greater extent done by the private sector in partnership with the public sector, especially on commercial annual production like ranches or research institutes. This has increased capital investment in the livestock sector both in production and research for better breeds. For example, most of ranches under the National Ranching Company (NARCO) have been privatised to allow private sector to take part in running livestock industry.

Improved pests and diseases control: Through continuous research and experiments on pests and diseases affecting livestock in Tanzania, much improvement has been done to control or reduce animals' mortality rates by using new agrochemicals. Vaccinations and treatments have been developed to counter massive pests and diseases that have been affecting livestock keepers especially the small scale farmers since 1980s. Researchers have brought new advanced and high disease resistance animal breeds which improve productivity and strengthen the industry.

Public awareness: With the development and advancement of communication technologies and mass media, farmers are kept aware of the transformation and new developments in the livestock sector including markets. The flow of information has been simplified and hence people are acquiring knowledge and skills easily through the mass media. The flow of information on goods and advanced technologies in livestock production has improved and changed people's attitudes towards the potentials available in the livestock sector.

Globalisation and market expansion: Globalisation, regional integration and changes in the national economy have offered opportunities for rural and urban development by providing market for live animals and animal products. Tanzania has a comparative advantage of producing various animal species and livestock products for these markets because it has a strong natural resource base and climate favourable for commercial and market oriented livestock production. Moreover, with the rapid population growth, Tanzania has the potential for internal market which has led to the increase in consumption of livestock products. The current rapid growth of poultry production has to a greater extent, been stimulated by the population growth.

Problems facing pastoralism in Tanzania

Some of the challenges encountered by the traditional pastoralists in Tanzania include shortage of grazing areas for large stocks of livestock. The number of livestock in the country has increased tremendously. For example, the number of cattle has risen from 3 million in the 1920s to more than 21 million in 2021. The conversion of suitable grazing areas into other and more preferred land uses such as crop cultivation and creation of protected areas has largely intesified this challenge.

There is also inadequate legal and policy arrangements to allocate land to pastoralists. This has aggravated conflicts between pastoralists and other land users. Another problem is related to the shrinking of land for pastoralism due to displacement of pastoralists from their traditional grazing areas. Displacement of pastoralists has reduced the land share of pastoralists to about 10% of the total land area in Tanzania. Pastoralism is also affected by pests and diseases such as Trypanasomiasis (sleeping sickness) caused by tsetse flies which are difficult and costly to control.

Exercise 2.17

1. Explain the term pastoralism.
2. Differentiate between nomadic pastoralism and semi nomadic pastoralism.
3. Describe the distinction between nomadism and semi-nomadism in Tanzania.
4. Examine four challenges encountered by traditional pastoralists in Tanzania.
5. Examine the measures which have been used by the government to alleviate conflicts between pastoralists and agriculturalist in Tanzania.
6. Assess the impacts of pastoralism to the environment.

Activity 2.27

1. Using textbooks and web resources, explore the disadvantages of pastoralism on land use planning and present your work in the class for discussion.
2. Study cases from Tanzania where land use conflicts emerged to find out the source of the conflict and present results in class.

Problems facing the livestock sector in Tanzania

Population pressure: Traditionally and over time, livestock was kept in marginal lands characterised by dry, hot climate and unfertile soils with sparse population. However, population has continued to rise along with the demand for food, water and other resources that are necessary for sustenance. There is also a problem of shrinking of grazing lands in favour of other investments such as crop cultivation and wildlife protection.

Loss of water and grazing areas: Changes in land tenure has severely restricted the movement of pastoralists. This in turn has resulted in loss of water sources and grazing land as the acquisition of land for cultivation in the marginal lands continues. In addition, more grazing land is increasingly set aside for wildlife protection by the government. This has impacted on the availability of pasture and water for pastoralists and, thus compromising their livelihoods. The loss of these two key resources (water and pasture) is the most challenging problem to nomadic pastoralism in the future.

Livestock pests and diseases: Livestock diseases are among the most serious constraints, limiting the development of livestock industry in Tanzania. High prevalence of livestock diseases such as the tick-borne diseases, east coast fever, ndagana (trypanasomiasis), malignant catarrhal fever, worms, foot and mouth diseases hinders the development of the livestock sector. Failure to meet the World Organisation for Animal Health (WOAH) and World Trade Organisation (WTO) sanitary demands affects the international trade in livestock products and by-products in Tanzania. There is also a failure to set-up Disease Free Zone (DFZ's) which contributes to low investment in the commercial livestock production.

Types of livestock production system: The low-genetic potential of the indigenous livestock coupled with limited supply of improved livestock has led to poor production and productivity in the livestock industry. This has been catalysed by the existing extensive low-input-and low output production system practiced by livestock farmers. Even though indigenous livestocks are well adapted to the marginal areas, their potentials have not been fully exploited due to lack of understanding on their production.

Poor processing and marketing of livestock products: In Tanzania, there is little value addition in the livestock value chain, characterised by lack of grading of livestock and livestock products, lack of fattening of animals to improve quality prior to marketing them, inadequate infrastructure for processing, and poor handling as well as presentation and packaging of most livestock products. In addition, processing and packaging costs are too high, and inadequate quality control and general inadequate knowledge and skills among actors in the livestock value chain have depicted great impact on the development of the sector.

Other constraints related to poor livestock processing and marketing include poor market infrastructure for livestock and livestock products, poor and costly transportation system, and poor or inadequate knowledge about the markets (both domestic and external) for livestock and livestock products. Moreover, weak livestock producers organisations including cooperative unions also limit the exploitation of economies of scale in production and marketing of livestock and livestock products, leading to high transaction costs, wastage, and inefficiencies. Another problem is weak linkages or coordination among actors in the livestock value chain.

The sector is also affected by inadequate entrepreneurship and business skills, including negotiation skills especially among smallholder livestock keepers, resource, and poor livestock producers. Competition from other livestock exporting countries for existing and new markets and competition from the subsidised livestock products imported from outside the country, discourage the investment by local producers.

Livestock services and capacity building: Inadequate farmers knowledge and skills on livestock keeping is one of the limiting factors to the development of the industry. Livestock services involve capacity building which include training, research, extension, information and regulatory services. This has been mostly due to weakness in the livestock curricular in the training institutions. Livestock training institutions are also faced with inadequate infrastructure, facilities, and experts in terms of their numbers and skills.

Poor extension services at local government levels: Livestock extension services are generally poor due to insufficient expertise especially at the district, ward, and village levels; inadequate infrastructure facilities; and weak private-public sectoral partnership in providing livestock research-extension-farmer linkages. Livestock information is important in facilitating planning, monitoring, coordination and making livestock development decisions. However, data and information on livestock is inadequate and unreliable as it varies from one source to another. The establishment of a centralised and reliable database is constrained by inadequate infrastructure and facilities, insufficient expertise, and inadequate financial support.

Inadequate research facilities: In order to have adequate and reliable information in livestock production, research is very important. However, in Tanzania livestock research is constrained by several factors, including long gestation period for some livestock like cattle. This demands much and long-term capital investment in livestock research, which is not prioritised in the government budgets. Another constraint is inadequate infrastructure and facilities for research especially, research that requires expensive chemicals and advanced laboratory facilities. Livestock research is also limited by inadequate expertise in important areas such as animal breeding and biotechnology.

Low investment in livestock development: Inadequate finance and low-level of private investment are critical weaknesses in the livestock sector. The banking and financial system currently provide inadequate support to livestock production, processing and trade on livestock and livestock products. Apart from the problem of collateral for individual livestock producers, processors and traders, loans repayment conditions attracts high interest rates. Unavailability of credit facilities to large, medium and small scale livestock entrepreneurs and low capital investment limits the expansion and commercialisation of the livestock sector.

Land use constraint: Despite the country having approximately 50 million hectors of rangeland suitable for livestock keeping, only 60% is used, and the rest 40% is not currently in use due to the prevalence of tsetse flies. Control of tsetse flies and trypanosomes is difficult due to uncontrolled livestock movements, proximity of wildlife to grazing areas, and high costs for developing insect resistance mechanism. Another challenge is low speed of demarcating and allocating land for livestock keeping. The activity has been very slow due to lack of funds and the use of inadequate survey equipments and incompetent personnel at the district levels.

Impacts of livestock keeping on the environment in Tanzania

Despite the numerous economic and social benefits of livestock keeping, the sector has the following impacts on the environment:

Deforestation and land use change: Free range animal production such as nomadic and semi-nomadic pastoralism require large land areas for grazing. On one hand, this has contributed to land use change, with some areas turning into barren land such as areas abandoned by pastoralists in Sukumaland. On the other hand, commercial livestock keeping in ranches induces deforestation and, consequently the loss of unique species of plants and animals. Livestock keeping also induces land degradation through overgrazing which removes nutrients from the soil that makes it not suitable for growing crops.

Land degradation: Livestock keeping causes land degradation due to overgrazing which removes the nutrients from the soil. Over 70% of grazing land in dry areas is considered to have been degraded mostly due to overgrazing, soil compaction, and erosion, all attributable to livestock.

Green House Gases (GHG) emissions and climate change: Scientific reports show that globally, livestock contributes about 18% of the total GHG emissions in the atmosphere, and 9% of total anthropogenic CO_2 as a result of expansion of the livestock production sector (pasture and arable land for feed crops). In addition, ruminant livestock produce methane gas through fermentation, while manure from livestock contributes about 65% of all anthropogenic nitrous oxide in the atmosphere.

Air pollution: Particulate matter (PM) released from livestock production processes such as dust and GHGs like methane, ammonia, and carbondioxide result into air pollution. Exposure to the particulate matter may increase the risk of upper respiratory diseases such as asthma and bronchitis.

Pollution of water sources: Wastes from livestock (manure, antibiotics, and chemicals from tanneries, fertilisers and pesticides and sediments from eroded grazing lands) pollute water sources. Increased nutrients from livestock wastes leads to eutrophication and decrease dissolved oxygen in water bodies. Polluted water reduces species diversity in aquatic ecosystems.

Impacts on wildlife: Livestock occupy areas that were once wildlife's habitats. Overgrazing leads to changes in land cover and food supply for wildlife. Tanzania's protected area network (National Parks, Forest Reserves, Game Reserves, Wildlife Management Areas and Wetlands) are threatened by the increasing number of livestock. Migratory corridors and dispersal areas in the North eastern rangelands, rich in wildlife, have been blocked and degraded partly due to pastoralism. Human-wildlife conflicts have increased as a result of declining size and quality of grazing land resulting into competition for protected grazing lands.

Measures for environmental management

In order to reduce the impacts of livestock on the environment there should be sustainable management of grazing areas (rangelands). This can be attained through participatory rangeland resources assessment, and identification of management institutions with clearly defined roles and responsibilities at the village level. This will ensure their conservation and sustainable use and reduce land degradation. Pastoralists should also be educated and sensitised on the emerging challenges that face pastoralism and their effects on land, water, and forest resources. Adoption of sedentary livestock keeping with a reduction in herd size will reduce pressure on rangelands, increase productivity and income and reduce community based conflicts.

There is a need also to establish and promote appropriate livestock infrastructure (dips, water sources/reservoirs) in rangeland areas. Appropriate forage conservation practices for dry season feeding should also be promoted. Moreover, sustainable intensification of livestock and production of feed crops in ranches will reduce carbon dioxide emissions and reduce land degradation. Methane and nitrogen gases from livestock in particular, can be reduced through changing of animal feed by including unprocessed oil seeds such as cotton seed, rope seed, and linseed. Furthermore, surface and groundwater resources of the rangelands should be managed in a sustainable manner to ensure long-term quality and availability. For example, improved management of animal waste will reduce water pollution.

Benefits of livestock keeping to the environment

If livestock keeping is properly managed, it has many benefits to the environment. Mixing livestock keeping with traditional cropping on one land reduces the need for larger grazing areas. Moreover, livestock can be used to provide power for various farm operations. Tillage, harvesting, and transport are among the examples. This energy is renewable and thus saving amounts of fossil energy that would have been used in the manufacturing and operations of heavy machinery. Animals are also a good source of soil fertility. In mixed farming systems, animals are fed on crop residues as well as pasture. In turn, nutrients and organic matter are returned to the soil through manure. Consequently, livestock ensures the maintenance of soil fertility and acts as a soil conditioner. Most of small scale farmers in Tanzania

cannot afford to buy industrial fertiliser, and fallow periods are becoming shorter due to increasing population. Therefore, manure alleviates this burden from the farmer. In addition, livestock can be used to control weeds and reduce the need for herbicide use. An example could be in sugar cane, oil palm, coconut, and rubber plantations.

Exercise 2.18

1. Explain the spatial distribution of livestock in Tanzania.
2. Briefly describe five common livestock diseases in Tanzania.
3. Describe how livestock keeping is responsible for land degradation in Tanzania. Limit your response to six points.
4. Examine the benefits of animal keeping on the environment. Limit your answer to four points.

Activity 2.28

Use your surrounding to identify effects

of livestock keeping on the environment. Propose the solution and present your work in the class for discussion.

Revision questions

1. Describe the importance of agricultural sector development in Tanzania.
2. A strong and supporting policy environment is a key to the growth of the agricultural sector. Using Tanzania as a case study, support this statement.
3. With examples, describe how biophysical factors affect agricultural activities.
4. Explain why investment in agriculture is crucial for the development of the industrial sector.
5. Citing examples from different countries, examine the role of science and technology in agricultural development.
6. Explore agricultural practices of other countries in the world and use them to suggest ways to improve agriculture sector in Tanzania.
7. The development of synthetic rubber production is likely to negatively affect the growth of natural rubber production. Discuss.
8. Examine the contribution of commercial farming to the economy of Tanzania.
9. Describe the socio-economic importance of livestock keeping.
10. Define dairy farming and point out factors that led to its successful development in Denmark.
11. Define ranching and with concrete examples, explain the importance and limitations of ranching.

12. Discuss factors which affect dairy farming in any of the countries you have studied.

13. Discuss factors which limit productivity of pastoral farming in East Africa.

14. With reference from Tanzania, compare and contrast commercial and subsistence livestock farming.

15. Using relevant examples from Tanzania, explain the impact of the livestock industry on the environment and measures to be undertaken to improve environmental management.

16. Explain how you would apply the competencies developed from this chapter in your daily life.

17. How does rapid population growth appeals to livestock farming in Africa?

18. Discuss factors that influence agricultural development in any country you have studied.

19. Discuss the impact of livestock keeping to the environment in Tanzania.

20. With reference to cocoa farming in Nigeria, describe three physical and four human requirements for the crop farming.

21. Elaborate four problems facing cassava production in Tanzania and suggest three ways which can be used to promote the crop.

22. Explain the impact of nomadic pastoralism on the environment.

23. Account for the development of beef farming in the USA.

24. Suggest ways of improving cattle keeping in East Africa.

25. 'Sheep farming is valueless rather than prestige'. Discuss.

26. Assess how sheep farming is done in Tanzania and suggest ways to improve it for positive contribution in socio- economic development in the country.

Chapter

Three

Sustainable use of natural resources

Introduction

Sustainable use of natural resources provide a fundamental life support both in the form of consumptive and public-good management services. It ensures efficient provision of goods and services that offer better quality to human life. In this chapter, you will learn about types of natural resources and their sustainable uses. Specifically, you will learn about energy, mineral, forest and fishing resources. You will also learn about natural resources use conflicts and conflicts resolution. Through case studies, you will make comparative analysis on the sustainable use of natural resources in different contexts. The competencies developed will enable you to manage different resources and ensure their sustainability.

Definition of concepts

Sustainable use of natural resources

Sustainable use of natural resources refers to proper utilisation and management of natural resources for the benefit of the present generation without compromising the needs of the future generations. The concept of sustainable development was endorsed by the World Commission on Environment and Development (UNCED) in 1987 to mean "development that meets the needs of the present without compromising the ability of future generation to meet its own needs". After the endorsement, the concept was adopted in the Rio declaration of 1992 by UNCED as the world conservation strategy. It is a concept that is widely used globally in diverse human endeavors. There are three common dimensions of sustainable use of natural resources, which are economic, social, and environment.

Natural resources

Natural resources are materials or substances that are found in nature which can be used by human beings. They include soil, water, fish, wildlife, forestry, minerals, and energy resources such as fossil fuels, coal, oil and natural gas, and the alternative energy sources such as solar, wind, Hydro Electric Power (HEP), geothermal energy, nuclear, and recreational resources. For a material to be a resource it must have value and utility to human beings. Therefore, a resource is defined on the basis of its value to man and not by its mere existence. Without human influence, what is regarded as a resource may be just a substance or physical entity. Resources are unevenly distributed over the space and their use vary over time and space. The variations in the use of natural resources over time and space depend on the availability of knowledge, improvement of technology,

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cultural change, change of life style, and change of livelihood options. Natural resources are broadly categorised into two types namely renewable and non-renewable resources.

Renewable resources

These are types of resources which have the ability of replenishing themselves or of being replenished after being used. They are also known as infinite resources as they exist in large quantities. The types of renewable resources include critical zone and non-critical zone resources. Renewability of the critical zone resources depends on the rate of exploitation in relation to their regeneration. Examples of these resources include fish, forests, animals ,and soils. If they are not properly managed, they may be depleted. Non-critical zone are resources that remain renewable irrespective of human use. Examples include solar energy, tides, winds, waves, and air. They are considered as public goods, which are consumed collectively.

Non-renewable resources

Non-renewable resources are the resources that cannot replenish themselves within a short period of time. after being used. They take millions of years to form. For example, minerals such as gold, silver, steel, iron ore, diamond, oil, gas, fossil fuels, and coal. Their rate of regeneration is very slow. However, both types of resources are critical to the livelihood of human beings, thus their sustainable utilisation is important for economic, social, political and cultural development of both present and future generations.

Energy resources

Energy resources are things that can produce heat, power or electricity. Power is essential in every aspect of human development as it is used for cooking, providing light and heat, driving machines, and many other activities. Energy resources are used in the modern world for heating and generating electrical energy. There are different sources of energy resources. These are fossil fuels including coal, natural gas and oil and Oil alternative energies including hydro-electric, biomass, solar, nuclear, geothermal, tidal, waves and wind. The main energy we use comes from fossil fuels.

Alternative energy sources

The alternative fuels are generally renewables. They are available domestically, and less toxic than fossil fuels. Alternative fuels are promoted worldwide not only for their environmental benefits, but also they provide energy security by reducing reliance on foreign sources of fossil fuels. In future, it is undoubtedly that there will be an increase in the rate of use of alternative fuel sources like solar, wind, nuclear or geothermal power. All these energies can reduce the pressure of using fossil fuels like petroleum in almost every aspect.

Solar energy

This is the energy from the sun. The sun is the primary source of the earth's energy. It is available almost everywhere in the world, with tropical lands receiving a very high supply of its energy. For example,

Tanzania, Kenya, and China receive high supply of solar energy because of their geographical locations. Solar energy is a renewable energy because the sun constantly produces the light. There are two ways of extracting solar energy. First, by using plates to collect and reflect the heat to power the generators. Second, by using photovoltaic cells (PVC) composed of a semi-conducting material that converts light into electric current.

Solar energy has several advantages. It is safe, pollution free, efficient, and of limitless supply. It is also used for domestic heating and in drying crops and clothes. In terms of cost, solar energy is less costly as compared to other sources such as wind energy. Solar energy is a widely used form of energy resources particularly in the tropical countries. In terms of disadvantages, it is expensive particularly at the initial stage which involves the installation of a solar plant. Moreover, harnessing of solar energy is affected by cloud cover and long hours of darkness, for instance in the northern hemisphere during winter season. Solar power plant also requires large area and regular inspection. Regardless of these disadvantages governments need to invest in solar energy and encourage people to use it. They also need to ensure that the price of solar equipments is low to enable people to purchase them. Lastly, vocational training should capacitate local innovators to produce more solar equipments. Figure 3.1 shows an example of a solar energy plant.

Figure 3.1: *An example of a solar energy plant*

Source:https://africa-energy-portal.org/news/tanzania-buys-solar-power-small-independent-power-producer

Wind energy

Wind is an air mass in motion. It is caused by differential heating of the earth surface by the sun. Air moves from high to low pressure belts. For example, from low to high temperature areas. Wind can therefore, be used to turn propellers and rotors that run machines such as wind mills. Before the invention of the steam engine, sea vessels were driven by wind power. In areas where the velocity of wind is high, windmills are built to generate energy to pump water, grind grains and generate electricity. The largest wind farms are found in California – USA and they were developed by private companies. Other wind farms are found in UK, Spain, Germany, China, and India. In Tanzania, wind energy is used to harness underground water by wind driven water pumps in regions such as Dodoma and Singida.

To ensure sustainability of resources, developing countries have to invest in

wind energy. Advantages of wind energy are that, wind farms are pollutant free; they do not contribute to global warming or acid rain as shown in figure 3.2. They are less costly compared to tidal and wave energies. Furthermore, land in the wind farm can still be used for other activities like agriculture or cattle grazing as wind turbine are widely spaced. Wind is a renewable resource because it is infinite and cannot be very much affected by human activities. Wind energy has several disadvantages. The use of wind for power production is extremely unreliable as it is dependent on time and location. Furthermore, wind greatly varies in speed, persistency and direction. Rotating wind blades are dangerous to flying birds and they also cause noise pollution. Moreover, wind driven turbines interfere with airport radar systems.

Figure 3.2: *An example of a wind mill farm.*
Source: https://wallpaperaccess.com/full/6186934.jpg

Tidal energy

In places where sea tides are high, mills can be installed to be driven by tidal waves to produce energy. Tides are governed by earth rotation, and gravitational forces of the moon and the sun. In the early days tidal power was used to power grain grinding mills. Today, it is limited to a few estuaries and bays of the world with very high tides, for example, at the mouth of river Rance in France, where the energy is used for generating electricity. Tidal energy is very expensive to establish while the few plants which exist do not make a major contribution to global energy production. Tidal energy is a renewable energy because it is not very much affected by human activities.

There are two forms of technology for exploiting tidal energy. These are tidal barrage and tidal lagoon. A tidal barrage is a dam – like structure used to explore the energy from masses of water moving in and out of a water source due to tidal forces. Water is allowed to flow into a bay or a river during high tides and it is released during low tides. A barrage is located at or across the estuary. A tidal lagoon involves a rock walled impoundment similar to water break and it encloses an area of shallow water. Water is trapped at high tide in the lagoon and released as the tide recedes through a bank of electricity generating turbines within the impoundment walls.

Tidal energy has the following advantages; it is environmental friendly, and produces cheap electricity. It is the most reliable and predictable renewable form of energy compared to wind and solar energy. However, tidal energy has disadvantages including high cost of setting up a tidal power plant as well as its possibility of obstructing shipping routes especially the tidal barrage which are located across an estuary.

Wave energy

Wave energy results from strong waves set in motion by wind energy. This is common in high pressure belts in the mid-latitudes, where there are air masses of different temperature and moisture characteristics converge. The waves are able to produce electricity and such stations act as wind breakers which calm the sea and control soil erosion. Harnessing of wave energy is not safe especially in areas with regular occurrence of storms, cyclones and hurricanes. Moreover, the power stations are expensive to set up, hence they are not economically viable in third world countries.

Hydro-electric power (HEP)

Hydro-electric power (HEP) is the form of energy produced by the power of falling water. HEP is derived from water sources such as streams, glaciers, natural waterfalls and man-made lakes. Examples of HEP sources in Tanzania are Kihansi hydro power and Mwalimu Nyerere hydro power which are natural waterfalls. Other HEP plants include Mtera Hydro power and Nyumba ya Mungu Hydro Power which are man made. Hydroelectric power is produced when the installed hydro - turbines rotates. Water falls on a paddle wheel fixed to an axle. The weight of falling water makes the wheel spin. The greater the height from which the water falls, the more rapidly the wheel will spin. Previously, the power stations were built along major rivers with large and long waterfalls, usually in the upper course of rivers.

Currently, there is a major shift from locating HEP plants on the mountainous regions to constructing dams and reservoirs in the middle and lower courses of rivers. Hydro-electric power accounts for 23% of the world's energy output. Several countries have high potential for producing HEP but the energy resource goes untapped. Industrialised nations with only 30% of the hydropower capacity produce and utilise much of it, whereas developing nations are exploiting much less of their resources. Africa, for example is producing only 8%. HEP is a renewable energy because water is constantly renewed through water cycle.

HEP development requires certain conditions to be met for its construction such as a steep gradient or slope and sufficient and constant water supply. Other requirement, include capital outlay, large volume of water, presence of lakes along the river course and a space for reservoir to hold large amount of water. There is also a need for fairly large market for power produced. Figures 3.3 (a) and Figure 3.3(b) show dams which generate HEP, in Tanzania.

Figure 3.3 (a): *Mtera dam for HEP production in Tanzania*

Source: https://www.ippmedia.com/sites/default/files/articles/2021/02/22/mtera%20ed.jpg

Figure 3.3 (b): *Stieglers Gorge dam for HEP production in Tanzania*

Source: httpsafricafeeds.com20190726tanzania-is-building-fourth-largest-hydro-dam-in-africa.

A dam is built in a place where a large lake will be formed. A dip valley with a narrow section where the dam can be built from one side to another is an ideal place for establishing a power plant.

World distribution of HEP stations

In the light of the conditions favouring HEP development, it is clear that, certain parts of the world are better suited by relief, climate or other factors to the exploitation of water power. HEP stations are found in the mountain areas, especially those which have been glaciated and have many waterfalls and lakes such as USA and Switzerland. They are also established in tropical areas such as Tanzania and Uganda and in temperate areas such as China, USA, France and Canada.

Moreover, HEP projects can also be established on major rivers with large volumes of water whether flowing constantly or having seasonal fluctuations which can be minimised by creating reservoirs and dams. HEP projects are common in industrialised countries where a wide range of power sources tend to be well developed because of high power demand. HEP projects are also built in areas where regional development is promoted by the construction of multi-purpose dams, which can store and supply water for irrigation, human consumptions, controlling of floods, power generation, and navigation. Figure 3.4 presents spatial distribution of hydroelectric energy production in the world.

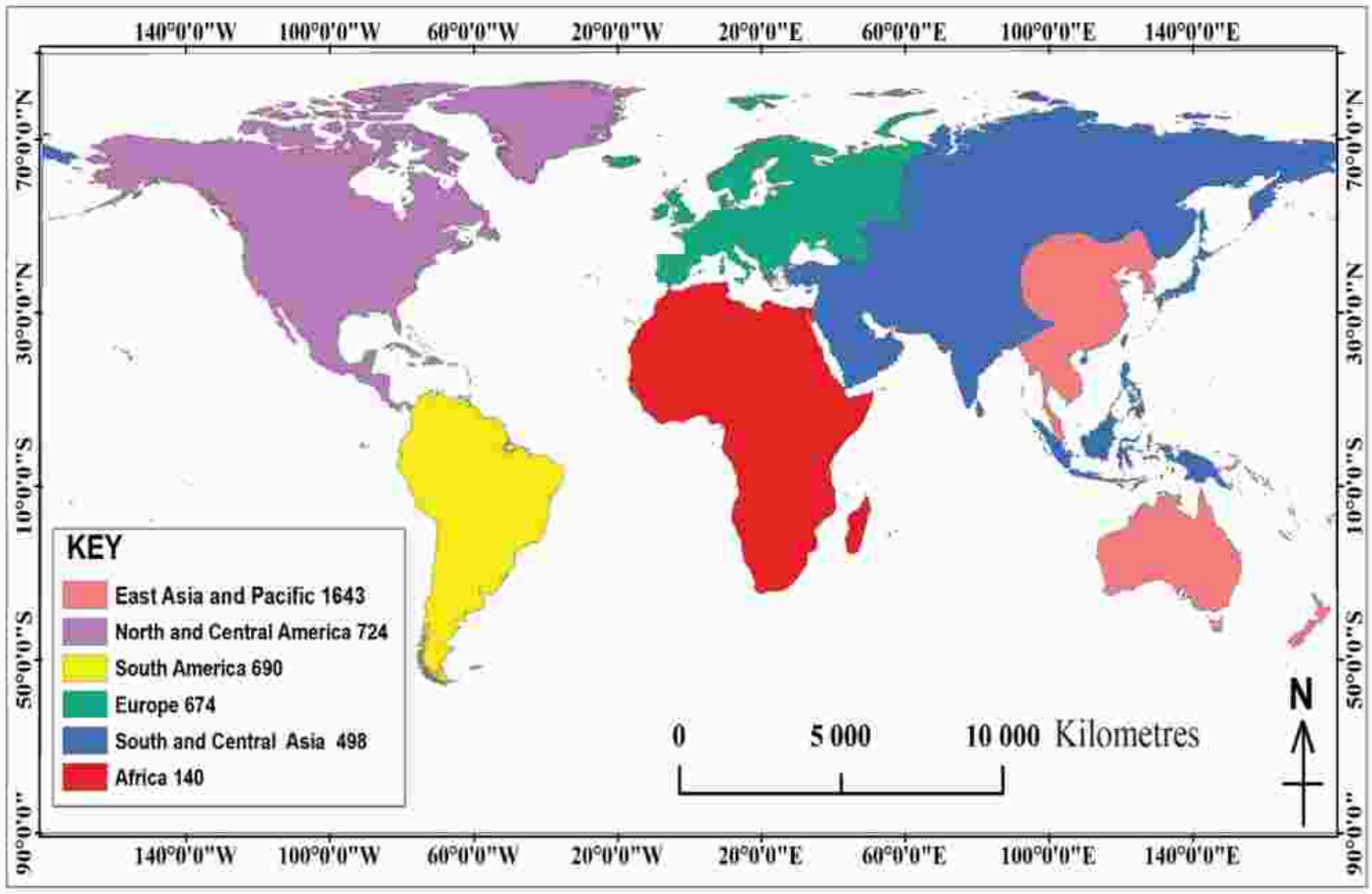

Figure 3.4: *Global distribution of HEP in Tera watts hours*

Source: International Hydropower Association (2021)

Hydro- electric power (HEP) in Africa

It is estimated that rivers in Africa supply 23% of potential world HEP. However, at the moment, Africa produces about 2% only of the worlds' installed capacity. The main rivers of Africa such as Nile, Niger, Zaire, Zambezi, Limpopo and the Orange are potential for power development. In Tanzania, there are different areas where HEP is being produced. These include Mtera power station (Dodoma), Kihansi Power Station (Morogoro), Nyumba ya Mungu Power Station (Kilimanjaro), Kidatu power Station (Morogoro), Pangani Power Station (Tanga), Hale Power Station (Tanga) and Mwalimu Nyerere Hydro power (Rufiji). Figure 3.5 presents an example of a HEP station.

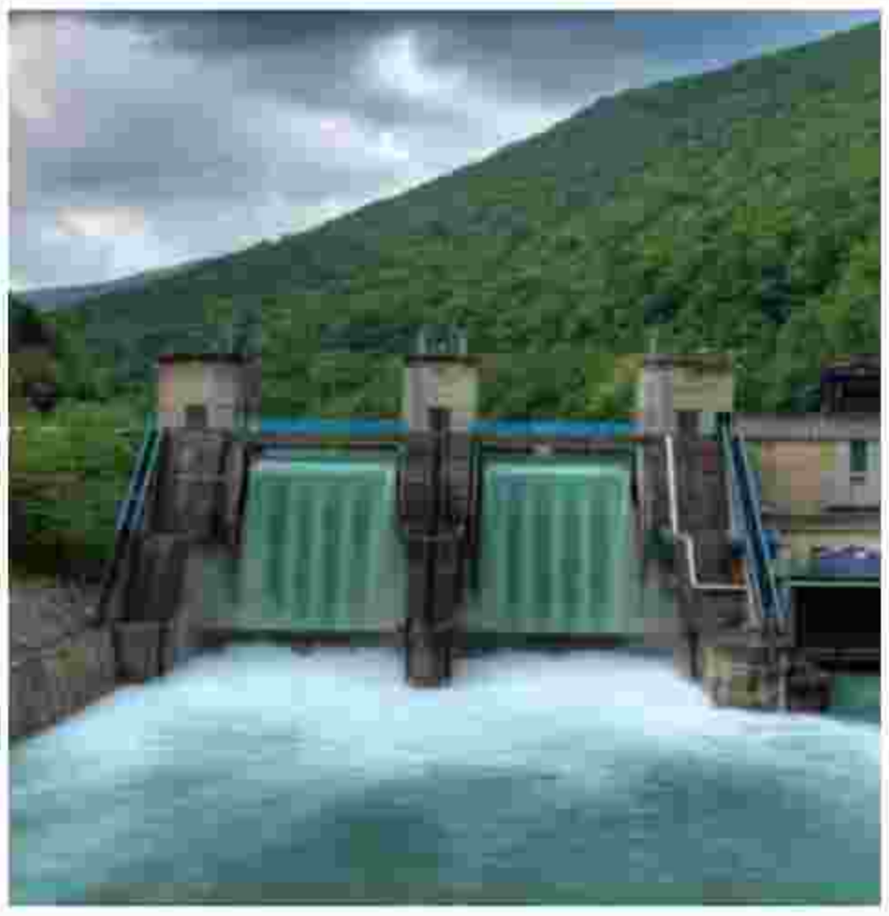

Figure 3.5: *An example of HEP station*

Source: https://www.power-technology.com/wp-content/uploads/sites/7/2021/03/Feature-Image-biggest-hydroelectric-power-plants.jpg

Factors influencing the development of HEP

Water force: The hydro-turbines are driven by the force of water against their blades. The force of water may be derived from natural rivers where waterfalls or rapids are available. Even a small stream of water dropping from a great height has a tremendous power to generate HEP.

Regular, reliable and lager volume of water supply: Although almost any river could be used to generate HEP, in practice, it is much more economical to harness HEP energy in large rivers such as the Nile or Congo. It is important to note that rivers from which power is harnessed are not supposed to be subjected to great fluctuations in the volume of water, since this would make it difficult for power plants to operate at a constant level of power production.

Presence of lakes: The presence of natural lakes along the course of a river is often a great advantage in HEP development especially in areas with a seasonal rainfall distribution. They help to store flood-waters and regulate river flow naturally thus serve as potential areas for dam construction.

Space for a reservoir: A water reservoir requires a suitable location to enable creation of a lake to be used when necessity arise.

Reliable market: As installation of HEP station takes time, the demand for power generation by both domestic and industrial consumers must be high enough to guarantee the running costs.

Capital outlay: Modern large scale HEP projects, such as Mwalimu Nyerere HEP project in Stieglers Gorge are expensive undertakings; involving dam erection, power plant construction, transmission, network installation, annual maintenance as well as compensation of individuals. All these activities are costly thus, they require high capital.

Geothermal power

Geothermal power is generated by the flow of heat from the earth's core to the surface. It mainly occurs in geysers where superheated steam is continuously being emitted from endorsed cavities believed to be over 1000 °C. The highest heat flows are found in areas characterised by seismic and volcanic activity like Iceland, Italy, New Zealand, Russia, Turkey, Iran, Morocco, Japan, and in the East Africa rift valley. The power harnessed through drilling can be used as direct heat in industrial, commercial or domestic appliances, and when the temperature is sufficiently high, it can be tapped to generate electricity. In Tanzania, potential areas for developing geothermal power include the volcanic zones of Kilimanjaro, Meru, Ngorongoro, and Rungwe in south west Tanzania.

Among the advantages of this energy source is that, it is freely available since the occurrence of heated rocks is fairly wide spread. It can be used for direct heating in homes or for generating electricity. It is environmentally friendly as it may cause little or no pollution when electricity is generated from it. However, it is expensive and vulnerable to earth

movement since hot springs and geysers are located in weak rocks/zones.

Biomass

Biomass is an ecological term for the total amount of living or once living matter present in a given area. It refers to any materials made by plants and animals such as crop remains, animal wastes and wood that can be converted into energy. The energy from plant and animal materials is also known as biofuel or bioenergy. In other words, plant and animal matters can be turned into usable energy in several ways. They can be converted into energy by means of biological or thermo-chemical processes whereby, the materials can be burnt to produce heat. In turn, this can be used to produce steam and drive electric turbines. On the other hand, animal manure can be processed to produce methane and biogas. It is renewable energy since plants can be grown and animals can be reared at any time once materials from them are needed. The following are common types of energies from plants and animal materials;

Charcoal: This type of energy is produced when wood is burnt with insufficient oxygen. It is a major household fuel in urban centers for low and middle income earners in Least Developed Countries (LDC's) such as Tanzania.

Wood Fuel: The burning of wood to produce energy has been in use ever since man discovered fire. This form of energy accounts for a big proportion of the world's consumption and it is mainly used in rural areas in the Third World. Wood fuel is a renewable energy source provided that trees which are cut down and burnt are being replaced. In case they are unsustainably used, they may be depleted.

However, rapid population growth poses pressure on these resources. This is because population exceeds available resources and as a result forests are over utilised hence the risk of desertification and irreversible damage of the environment increases. Immediate population control measures and use of alternative resources of energy are recommended in order to allow regeneration and replacement of trees.

Biogas: This is the energy derived from animal dung. Animals have been sources of energy for a long time. Animal dung is collected in constructed pits (digesters) where it is allowed to decompose to produce methane gas known as biogas. Pipes are installed to direct the gas from the pits to the house. Biogas provides a vital domestic fuel. Animal dung is easily and cheaply obtained and it does not need high technology. Moreover, wastes for biogas are recycled and energy obtained is environmentally friendly. However, the initial costs for construction of digesters are slightly high. The constructed biomass facility requires careful handling to ensure that methane gas is not released into air as it contributes to accumulation of greenhouse gases which cause global warming. Biogas is considered to be a renewable energy source because animals can be kept once the energy is needed and the energy can therefore, be replenished back once finished. An example of a biogas plant is presented in Figure 3.6.

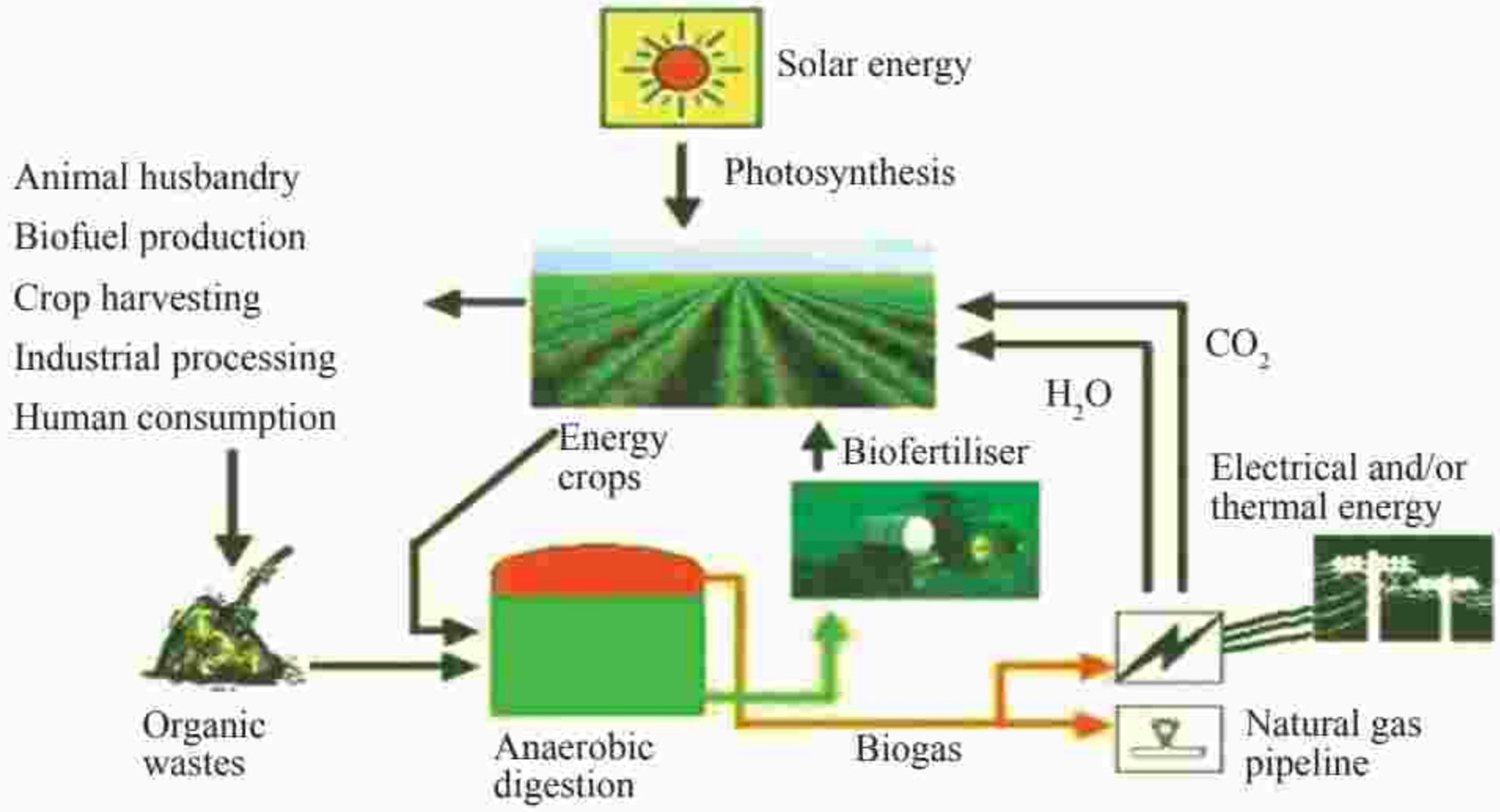

Figure 3.6: *An example of a biogas cycle*

Source: Damyano va and Beschkov, (2020)

Biofuels (Bioenergy)

It is the form of energy derived from crops and crops residues. It was first used in Brazil where sugar cane was allowed to ferment to produce bio-ethanol which was used as a vehicle fuel that was cheaper than petrol. Biodiesel from oil palm is recently more widely used. Oilseed rape in the EU countries and maize in the USA, are being grown for the same purpose. In spite of being an ecofriendly type of energy, biofuel utilisation can cause shortage of food and increase global food prices. The use of biofuel has also led to an increase of forest degradation in order to grow oil palms. A good example of a country with large investment on biofuel is Malaysia.

Exercise 3.1

1. With examples from Africa, outline the characteristics of renewable resources.
2. With examples from Tanzania, describe the characteristics of non-renewable resources.
3. Examine the advantages and disadvantages of solar energy on the environment.
4. Analyse the factors that make wind a sustainable source of energy.
5. Explain why we should use natural resources sustainably.
6. Discuss the factors that influence the development of HEP in Tanzania.
7. Explain the significance of alternative energy sources.

8. By using examples from Tanzania, explain why majority of the people prefer the use of firewood and charcoal.

Activity 3.1

Visit a community around you and;

(a) Identify the types of energy resources used

(B) Investigate the alternative sources of energy

(c) Suggest measures to improve the use of identified energy resources in that community

Activity 3.2

In a group, go around the school area and collect materials which can be used for the production of biomass. Write the type of energy that can be obtained from the materials collected. Present your work in the class.

Fossil fuels

These are types of energy resources that cannot be replaced or replenished easily. They take a long time to be replenished or brought back into use again. They lack natural capacity of recycling themselves after exhaustion, and in most cases, if not carefully used or extracted, they can vanish or get exhausted. Fossil fuels are also known as finite energy resources and are found in limited supply. They include petroleum, coal, peat, natural gas, and nuclear energy. These resources need to be properly utilised to ensure that they do not get exhausted. For instance, the use of petroleum is increasingly posing a danger of being exhausted.

Coal

Coal is a black or brown rock consisting mainly of carbon which is formed by the compressed vegetative remains of past ages. Coal is a result of vegetation matter laying down in swampy areas and being buried under other materials for a long period of time. It is made up of decomposed plant matter under the condition of high temperature and pressure. Coal consists mainly of amorphous deposits usually extracted after many years since formation. Most coal deposits are of carboniferous age (about 300 million years old). More recent deposits of tertiary age are usually composed of lignite (brown coal) and peat which represents an early stage of coal formation. There are different types of coal such as peat, lignite, bituminous, anthracite, and Graphite.

Major categories of coal

Peat: Peat is a young coal consisting of partially decomposed organic matter and inorganic materials that have accumulated in water-saturated environments. It is a fibrous brownish substance formed by partly decayed organic remains in swamps and bog. It represents the first stage of coal formation. Peat accounts for 0.4% of the world's fuel output making it of little significance to energy production

and use. It is common in Russia, Ireland, Finland, and the USA.

Lignite (Brown coal): Lignite is a brownish rock that contains recognisable plant matter and has a relatively low calorific value. Lignite is basically the halfway point from peat. Usually, this is regarded as the second stage of coal formation after peat. It is soft and still retains much of its brownish woody appearance.

Bituminous coal: Bituminous coal is hard, black and compact which makes up almost 80% of the total world's coal output. Bituminous coal is the highest quality of coal. It is jet black, very dense and brittle. This type of coal has high calorific value.

Anthracite: Anthracite is the hardest and ranks highest amongst the coals type and it burns for a long time and leaves very little ash behind.

Graphite: Graphite probably represents the ultimate stage in carbonisation of vegetative remains. Unlike other carbonaceous rocks, graphite is never used as fuel but utilised in other spheres like pencil making, and manufacturing of crucibles.

Methods of coal mining

There are two common methods that are adopted in coal mining. These include surface mining and underground mining. Surface mining involves strip or open cast mining and hill slope boring while the underground involves drift mining, slope mining, and shaft mining. Strip mining is mainly done where coal is found near the surface of the earth crust, while nearly the underground one is done where coal is buried deep in the ground. Britain and Germany are the main producers of coal using underground mining methods while in countries like the USA, Poland, and Australia, coal is mined cheaply and in large open-cast pits.

Uses of coal

Coal is used in the smelting of iron and steel. In chemical industry, coal provides a number of raw materials such as coal gas, coal tar, and sulphate of ammonia. Coal tar is used for making plastic, perfumes, disinfectants, solvents, antiseptics, adhesives, synthetic fibres, and liquid fuel. Sulphate of ammonia is used for making fertiliser which contributes to the development of agricultural sector.

Despite these various significances, to date, the international trade in coal has been reduced greatly due to a switch to mineral oil (petroleum) and development of alternative cheap sources of power.

Factors contributing to a decline in coal production

A number of factors contributes to the decline of coal production in the world. Transportation is one of the factors due to the fact that coal is bulky and heavy. Demand for coal has declined in many industries because of its high production and transportation costs. Coal has low calorific value when it burns, which means that only about 15% of the energy released is converted to power. Coal is black and dusty, so it discourages some people to use it. Environmental degradation associated with coal extraction and use is another factor. Moreover, most of the

products obtained from coal including fertilizers, plastic, perfume, antiseptics and detergents can easily be obtained from petroleum. This discourages coal production.

Use of alternative energy sources

Countries which were once importers of coal have turned to other alternative energy sources. For example, Italy now produces oil and natural gas while Norway produces HEP. Many others countries have turned to importing petroleum rather than coal, thus reducing the need for coal. The shortage of labourforce in coal fields due to air pollution and proliferation of better paying industries has also contributed to the decline of coal production. Some of the coal field towns in Europe have been vacated by some of their residents due to heavy dust causing air pollution.

Areas producing coal

Coal fields in China

China is endowed with all types of coal. The greatest concentration of China's coal deposits is in the north. Coal is found in Shanxi and Shaanxi (Shansi and Shensi) which together account for 47% of China's huge reserves. Inner Mongolia also accounts for 25% of coal in Manchuria coalfields. In the south, there are many scattered deposits such as Sichuan basin, Yunnan, Guizhou, Jiangxi and Hunan. All these coalfields have supported development of heavy and light industries in China. Such heavy industries are involved in making steel, machinery, tractors, electrical apparatus, cars, and aircrafts.

Coal fields in South Africa

Coal deposits in South Africa are concentrated in Transvaal and Natal. Major industrial areas in South Africa are found near coal mining areas. For example, most steel and locomotive industries are found in vereenigning and other place near coal mines.

Coal fields in Tanzania

In Tanzania coal deposits are found in Ngaka, Mchuchuma, Liganga, and Kiwira. The country coal reserves is estimated at 5 billion tonnes. Majority of the coal reserves exist along the Songea kargo belt in southern Tanzania. The highest coal deposit is in Ketawaka – Mchuchuma in the Ruhuhu Basin. It is estimated that the Mchuchuma coal deposit has more than 480 million tonnes of coal reserve.

Exercises 3.2

1. Outline five factors that contribute to low use of coal as an energy source.
2. Describe problems associated with coal mining in South Africa.
3. Explain six benefits of coal to economic development of Tanzania.
4. Fossil fuel energy is considered as a finite energy source. Substantiate.
5. Discuss the effect of coal mining to the environment.
6. By citing examples from Tanzania, examine the role of coal mining industry.

7. Analise different alternative sources of energy for industrialisation in Africa.

Activity 3.3

1. Using textbooks and web based sources, identify negative impacts of coal on the environment. Limit your response to six points.
2. Use textbooks and web-based sources to document coal mining in Liganga and Mchuchuma sites in Tanzania.

Natural gas

Natural gas may occur in combination with petroleum in the upper most part of an oil trap or may occur alone. Natural gas consists of a mixture of gaseous hydrocarbons of which methane alone makes up 80% to 90%. Other gases include ethane, propane, and butane. Trace gases such as helium, nitrogen, carbon dioxide and hydrogen sulphide may also occur. Natural gas has become the fastest growing energy resource providing alternative energy to coal and oil. In 2007, it comprised almost a quarter of the world's primary energy consumption.

Major natural gas fields are found in the USA, Russia, Canada, Middle East, China, Europe and North-West Africa. Natural gas is extracted through a process, similar to that of petroleum and it is transported through pipelines after a liquefaction process at considerably high pressure. It can also be transported in special tankers or barges as liquefied natural gas. On arrival in the consuming places, it is carefully stored in underground storage reservoirs, with all fire-fighting precautions observed as it is in oil installations. The gas is re-vaporised and delivered to household consumers or industrial plants through a system of low-pressure pipelines. Alternatively, it may be distributed in liquid form in cylinders for use at household and small scale industries. Natural gas is also used by electricity companies to generate electricity.

Natural gas in Tanzania

The first natural gas discovery was made in 1974 on the Songo Songo Island (Lindi region) followed by a second discovery at the Mnazi Bay (Mtwara Region) in 1982. The Songo Songo natural gas was commercialised in 2004 and that of the Mnazi Bay in 2006. The commercialisation of the two discoveries propelled further exploration both on- and off-shore.

Natural gas discoveries of about 8 Trillion Cubic Feet (TCF) have been made from the on-shore gas fields at Songo Songo, Mnazi Bay, Mkuranga, Kiliwani North and Ntorya. As of June, 2013, natural gas discoveries of about 42.7 TCF (7.5 billion barrels of oil equivalent – BoE) have been made from both on- and off-shore basins. Further exploration and natural gas discoveries, with the current estimated reserves of 57 trillion cubic feet (TCF) have also been made. Figure 3.7 presents an example of a natural gas plant.

Figure 3.7: *Songosongo natural gas plant in Ubungo Dar es Salaam*

Source:https://www.ippmedia.com/en/news/general-electric-upgrade-songas-ubungo-plant%C2%A0

Advantages of natural gas in Tanzania

Natural gas is connected to electricity national grid and it was estimated that it added over 2 000MW of new gas fired power by 2018 and a total 10 000MW by 2025. Natural gas has, therefore, increased electricity generation and capacity, which has stimulated industrialisation in the country. For example, the natural gas has attracted the construction of the Dangote Cement factory in Mtwara. The gas has also reduced high dependency on HEP. Currently, HEP amounts to about 33% of the total power generated in the country. Moreover, it has stimulated creation of more employment opportunities in industries that are located in Dar es Salaam, and Pwani regions. It has also promoted environmental conservation since it does not emit pollutants as it is the case with coal and oil. It has also stimulated petroleum exploration in the coastal regions and Zanzibar. Entrepreneurship and business undertakings in the gas sector has also been stimulated. Apparently, wholesale and retail trade for gas related commodities has increased. Because of these benefits, different strategies need to be adopted to ensure that the use of gas increases among the people. These strategies include:extending the gas network from Mtwara to other neighbouring regions such as Dar es Salaam, Ruvuma, Morogoro and Pwani.

Nuclear energy

Nuclear energy, also known as atomic energy, is derived from the alteration of the atomic structures. It involves release of heat that may be used to produce steam which is used to generate electricity. Nuclear is also used in making of atomic bombs or weapons. Nuclear energy is very common in many developed countries like the USA, Russia, Japan, and Germany. Tanzania is endowed with uranium deposits which serve as raw materials for nuclear energy. The deposits are located in Namtumbo, Bahi, Tunduru, and Nachingwea district. Lake Natron in Ngorongoro district, Minjingu in Babati and Madaba in Songea districts. There are no plans yet for using uranium to produce nuclear energy in the country

Production of nuclear energy

There are two processes by which atomic structure can be altered to produce energy. These are nuclear fission and nuclear fusion. In nuclear fission, the nucleus of an atom of a heavy element such as uranium is split into two to release energy. This process is used in the atomic bomb and in nuclear power stations. Nuclear fusion

is the process where the nuclei of two light atoms such as those of hydrogen are fused together to form a new composite nucleus and to release energy at the same time. Fusion is used in the making of hydrogen bomb, but the reaction is not yet sufficiently hinder human control for it is to be used safely in power stations.

International trends

The first nuclear power station was built in Britain in 1956 at Calder hall. Currently, there are 33 nuclear reactors (nuclear plants) in UK which provide 14% of total electricity output. Britain was rapidly overtaken in this field by USA with 66 stations in operation and about 142 either under construction, or in the projection. Nuclear power provides electricity supply of about 11% in USA,11% in Japan, and 9% in Germany. The most recent trend is that of a number of developing countries to opt for nuclear power as an alternative to conventional sources of electricity production. Among these countries are Egypt, Brazil, Iran, Iraq, China, and North and South Korea. Other countries investing in nuclear energy are Pakistan, Taiwan and Argentina.

Advantages of nuclear power

Nuclear power is sustainable because it produces minimal wastes, it is inexpensive and a clean energy resource. Uranium, which is used as raw material in nuclear reactors has a much longer lifetime than coal, oil or gas. Furthermore, nuclear power stations produce fewer greenhouse gases than power stations which use coal, oil, and gas. Nuclear energy also produce large amounts of electric current than other resources.

Disadvantages of nuclear power

First, nuclear power cannot supply highest amount of electricity requirements, hence; a need for alternative sources. Second, it is more economic if only operated at or near full capacity. Like other sources of power, nuclear power generation also causes environmental deterioration since nuclear reactions generate radioactive wastes which can lead to serious health problems such as cancer because it is difficult to dispose them safely. Third, the environmental hazards of radiation from nuclear power are not well understood. Fourth, it is expensive to develop a nuclear power. This is because it requires advanced technology specifically in designing power stations and for essential safety precautions. Fifth, a nuclear power plant is supposed to be developed away from population centres unlike other power resources.

Dangers of nuclear power

A nuclear power plant can cause worse radioactive accidents resulting from the melting-down of reactor cores. For example, in 1979 there was an accident at the Three Mile Island plant in the USA. In 2007, the world's largest nuclear power plant, kashiwaski-karine, in Japan was hit by an earthquake and fortunately there was no leakage. The radioactive substance in the nuclear power has a long half-life. For instance, while iodine, with a half-life of days becomes 'safe' relatively quickly, plutonium 239, produced on nuclear reactors, has a half-life of

250 000 years and may still be dangerous after 500 000 years.

Moreover nuclear power is characterised by routine radioactive emissions linked to increased leukaemia, especially in children. Operational failures of nuclear power generation may release dangerous amounts of radiation into the atmosphere. For example, the Chernobyl leakage accident of 1986 in Ukraine killed 32 local workers immediately and thousands more in the following years. The plume of radiation reached Asia, Europe, and parts of the United States.

Naturally, nuclear power generation is not widely accepted because it is associated with nuclear power weapons such as atomic and nuclear bombs. For example, cities of Hiroshima and Nagasaki in Japan were attacked and hit by atomic bombs during the second world war and their effects were devastating as about 80 000 people were killed and the survivors still suffer from cancer.

Exercise 3.3

1. Describe five risks of using nuclear energy on the environment and people.
2. Why is Tanzania still lagging behind in nuclear energy inspite of having more than three sources of uranium?
3. Discuss five advantages of natural gas for the economy of Tanzania.
4. Under which conditions is nuclear energy regarded as advantageous and disadvantageous?
5. Why is nuclear energy considered to be a cheaper energy source despite being expensive compared to other sources of energy?

Activity 3.4

Use library and web sources to:

(a) Identify areas affected by the use of nuclear power in the world

(b) Make a summary to present the impact of using nuclear power that have occurred in the identified areas

(c) Suggest five measures that have been taken to reduce the risks of using nuclear energy in the area

Petroleum

The word petroleum was derived from a Latin word Petra *(rock)* and Oleum (*oil)*. This is because petroleum is derived from rocks, where it flows freely in liquid form or gaseous state. It consists of gaseous and liquid hydrocarbons from animal and vegetable matters laying in sedimentary rocks. It was first discovered by Samwel M. Kier in 1848 by chance in wells on the bank of river Pennsylvania, USA. Thereafter, Colonel Edwin L. Darke struck oil for the first time, in 1859.

Demand for petroleum

Petroleum is the leading and the greatest demanded source of power in the World. Petroleum supplies almost half of the world's energy requirements. According to the International Energy Agency (IEA), in 2014, over 66% of the world oil production came from the following

countries; Saudi Arabia 13%, Russia 12.9%, USA 12%, China 5%, Canada 5%, Iran 4%, Iraq 4%, and Kuwait 4%.

Petroleum provides fuel for heating and lighting, lubricants for machinery, and raw materials for a number of manufacturing industries. It occurs in great abundance and it is easily obtained and cheaply distributed. It has the widest range of domestic as well as industrial uses. Due to its importance, petroleum is often referred to as black gold.

Petroleum in ancient world

The use of petroleum can be traced back from medieval times. The Chinese used it as fuel to evaporate brine. The Egyptians used it to preserve the dead before burial. It is also reported in the Bible that, dark pitch from petroleum residues was used to make Noah's ark (wooden vessel) because it is water proof. It is also recorded that tar (bitumen) was employed in binding bricks in the construction of the Tower of Babylon as well as paving streets in Mesopotamia. In some parts of the world such as around the Caspian sea, Romania, Burma and India, it was often used in lighting, cooking, lubricating and for medical purposes. Petroleum can be obtained by trapping or drilling.

Ways of trapping oil

As it has been noted above, petroleum is a general and a technical term representing a moisture of hydrocarbons in liquid, gases, and solid form. However, the term is restricted to the liquid form commonly called crude oil. There are several ways in which oil can be trapped. The following are four common ways;

Anticline trap

Rock strata or layers are often subjected to folding as a result of earth movements to form anticlines or domes. Oil is trapped in the crest of the up-fold, usually in the gas-oil-water sequence. The oil bearing stratum or layer is porous such as sandstone through which oil may flow. The oil is prevented from rising or sinking by intervening layers of non-porous strata.

Fault trap

Earth movements may also cause faulting whereby porous and non-porous strata or layers may be brought into a juxta position. The oil is trapped in tilted layer of reservoir rock through faults.

Salt plug trap

A salt plug trap is formed when a mobile and weak huge body of rock salt is subjected to great pressure from above. It pushes upwards through a weak point in the overlying strata or layer to form a steep-sided dome.

Stratigraphic trap

After folding, rocks may erode down and trap oil stratigraphically and cause renewed deposition. The layers above the unconformity may be non-porous, thus trapping the oil.

Methods of oil drilling

Drilling oil is a tough task which may take several weeks or months. Usually, a comprehensive study has to be conducted before the drilling takes place. Improved drilling techniques help better understanding of oil availability and extraction as it enables oil extractors to

recover a large percentage of available reserves. There are three methods of oil drilling as follows;

Percussion (Gable-tool) method: Percussion (Gable-tool) method is a manual drilling technique in which a hammering bit is attached to long cable that is lowered into a wide open hole or drilling shallow wells. This method was used by Edwin Drake and the earlier drillers for drilling shallow wells of not more than 610 metres (2 000 ft). It is cheap, but slow and inefficient and it is rarely used today.

Rotary method: Rotary method involves lifting and dropping heavy tools to brake rocks. The hole is drilled by a rotating bit to which a down force is applied. This is a method used by modern oil companies. Diesel engines move the rotary table and spin the Kelly and the drill stem. The drill stem carries steel drilling pipes each 9 metres (30 ft) long and 13 cm in diameter and at the bottom there is the powerful drilling bit that makes its way through the earth and rocks. As the drilling operation progresses, more and more length of the steel pipe is added until the bore hole heals thousands of metres deep.

Off-shore drilling method: Off-shore drilling method is the process of extracting petroleum from reserves located beneath the ocean water by using pipes that are connected with bit that grind down the earth. In many parts of the world, where oil occurs under the continental shelves, offshore drilling method has to be used such as in the Gulf of Mexico in the North Sea and off Malaysia. Other areas where that method is used include Brunei and Sumatra in the Sunda shelf. Off-shore drilling is more complicated. Derricks and other equipment have to be mounted on platforms. These platforms may float or may rest on huge piles where water is shallow.

Challenges associated with oil drilling

First, there is wearing of drilling machines due to constant drilling hence regular replacement is needed. Second, there are problems associated with keeping bore holes vertical and straight deep into the earth such as an oil derrick as shown in Figure 3.8. The problems include pipe striking, lost circulation, hole destruction, pipe failure and borehole instability. Third, it may cause disasters especially when drilling reaches the oil unexpectedly and allows the escaping oil and gas to catch fire. For example, a Gulf of Mexico oil disaster in 2010 killed about ten workers. Fourth, the decrease in pressure in the well may lead to difficulties in oil trapping. Pumping has to be applied to bring oil to the surface. Fifth, oil drilling may cause marine pollution due the to accidental leakage of oil in the ocean water. For example, the Gulf of Mexico oil disaster of 2010 caused marine pollution where about 4 million barrels of oil flowed from the damaged macondo well for over 87 days. Sixth, there are frequent misunderstanding between oil companies and the surrounding communities due to the fact that marine pollution endangers the life of marine organisms and the people. For example, the British Petroleum company (BP), Mexico, and the USA government have been in conflict occasionally.

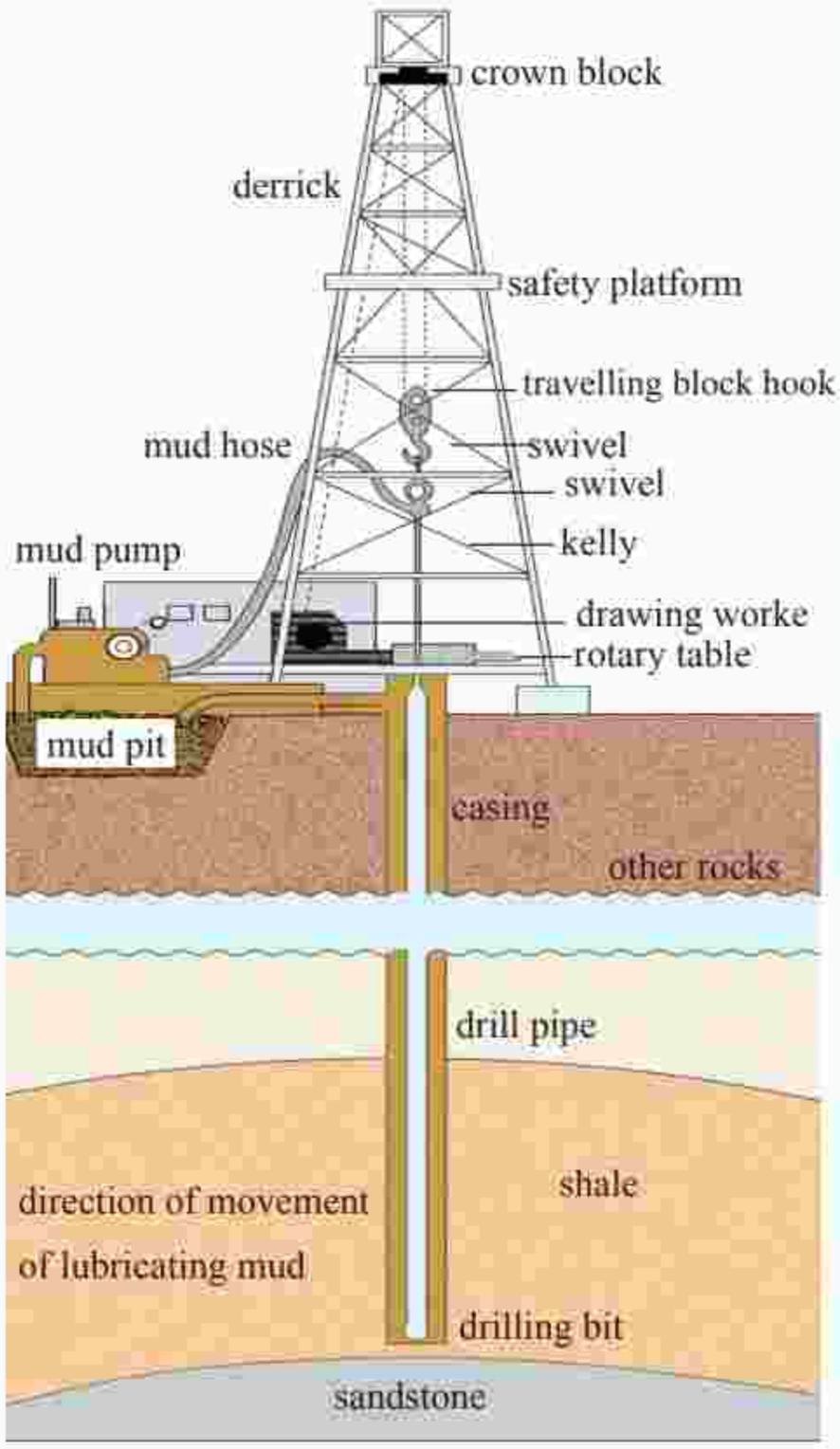

Figure 3.8: *An oil derrick*

The oil field sights

The most familiar sights in the oil fields are the great steel towers or derricks, 35-60 metres (120-200ft high), which mark places where the oil is being drilled. The derricks and other equipment have to be mounted on platforms and platforms are required to float or may rest on huge piles where water is shallow. The platforms may be very near shore, but many are as much as 160 km (100 miles) out of the sea. These should be self-contained with: power plants, food and fresh water supplies, living quarters, boats and helicopters which ferry men, equipment and food supplies in and out of the plant form.

Oil transportation

Petroleum is one of the few liquid commodities which are traded in large quantities and transported over long distances. It can be conveyed by road in oil trucks, by rail in tank wagons, by sea in oil tankers, by air in military aircraft for emergency purposes and through pipelines. For example, the TAZAMA pipeline covers 1 710 km from the port of Dar es Salaam (Tanzania) to the Indeni petroleum refinery, Ndola Zambia.

Oil refinery

The extraction of oil from oilfields produces oil which is known as crude oil. This is made up of various hydrocarbons. Crude oil has little industrial use unless the basic components such as hydrocarbons are separated. The function of the refinery is to break down the various hydrocarbons into their respective groups or fractions through a complex process of distillation. In the oil refinery, crude oil is not only split into its various functions, but also some of its impurities such as sulphur are removed. A refinery may produce as many as eight different forms of oil gas and chemical products. The most important are; fuel of lighter fractions such as petrol, parafin (kerosene), and benzene; fuel of heavier fractions for example, diesel, lubricants, and oil gases such as butane and propane. Residues that are produced after the oil refining process include coke, asphalt, bitumen (tar), and wax (vaseline). Oil refineries may be located near the raw materials, markets or

at intermediate points. Figure 3.9 shows an example of oil refinery. Oil refining has greatly been improved in the modern times enabling refiners to extract more of the most valuable fractions, such as petrol, from a given quantity of crude oil.

Figure 3.9: Oil refinery

Source: https://image.shutterstock.com/image-photo/oil-refinery-600w-131980781.jpg

Uses of oil

Oil has a wide range of uses in industries, commerce, agriculture, and in other fields and it has contributed greatly to the world industrial development, especially in the last hundred years. It serves as fuel, lubricant, illuminant, and raw material for a wide range of products in chemical industries, pharmaceuticals, textile industries, and many other industries. The major uses of petroleum are as follows;

Transportation: The major use of petroleum is in transportation. Almost half of petroleum is used for motor fuel alone. Development of the internal combustion engine and of automobiles in the late 19th century created an enormous demand for the lighter grades of oil. The rate of consumption of oil may be reduced due to the development of better forms of transport which use less oil. For instance, automobile manufacturers have greatly improved fuel consumption characteristics of cars so that they can travel further on a given amount of fuel/gas.

Industrial power: Oil is a major source of industrial power. Petroleum and natural gas have largely replaced coal in factory boilers and furnaces. It is also very important in the generation of thermal power which is used in the production of gas for domestic and industrial use.

Heating and lighting: Heavy oil is used in central heating plants for shops and offices as well as homes and it contributes to the production of electricity. Lighter oil is very important, for example, paraffin (kerosine) was one of the earliest oil products used widely. Some of the petroleum derived from gases, especially propane and butane, are also important as domestic fuel.

Lubricants: Only 1% or 2% of crude oil distilled is processed into lubricants and greases. These play an important role in transport and industries. Vehicles of all kinds and the vast range of sophisticated machinery used in factories and offices today rely on lubricants without which, they would grind to a standstill. Motor vehicles also require thorough and regular lubrication to run efficiently.

Raw material for chemical indusries: Petroleum has become a raw material on enormous range of chemical industries. Petroleum fractions such as naphtha, ethylene, and benzene are used in

HUMAN GEOGRAPHY FORM V-VI_PRE-...indd 150

performing a wide range of chemical reactions through which many varying products are made. Among these are synthetic textile; dyestuff fertiliser, insecticide, resin, solvent, detergents, plastics like plastic sheets, plastic foam, household goods such as bowls and buckets, and synthetic rubber paints, decoration, printing inks, carbon paper gramophone records and tyres.

Other uses: Heavy residual substances such as asphalt, bitumen, pitch or tar are used for road-surfacing, roofing and water proofing, purposes. Petroleum wax is used for making candles, seals, polishes, and illuminants. Moreover, Vaseline is obtained from lubricating oils and benzole. The petroleum industry is thus an expanding industry and as a provider of power, light and heat, as well as numerous chemical products, making it penetrate deep into every sphere of life from the household to the largest industrial undertaking. Therefore, petroleum merits the name, "modern industrial giant".

Location of world oilfields deposits

Oil fields are located in the USA, Canada, Venezuela, the Middle East, the Sahara, and Russia. There are also minor fields in Indonesia and Austria. African countries which produce oil include Angola, Nigeria, and Libya. Figure 3.10 shows world distribution of oilfields. Most of the oil production in the USA, Canada, Russia, and Europe is for home consumption.

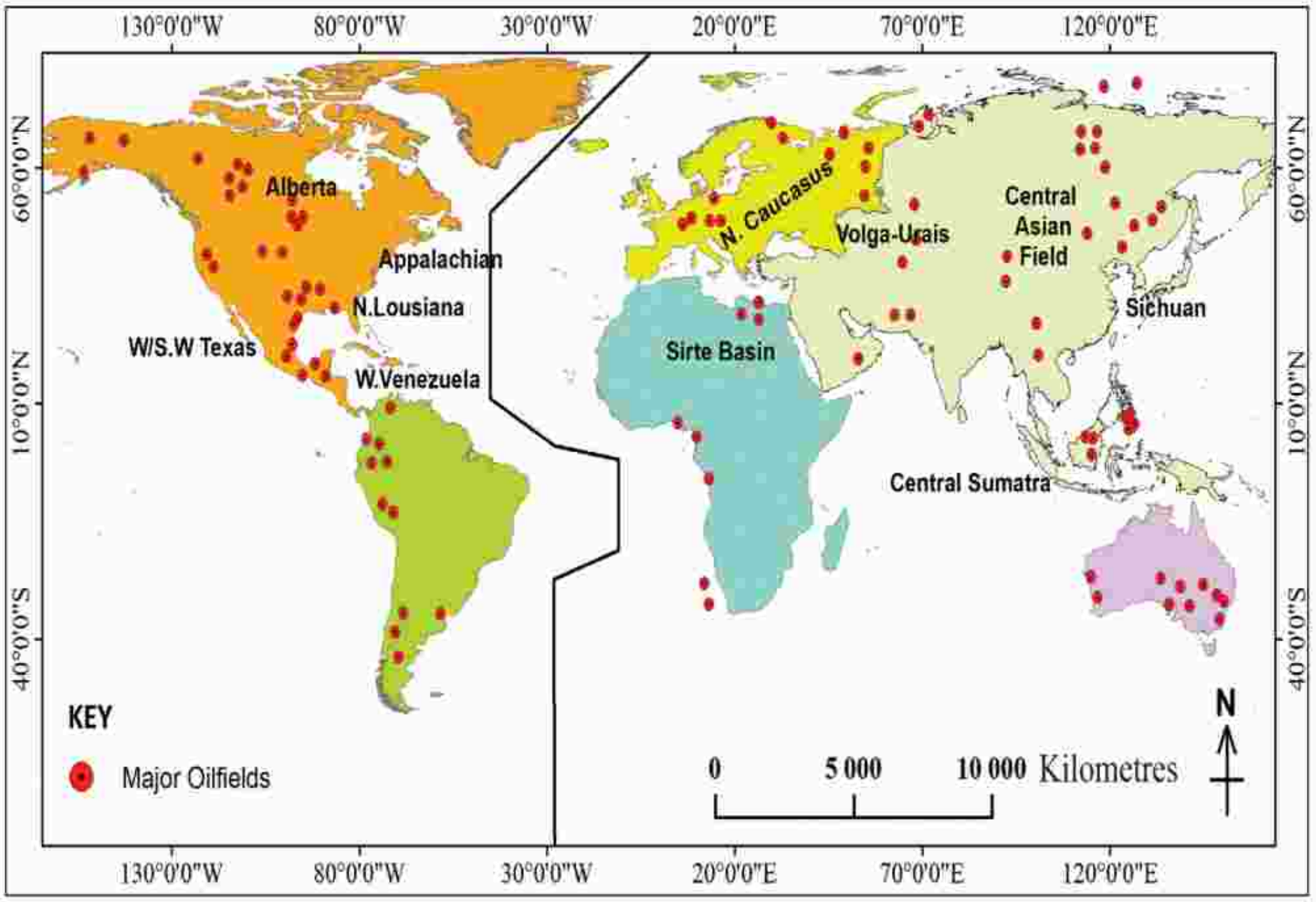

Figure 3.10: *World distribution of oilfields*

Petroleum reserves and the future of the oil industry

Scientists have not yet established the amount of petroleum stored in the earth's crust. Despite many recent discoveries, all over the world, the Middle East countries such as Saudi Arabia, Iran, Iraq, Kuwait, and the United Arab Emirates maintain a dominant position in the future of the oil industry, having more than half of the world's proven resources. The amount of known world reserves may be greatly increased by continued exploration and at the same time, several factors may also lead to a decrease in the rate of consumption. There are factors affecting the long-term future of the oil industry as explained as follows;

Continued exploration

Many parts of the earth remain unexplored for oil, especially remote areas where accessibility and transport challenges are experienced. Much oil is believed to lie beneath the sea, which requires high investment costs and technology for its exploration.

Reserves at depth

Oil reserves may lie very deep in the earth's crust, beyond the range of present equipment. Similarly, sea-bed reserves under a great depth of water are at present difficult to exploit but will certainly become available in the future as oil technology advances.

New oil sources

Developments in oil technology will undoubtedly make economic exploitation of oil shales and tar sands a possibility in future. When this happens, the world's resources will greatly increase since such sediments are widely distributed and they contain large reserves of oil.

Pollution dangers

It has already been realised that carbon monoxide and sulphur in the exhaust of motor vehicles are probably the major and the most dangerous air pollution sources. In almost every country, legislations are being enacted to reduce air pollution. This will undoubtedly lead to the speeding up of the development of alternative sources of energy.

Challenges facing oil industry

The oil industry in the world is facing various challenges such as expansion of oil consumption and a rise in the price of oil due to increasing socio-economic demands. Insufficient capital also emerges as a challenge since there are only few world governments that can afford to conduct research for the purpose of developing alternative energy. Another challenge results from the politics of oil supply and demand. For example, Middle East oil producing countries have been in crisis amongst themselves and sometimes with developed countries. For example, the United Arab Emirates (UAE) and South Arabia have been in the crisis over oil production policy. Saudi Arabia and Russia on the other hand have been in a crisis over oil prices. Such crises may probably cause more friction in the future leading to a phenomenon known as 'energy crisis' such as that of 1970s when the USA, Canada, Western Europe,

Australia and New Zealand experienced substantial petroleum shortage.

The energy crisis: Energy crisis is usually considered to be the question of price and supply uncertainties and rapid depletion of the fossil fuel. Until the end of 1960s, oil was regarded as an inexhaustible resource. The advantage that oil has over other fuels is enhanced by the relative cheapness of its production costs. For instance, the cost of producing a tone of oil is about half of the cost of purchasing a tone of coal.

Causes of energy crises

The root cause of energy crisis in the world is the control of limited international resources by few countries and the inequitable pattern of resource distribution. The second one is an increasing world dependence on oil supplies. Petroleum is increasingly becoming the major energy source, partly because of its relatively lower price. For example, about three quarters (75%) of the US energy requirement was met by oil and gas. The third cause is that the USA taxation policy during the 1970s discouraged domestic production of oil for a time. This resulted to an increase in demand for oil which outstripped the supply. This caused members of the organisation of Petroleum Exporting Countries (OPEC) to benefit from the increased demand. The fourth cause is that the increased demand escaleted the price of petroleum which drastically hurt many economies. For example, between 1973-1974, there emerged the Arab-Israel war (Yom-Kippur war) which saw Arab countries that were members of OPEC deciding to withhold oil to allies of Israel. This caused the shortage of oil worldwide, as the price of one barrel of oil increased.

Another oil crisis started from 2nd September 1990 to 28 February 1991 and it was popularly known as the Gulf oil Crisis (1990-1991). The tension mounted in the region when Iraq attacked Kuwait which prompted the United Nations (through coalition forces from 35 countries led by USA) to attack Iraq on 17th January 1991 and forced it to withdraw its forces from Kuwait. This made crude oil prices to increase by about 74%.

Effect of energy crisis

The most immediate effect of energy crisis is the distortion of national economic and social systems of oil importing counties like Tanzania. There is normally an increase in price, whenever oil price escalates. Petroleum price adjustment may also cause a general inflation and the price of various commodities to rise. An increase in the import bill affects the balance of trade because earnings from the exports will be lower than costs of imports. During such times, costs fall on the shoulder of consumers, resulting to inflation. The oil crises are also known to lower the gross domestic product (GDP). For instance, between 1963 and 1972, Kenya's GDP was 65% but between 1973 and 1975 it dropped to less than 0.1%. The oil crisis also creates recession, hence making countries economies unable to create more jobs.

Energy crisis may also lead to retrenchment of employees as some industries in the economy may be affected to a point where they cannot pay salaries. Lastly, oil crisis

and an increase in oil price may affect processing and costs of other goods and services such as transportation costs, which in turn may affect other sectors like tourism and agriculture.

Exercise 3.4

1. With examples, explain the major uses of petroleum.
2. (a) List down the major oilfields in the world
   (b) Explain the contribution of oil sector in socio-economic development of Tanzania
3. Examine factors which cause energy crisis in the world.
4. Assess the impact of energy crisis to the economy of non-oil producing countries.
5. An increase in oil price affect other sectors of the economy. Substantiate
6. By providing examples, discuss five challenges that face the oil industry.
7. Analyse the impact of fossil fuels on the Environment.
8. (a) Differentiate between alternative energy and fossil fuel energy sources
   (b) Discuss the main factors which influence development of the oil industry in any country of your choice.

Activity 3.5

Using library and internet materials, propose suitable measures to be taken by the government of Tanzania to address different oil crises.

Activity 3.6

Draw a map of Tanzania and indicate areas with oil deposits.

Thermal energy

Thermal energy is produced by burning other fuels such as coal, petroleum or natural gas in thermal generators with special designed furnaces. Different factors affect the location of thermal electricity generating plants. The factors include;

Thermal plants dependence on a supply of solid or liquid fuel. They are advantageously sited on coalfields, oil or natural gas. Being in close proximity, fuel supplies will greatly reduce transport costs of the basic fuel.

Thermal plant need adequate water supply. When electricity is generated, a great deal of heat is released and therefore, much water is required for cooling purposes. The proximity to larger river, lake, estuary or coastal site will be advantageous.

Furthermore, a thermal, electricity plant should be located near main markets such as industrial and business centers so as to make the plant profitable by reducing transmission costs.

The location of the thermal electricity plant also depends on economic and political stability because the plants are often financed and operated by private companies whose major aim is to make profit, thus conducive environment is highly important.

Comparison of thermal electricity and hydroelectric power (HEP) generation

It is clear that factors governing thermal electricity generation are in most cases quite distinct from those governing HEP generation. Both methods have advantages and disadvantages from locational and economic point of view.

Effects on the environment: HEP is a completely clean source of energy, it creates no pollution. However, HEP is sited in areas of natural beauty which might lead to biodiversity destruction. On the other hand, thermal electricity produces air pollution.

Conservation of resources: Thermal power requires the use of fossils, either oil or coal which cannot be replaced, while HEP on the other hand utilises a flow resource (water).

Economics of development and operation: In terms of initial costs, thermal generating plants are much cheaper, partly because they are usually erected in a more accessible position while HEP plants are very expensive since they are located in mountainous areas or they necessitate construction of large dams.

Output: In terms of output, thermal plants, which are usually much smaller than HEP plants, generate less amount of energy than HEP plants.

Value in the national economy: HEP stations are often part of multipurpose dam projects and, thus play a role far beyond the mere generation of electricity. Thermal plants on the other hand are solely intended for power generation only.

Future development: Thermal plants are cheaper and quicker to install but their investment might be reduced due to the fact that the price of petroleum is fluctuating. HEP schemes may not be preferred by some of the countries due to high cost of initial investment; most of underdeveloped countries take loans from international organisations when they decide to develop HEP projects.

Management and conservation of fossil fuel

The following are different ways in which fossil fuel energy can be managed and conserved. First, one of the strategies is the use of alternative energy such as solar power, geothermal or wind power. This will reduce threats on non-renewable resources. Second, limitation of the oil usage to essential services so as to reduce large import bills. Third, encouraging the use of public transport especially in the urban areas. This will reduce the amount of oil consumption as well as air pollution. Fourth, tax on equipment used for alternative energy sources such as equipment for solar power has to be reduced in order to encourage the use of alternative energy among people.

The impacts of power and fuel to the environment

The use of energy is associated with environmental problems. The problems

may include, air pollution, climate change, water pollution, thermal pollution, and solid waste disposal.

Air pollution: The emission of air pollutants from fossil fuel combustion is the major cause of air pollution. Burning fossil fuels is also the main contributor to the emission of greenhouse gases. The main pollutants produced by fossil fuel combustion include; nitrogen oxides, carbon monoxide, sulfur oxides, and hydrocarbons. Moreover, smog is also highly produced by the burning of fossil fuels. These pollutants are the cause of global warming. For example, coal production leads to air pollution due to large amount of dust produced. This mainly affects the respiratory and inflammatory systems and it can also advance the challenge of global warming, and the occurance of acid rain.

Water pollution: Water pollution is associated with energy use. For example, in most of petroleum-handling operations, there is a probability of spilling oil either on the earth or in water. The spills often result in the loss of aquatic organisms such as plants and animals. For example, oil extraction in the Gulf of Mexico and oil leakage caused by BP Company killed many aquatic animals such as fish, crabs, whale, dolphins and plants. Coal mining can also pollute water. Changes in groundwater flow produced by mining operations often drain unpolluted waters into contact with mineral materials which are leached from the soil and produce an acid mine drainage.

Destruction of biodiversity: This action involves clearing of the area which previously was home to a variety of species. This may cause some species to migrate or die.

Radioactive leakage: Radioactive leakage may affect, water, vegetables, and fish; making the environment not conducive for species to live. The leakage of radioactive materials may lead to mass killing similar to the Chernobyl disaster which occurred in Ukraine in 1986. Radioactive leakage caused by either error in scientific experiments or earth's natural catastrophes like earthquakes may pose threats to human and environments. A good example is the Fukushima disaster in Japan which occurred in March 2011.

Exercise 3.5

1. Describe the advantages and disadvantages of using fossil fuels.
2. Explain at least five measures to be taken to manage fossil fuels.
3. Compare and contrast thermal energy and HEP.
4. Examine the advantages of using alternative energy sources such as solar power, geothermal or wind energy over fossil fuel energy.
5. Discuss the challenges encountered by African countries in harnessing hydroelectric power.
6. Compare and contrast the economic benefits of HEP and coal energy sources.

Activity 3.7

In a group, prepare a model of furnaces for geothermal power and present your work before your school geography club members.

Sustainable mining

Mining represents one of humankind's earliest activities which has played a major role in the development of civilisation. It contributes to economic progress of nations worldwide by improving the quality of life of people. A proof of the importance of mineral resources is obtained from ancient times in the history of the Stone Age (prior to 4000 BC), Copper Age or Chalcolithic, Bronze Age (4000–5000 BC), and Iron Age (1500–1780 BC). These are sequences of ages linked to the complexity of mining. They reflect the relevance of nonfuel minerals, metals, materials technology, and application. Each metal discovered led to a range of innovations and applications that were adopted by competing civilisations. The demand for minerals has increased over the centuries in both volume and variety. Thus, today's society is more dependent on the minerals than it was in the past.

The increased demand can cause overexploitation, thus sustainable use of the minerals is vital. Sustainable mining refers to extraction and utilisation of geological materials such as extraction of oil, natural gas, and minerals in a manner that does not affect the future generation to access and use the same resources. It should be understood that, mining industry relies on the capital and markets to operate. Therefore, without the stock market and larger financial institutions, it is difficult for the mining industry to operate. Extraction of geological materials such as minerals from the ground is a complex process, involving a great deal of technology, knowledge, and understanding of the nature plus the mode of occurrence of various minerals.

The occurrence of minerals

A mineral resource is defined broadly as the concentration of material of economic interest in or on the earth's crust. Minerals include solid earth materials such as metals (copper, gold, iron), industrial minerals (fluorite, quartz), and rocks (limestone, sand, and gravel). The occurrence of minerals falls into four main types; veins and lobes, bed and seams, weathering products; and alluvial or placer deposits.

Veins and Lobes: Veins and lobes are formed when molten materials containing minerals intrude and solidify into cracks, joints, faults, and crevices. These are mainly associated with igneous and metamorphic intrusion. Examples of vein and lobes include tin, copper, silver, lead, manganese and zinc.

Bed and seams: Bed and seams are formed as a direct result of deposition, accumulation, and concentration in horizontal strata of the earth crust. These include gypsum, potash, and salt which are formed by evaporation of lakes in desert areas and later are covered by other deposits as seams at depth.

Weathering products: Weathering products are formed by the deep-weathering of variety of rocks under tropical conditions with a seasonal rainfall regime. When decomposition of surface rocks occurs with the removal of soluble constituents, it leaves a residual mass of weathered material containing mineral ores. Bauxite is formed in this way.

Alluvial or placer: Alluvial or placer deposits are minerals that are found in sands of valley floors and in the base of hills. These deposits are also called 'placer deposits' and they are not corroded by water. Examples are gold, silver, tin, and platinum. They do not corrode in water (as iron would). They usually occur as alluvial deposits within the sand, clay, and gravels.

Classification of minerals

A classification scheme is basically a means of grouping together known geological processes, minerals, and mineral-rock association. Classification is very useful because it provides a common reference scheme. Minerals can be classified in three main ways; based on mineral resources commodities; according to forming process (genetic classification), and according to content in chemical elements. This is possibly the most scientific way used to classify minerals

Mineral resources commodities

Mineral resource deposits are classified according to the value of the raw material being extracted. This classification is based on economic value and it gives raise to three main groups. The groups include energy mineral, metallic minerals, and nonmetallic minerals. Energy minerals are formed by bituminous shales, coal, petroleum, natural gas, tar sands, and uranium. Metallic minerals are large groups that include many metal types. The types are related to their uses, density, monetary value, and any other accepted parameters. They include ferrous (iron ore, nickel, cobalt and manganese, nonferrous (copper, lead, tin, bauxite), and precious (gold, silver and platinum). Non-metallic minerals do not contain metals. These are divided into two essential categories which are industrial minerals and industrial rocks. Industrial minerals include minerals used by their specific chemical and physical properties such as sodium sulfate utilised as laundry detergent. Industrial rocks include a wide variety of raw materials that are used preferably in construction of buildings, roads, or bridges. For example, natural aggregates and building stone.

Genetic classification

Genetic classification categorises minerals according to the main ore-forming processes. It considers the type of rocks under which the mineral deposit is formed through. Based on this classification, minerals can be formed from sedimentary rock, magmatic rock, metamorphic or hydrothermal. Genetic classification, classifies minerals in the four main groups namely magmatic, hydrothermal, sedimentary, and metamorphic/ metamorphosed. A magmatic ore deposit is formed by an accumulation of magmatic minerals. Diverse groups of ore deposits originate through magmatic

processes and they include alloys of the platinum, magnetite and granites. Sedimentary mineral are those that are formed through sedimentary processes. For example, placers originated through erosion, transportation, and sedimentation processes as well as deposits related to water infiltration.

Metamorphic mineral deposits include orogenic gold, graphite veins, and several large talc deposits, among others. The most important ore deposit is the skarn. Skarn is a term that encompasses a large variety of coarse grained calc-silicate rocks rich in calcium, iron, magnesium, aluminum, and manganese. They represent diverse classes in terms of geological setting and ore metals and they range from Precambrian to late Cenozoic in age. These constitute the world's premier source of tungsten and important sources of copper, iron, molybdenum, and zinc.

Hydrothermal deposits represent an essential group of ore deposits. They are the source for most of the metal production of the world and they provide almost 100% of lead, zinc, molybdenum, and silver and 60-90% of copper, gold, and uranium as well as gemstones and industrial materials such as clay minerals and quartz. Hydrothermal deposits are located in a broad rank of geological and tectonic settings and some of them are closely linked with granitic rocks. Others form on the ocean floor, and still others are in sedimentary basins. All the deposits have common origin via the precipitation of metals or ore minerals from hot aqueous fluids.

Methods of mining

Methods of mining can be categorised into two namely surface mining and underground mining. The choice of which method to be used is a complex process involving many interrelated factors. The factors include size, shape, and depth of the deposit; geological structure and geotechnical conditions; productivities and machinery capacities; availability of experienced work force, capital requirements and operating cost; it also requires ore recovery revenues costs. Other requirements include environmental impact assessment during and after the mining, reclamation, and operation permit. However, surface mining is more preferred because of lower development costs, quicker startup time, and lower number of accidents. Underground mining is considered to be more hazardous and more expensive (capital intensive) requiring significant amount of infrastructure to be installed before planned mining activities are implemented.

Surface mineral extraction methods

Surface mining is the extraction of mineral from the ground. It can be mechanical or aqueous extraction. The mechanical extraction is dominant than aqueous extraction because the later requires large amount of water. There are four main mineral extraction methods. They include open-pit mining, strip (opencast) mining, quarrying mining, and auger mining. The mechanical extraction methods are clearly related to the commodity mined. Open pit and strip mining are the dominant

methods used because of their greatest choice of equipment. Open-pit mining is used in metals and diamonds extraction and strip and auger mining are methods mainly applied to coal deposits. Aqueous extraction include dredging, hydraulic mining, in situ leaching, and evaporate processing.

Opencast mining

Opencast mining (strip mining) is a surface mining method that resembles open-pit mining. It is used to extract minerals for large, tabular, flat-lying mineralisation that is close to the surface. This method involves removing the top layers of the earth and other overlying materials above the mineral ores. Usually, earth moving machines and bulldozers are used and sometimes electric shovels are used to dig up the mineral deposits and load them into the trucks or lorries. There are times when explosions are used to blow overlying materials in order to reach the ore beneath. A range of minerals such as phosphate, bauxite, tar sands, manganese, and even industrial materials from quarries have been recovered through this method. Open cast mining is a common method in the mining of coal. It is also used to exploit limestone which is used in making cement. A good example is the quarrying of limestone and corals at Kunduchi in Dar es Salaam and Barubuni in Kenya. Open cast method offers opportunity for reclamation requirements as opposed to open-pit mining. The main difference between strip mining and open-pit mining lies in the overburden disposal. In strip mining, overburden is dumped directly onto mined-out panels while in open-pit mining it is dumped outside the final pit boundary. In open cast mining the waste are placed almost entirely inside the pit. The method is cheaper because the output is bigger than the costs of running.

Quarry mining

Quarrying is the extraction of industrial minerals and rocks from the ground. The design of quarries is very similar to the operation processes of open-pit mines. Quarries are used to mine commodities such as aggregates, natural building stones, lime for cement, and clays for bricks and tiles. The excavated rock can be crushed, screened, and separated into different size fractions for subsequent sale and use. The products are normally relatively of low value and for local markets. They are also sensitive in terms of transport cost. Thus quarries of crushed stones are located close to the market.

Auger mining

Auger mining is a method used on mountainous terrains. It needs a surface cut, extraction of overburden, and a fraction of the coal bed to enable the auger to access the bed. The method involves boring horizontal holes in a face of the coal and loading the coal extracted by the auger. It is also applied where the terrain is too steep for overburden removal. This is because retrieval of coal using underground methods can be unfeasible or unsafe to extract a proportion of the coal left underground. Auger is a comparatively low-cost method of coal mining. It started in the West Virginia

coalfields (USA) since the 1940s. Figure 3.11 shows auger mining equipment.

Figure 3.11: *Auger mining equipment*
Source: Revuelta, (2018)

Aqueous extraction

Aqueous extraction is a method that is used in special circumstances. The method commonly uses water or a liquid solvent as the basic component in the mining process. This method is particularly suitable if adequate water supply is available and if mining operations can comply with the applicable environmental regulations. This can take place either through hydraulic disintegration or physicochemical dissolution. Examples of these methods are dredging, hydraulic mining, in situ leaching, and evaporate processing. Dredging is the most common method of large-scale mining of placers. It involves the extraction of the unconsolidated materials from a body of water without the use of explosives or significant means of rock-breaking force. Hydraulic-king is used to extract placer deposits. It is a low-cost method to extract large amounts of unconsolidated materials. A high-pressure stream of water is directed against a bank to undercut and cave it. Then, the loosened particles are washed and transported by gravity to a concentrating device. However, the method is not commonly used due to its potential to cause environmental effects.

In situ mining

In situ mining is the extraction of mineral deposits without physical removal of the solid material. It is carried out by dissolving the mineral in an adequate liquid that is later removed for recuperation of the needed constituent. *In situ* mining can be used to extract water-soluble salts, brine extraction, and sulfur extraction.

Underground mineral extraction methods

Underground mining involves the extraction of material in excavations below the Earth's surface. It is used where the minerals lay very deep below the earth's surface. Vertical shaft has to be sunk in the ground. Galleries and tunnels are dug from the shaft horizontally and supported by steel or concrete beams to prevent them from collapsing. There should be a ventilation and the ground should be free from water. Railway tracks are usually laid to bring ore and waste materials to the foot of shaft. Underground mining exists where a surface mine is prohibited to operate due to different reasons. The reasons may include high ratio of extracted waste, insufficient waste storage space, pit walls fail, environmental considerations outweigh the extraction benefits, and environmental or social factors that limit the viability of surface mining. Underground mining is a method of mineral extraction that has less environmental impact. However, it is more expensive and involves greater safety risks than surface mining. Underground

mines are generally utilised to exploit high-grade, deep minerals.

Underground mineral extractions consist of three categories of methods which include natural supported, artificial supported, unsupported, and caving methods. The unsupported methods are used to mine mineral deposits that are roughly tabular, flat or steeply dipping and have high competent ore and waste rock while supported mining methods need important amount of artificial support to keep stability of openings throughout the mine. They are utilised in mines ore or rock waste that are incompetence. They are basically used where the other two types of methods (unsupported and caving) are not appropriate. Caving methods are varied and involve induced, controlled, or massive caving of the ore body. The methods include longwall mining, block caving, and sublevel caving.

Industrial mining explosives

Industrial mining explosives are designed, produced, and utilised for commercial applications rather than for military purposes. The principal explosives utilised in mining generally contain fuel, oxidizer, and in many cases a sensitiser. Fuel is used to burn and generate heat. The oxidiser accelerates the process of burning, and where high-energy output is required, a sensitiser is supplemented to the explosive mixture. There are four main groups of explosives used in mining blasts. These are dynamites, blasting agents, slurries, water gels, and emulsions.

Dynamites

The original dynamite made by Alfred Nobel was a mixture of nitroglycerine and kieselguhr. The kieselguhr absorbed the oily nitroglycerine and the mixture became quite insensitive to shock. Over the years, formulations of dynamite have changed, but nitroglycerine still remains the main exploding component. There are three basic dynamites namely granular/ powdery, gelatine, and semi-gelatine. They are offered in cylindrical paper, cardboard, or plastic cartridges. Among them, gelatine dynamites are powerful explosives with a detonation velocity ranging from 4 300 to 7 500 m/s and they generate high shattering capability. Gelatine dynamites as shown in Figure 3.12, can be utilised as the principal explosive component where high density and energy are needed in mining.

Figure 3.12: *Cartridges of gelatine dynamite*
Source: Revuelta, (2018)

Factors affecting the exploitation of minerals

The main factors that affect the exploitation of minerals in a given area include the value of the mineral, the size of deposits, the quality of the ores, transport costs, labour availability, and methods of extraction. Mining costs vary due to the size of deposits because mining requires intensive capital investment such as large amount of expensive equipment. It is therefore, not economical to put up expensive equipments to operate in mineral deposit which will run out in a short time. Small deposits may be worked out profitably where initial and operational costs are low.

The abundance of minerals and their values also determine their commercial exploitation. Higher-grade ores are more economic than lower grade ores. This is because they yield large amount of metal and their higher metal content makes them easier and cheaper to smelt. Minerals of high value such as gold, diamonds, copper and uranium, can often be mined at very high cost, because they are in great demand and are expensive.

The method of mining also depends on the mode of mineral occurrence and the scale of operations. The cheapest method of mining is open-cast, but has highest possibility of environmental costs while shaft mines are very expensive. Furthermore, successful mining requires transportation facilities. Transportation in mining is necessary for mined ores to be transported from the mines to different destinations such as processing sites and market areas. Therefore, infrastructure like roads, rails, and ports should be available and well-functioning.

On the other side, labour (human resource both skilled and semi-skilled) is essential in mining operations. Mining requires operators of different heavy vehicles, drillers, and blasters; mechanics of machines and mining supervisors, whose skills are important in production and productivity in the mining operations. Modern mining requires familiarity with work environment, multi-tasking jobs and proper technical training. Deterioration of workforce quality and inadequate training may hinder mining industry operations. Naturally, labour is cheaper and hired more easily in moderately or densely populated areas. However, mining is done on a large scale by open cast method which is highly mechanised with relatively little labour requirements. Apart from the above factors other factors affecting exploration of minerals include market availability, policies and political environment of a country.

Effects of mining to the environment

Generally, mining activities are associated with potential environmental issues. Mining involves many stages such as deposit prospecting and exploration, mine development and preparation mine extraction, and treatment. Each stage of operation may cause environmental damage such as water pollution, air pollution, land degradation, biodiversity loss, noises, fire, explosion, and visual impacts. These issues can occur in all phases of the mining cycle. That is, from

exploration to closure and post-closure phases. The effects are caused by the materials, tools and chemicals used in the mining processes. Mining activity produces solid wastes in all phases. Generally, the principal types of solid mine wastes include overburden, waste rock and tailings. These are responsible for much of the environmental impact caused by mining. Therefore, it is worth to initially survey on the state of the environment before starting any mining project to avoid environmental effects. Possible effects on the environment are;

Water pollution: The release of contaminants to surface water is the principle source of water pollution. Many activities during mining operation can generate toxic and nontoxic components to surface water. The contaminants can be released from open-pit, tailing ponds, mineralisation stockpile, waste rock dump, and heap and dump leach pile. These are possible important sources of toxic pollutants. Exposure to rainfall increases the mobility of the contaminants from these origins. Some adverse effects to surface water include the buildup of sediments that can be polluted with heavy metals, degradation of aquatic habitat, contamination of drinking water, and other human health issues.

Acid mine drainage (AMD) is one of the most sensible and visible environmental problems facing mining industry. An example of acid mine drainage occurred in Acacia gold mine of Bulyankulu in 2019. AMD is used to describe the drainage resulting from the natural oxidation of sulfide minerals that occur in a mine rock or wastes exposed to air and water. It is usually very harmful to aquatic life because it can incorporate acidity and dissolved metals into water. This is because it is often a method of transport for a rank of contaminants, which can affect on-site and off-site water resources and it is also associated with human and ecological receptors. The impacts of AMD are long term, and they can persist even after the mine closure. Therefore, AMD prevention, mitigation, and treatment are important components of overall mine water management over the entire life of a mining operation.

Visual impact: Mining activities can generate negative visual adverse effects to resources related to other landscape utilisations such as recreation or tourism. The contributors to visual impacts are roads and highways, erosion of mines, changes in water colour, haul roads, waste dumps, slurry ponds, abandoned mining, garbage and refuse dumps, open-pits, and deforestation. Abandoned land losses its natural beauty. This occurs after minerals have been exhausted due to open cast mining. For examples, for this occurred in Geita gold mine and Tegeta Salasala gravel quarrying. Abandoned open pits and piles of waste materials have been posing accidents to children while landslides have been affecting human settlements that are near abandoned pit holes. Figure 3.13 shows the images of mining impact.

Figure 3 13: *Visual mining impact (Abandoned inactive mine pits) at Geita in Tanzania*
Source: Kitula (2006)

Impact of hazardous materials: Hazardous substances are materials that can have adverse effect on human health due to their physical, chemical, and biological properties. Some materials found in mining and processing operations can be hazardous to human health and the environment. Extraction of minerals can expose naturally occurring materials that can be classified as hazardous. They include asbestos, silica, metals, and radioactive minerals. Chemical substances utilised in mining such as explosives and flotation reagents, are hazardous as well. Other hazardous materials or compounds can be acids (sulfuric and hydrochloric), Sodium cyanide and mercury for gold recovery. For example, in artisanal gold mining in Geita - Tanzania, the use of mercury pollutes water sources and has adverse impacts to human health.

Impact of mining on biodiversity (Wildlife): Mining can affect the environment and the associated biota through the removal of topsoil and vegetation, displacement of fauna, the release of pollutants, and the generation of noise. The United Nations Convention on Biological Diversity defines biodiversity as the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species and of ecosystems. Biodiversity has significant environmental, social, and cultural values. Mining can affect biodiversity, both directly and indirectly throughout the life cycle of a project. Direct effects from mining can result from any activity including land clearance for

road or tailings, dumps construction or direct discharge to water bodies such as riverine tailings disposal, or air pollution from dusts or smelter emissions. On the other side, indirect impact can be generated from social or environmental variations produced by mining operations. These are usually very difficult to identify quickly compared to direct impact. Direct and indirect impacts can both alter terrestrial and aquatic habitats. The greatest alteration occurs during the construction and operational activities. Variations in surface water and groundwater flows can affect aquatic habitats thus increasing pressure on fish and wildlife communities. Several methods used to extract resources, such as dredge mining and deep sea mining or offshore loading activities, port development, and tailings disposal ,affect aquatic habitats.

Airborne contaminants/Air pollution: Successful mining operations require provision of adequate air to promote the health, safety, and comfort of people. Airborne emissions can take place during all stages of the mine cycle (exploration, development, construction, and operation activities). The main sources of these contaminants are dust from blasting, crushing ore, exposed surfaces such as tailing facilities, stockpiles, waste dumps, haul roads and infrastructure, and, to a lesser extent, gases from combustion of fuels from the operating machines. Adverse effects of air emissions depend on the type of pollutant, its release features, and the nature of the receiving environment. The pollutants can be present in solid, liquid, and gaseous states. Gaseous emissions generated by fuel combustion or mineral processing include pollutants such as carbon dioxide, sulfur dioxide and nitrogen dioxide.

Dust and smoke from mining, carbon dioxide from heavy and concentrated metallurgical industries cause global warming and lead to more serious health impacts such as heart, cancer, and lung diseases. Other effects include depletion of ozone layer, global warming and climate change which affect agricultural sector. The occurrence of acid rain well as affects wildlife.

Noise pollution and vibration effect: Noise is an inherent health hazard in mining industry. Mineral exploration, extraction, and processing can generate great levels of noise that can affect the surrounding environment. This is because mining industry is highly mechanised, from ore removal to final processing. Heavy equipments that produce noise are essential at every stage of operation. Thus, noise is a concern to workers who drive mechanised equipments and those who work near stationed equipments such as haulage belts or crushing equipment. Increased noise level can result into hearing loss. It can also cause high blood pressure, heart disease, sleep disturbances and stress. Operation of heavy equipments can also cause vibrations and trigger mass wasting to the surrounding areas.

Subsidence of the ground surface: Subsidence of the ground surface can be caused by the extraction of underground resources either in solid, liquid, or gaseous form. Subsidence effects depend on the

type of mineral deposit, the geological features (nature, structure of the overlying rock or soil) and the mining method used in the extraction process. Surface displacements and deformations may affect any use made of the ground surface. Subsidence can generate serious effects on surface structures such as buildings, transport and communication infrastructures and agricultural land.

Fire and explosions

Fires and explosions have the potential to cause environmental impact and loss of life. The most characteristic source of fire in mining industry is the presence of methane. High levels of methane can be exposed with underground mines where operations focuses on the exploration or extraction of coal or metalliferous mines and tunnels where methane is present at levels greater than 0.25%. Therefore, it is essential to develop fire and explosion risk assessments and to identify the measures required to prevent, manage, and mitigate those risks.

Socio-political impacts: When communities are unfairly treated or inadequately compensated, mining projects can lead to social tensions and violent conflicts. This may be associated with displacement and resettlement, migration, loss of access to clean water, loss of livelihood opportunities, health impacts, abuse of children rights, corruption, abuse of human rights, and human trafficking.

Ways of minimising negative effects caused by mining

To ensure that mining processes are sustainable, there are various ways which can be used by the governments, individual miners and companies in combating the negative effects of mining.

Environmental Impact Assessment (EIA)

Environmental Impact Assessment (EIA) is the most essential tool in accomplishing sustainable mining. EIA provides an anticipatory and foreseeing procedure for environmental management and protection in any development. The EIA procedure is an interdisciplinary and a multistage process. It assures that potential mining effects to the environment are taken into account in decision making. The EIA process assists in suggesting action on how those impacts can be addressed. The principal goal of the EIA procedure is to inform decision-makers and the public, the environmental impacts of implementing the mining project and procedures suggest safe mining. For example, in Tanzania the National Environmental Management Council (NEMC) is responsible for enforcing EIA procedures to any development project including mining projects.

Waste management: Mining wastes can be regarded as the principle cause of the most environmental problems experienced in the mining sector. Wastes need to be properly handled for sustainability of mining activities. There must be waste disposal facilities located in the mining sites to minimise environmental impacts and long term environmental problems. The selection process of the disposal sites should consider a review of site regulatory requirements, baseline conditions, environmental considerations, environmental consequences, and direct

surface impacts caused by the disposal. The disposal site should be in legally permitted areas in places where drainage is not disrupted, where there will be less visual impacts, and less biodiversity disturbance. Mining projects should not be conducted where there is significant ground water recharges and surface water bodies and they should not be close to residences.

Rehabilitation of mining environment: Rehabilitation of degraded areas is the restoration of biodiversity as well as ecosystem structure, functioning, and services. This is necessary to offset net losses of biotic resources and achieve ecological sustainability of mining operations. A rehabilitation project can involve actions such as replacement of the soil by planting trees in the destructed areas. Miners should take up this responsibility and government should enact laws and regulations to enforce mining companies which use open cast mining method to rehabilitate land after use.

Land revegetation: Land vegetation plays a vital role in the ecological improvement and economic development of mining regions. For instance, vegetation can be grown in tailings impoundments. This can be particularly important to prevent dust generation from inactive tailing surfaces. Moreover, planting of vegetation can reduce erosion, increase evapotranspiration, and reduce the amount of water that infiltrates the underlying waste material. Revegetated land can be used for other activities such as recreation and tourism. An example is the Bambuli in Mombasa which was established as a tourist park. Figure 3.14 and Figure3.15 show revegetated lands. The Government and local government should therefore, encourage reclamation of abandoned mining land.

Figure 3.14: *Revegetated waste rock area*
Source: Revuelta, (2018)

Figure 3.15: *Open pit mining revegetated to a National Park (abárceno, Santander, Spain)*
Source: Revuelta, (2018)

Enforcement of laws and policies: Government needs to enforce the laws and policies for environmental management. For example, specified control measures of pollution such as pollution tax and fines may be useful.

These can be based on polluter pays principle. The 'Polluter Pays Principle' is the commonly accepted practice which requires those who cause pollution to bear the cost of managing it to prevent damage to human health or the environment. Therefore, a mining project that produces potentially poisonous substances such as a by-product of mining activities should be held responsible for unsafe disposal. The polluter pays principle is part of broader principles that guide sustainable development worldwide. The principle was adopted in the Rio declaration of 1992 and became incorporated in the Tanzania's Environmental Management Act no 20 of 2004.

Mining as a robber industry

Unlike agriculture or forestry where crops can be grown over and over again, mining is a robber industry, due to the fact that minerals are non-renewable resources and can never be replaced in a short while. Human beings will look for new areas which are unexploited but they can never increase or replace the minerals that are mined. The natural replacement of minerals depends on geological events such as the accumulation of iron in sediments or the development of native ores as a result of earth movements.

Significances of the mining industry

Mining industry has diverse socio-economic impacts. These include income, employment, livelihood, exports, training and skills development, community development, and accessibility of social services. Well-structured mining engages with the local communities and provides them with jobs and improved living standards. Mining industry provide revenues which helps in developing social services such as school, hospitals, and other social amenities. Mining activities promote business enterprises in the mining regions. For example, construction of residential and commercial buildings such as renting houses and hotels which are expected to cater for worker's needs. Moreover, as minerals are also important source of foreign currency, they contribute significantly to the Gross Domestic Product (GDP).

Challenges facing the mining sector

In spite of the large profit generated from mining, sector, the industry is faced by the following challenges; First, lack of initial capital, for instance many coal and iron deposits remain unexploited due to lack of capital. Capital is needed for purchase of modern equipments. Second, shortage of skilled labour especially in developing countries like Tanzania. Mining exploration, surveying, and processing require modern skills which are limited in most of the developing countries. Third, small mineral deposits are not economical. This discourages some investors. Forth, poor and insufficient infrastructure. Infrastructure such as railway lines, roads, harbours, airports, and telecommunication network are important to support production and processing. Fifth, price fluctuations lower income and affect mineral investments. Sixth, insufficient power supply that affect exploration and processing of minerals that require sufficient power and electricity. Most of the countries depend

on HEP which is sometimes affected by rainfall. Seventh, land locked countries are affected in terms of transportation of minerals. Some minerals are heavy and costly to transport, sea way is cheaper and convenient. Zambia is a good example of countries whose mining sector is affected by lack of proximity to the sea which make the transport to be expensive. Eighth, the political instability discourages not only foreign investors but also local people to engage in mining activities. Countries like Angola, Ivory Coast, and Democratic Republic of Congo have not been performing well in the mining sector due to frequent civil wars and foreign encroachment.

Distribution of minerals and regional producers

The distribution of mineral resources in the earth's crust is uneven. The uneveness is considered from a commodity point of view to the geographical distribution of the mineral deposits across the different continents. The major reserves of metal ores are geographically concentrated in few countries. The distribution of valuable minerals in each deposit vary according to the grade and the tonnage of the mineralisation. The type of mineral or metal determines the global geographical distribution. For example, gold deposits are distribute in more than 100 countries, but the largest reserves are concentrated in South Africa (about 28% of world's reserves). Platinum metal group deposits are available in 16 countries and the largest reserves are in South Africa and Russia (about 97% of world's reserves). Some minerals are found only in relatively specific areas of the world. For example, tin vanadium, nickel, cobalt, and asbestos are minerals which are highly localised in occurrence. In particular, more than half of the world's tin comes from eastern Asia alone (Malaysia, Thailand, Indonesia and China). USA is also by far the largest producer of molybdenum, sulphur, and phosphates while Canada dominates worlds' nickel production. Other minerals are very rare on Earth. For example, Tanzanite is only found in Tanzania.

Case studies

Copper mining in Zambia

Copper is a soft brown metal found almost solely in igneous and metamorphic rocks. It was one of the earliest metals used by men because it often occur in a pure state and can easily be processed. The use of copper was recorded in Egypt as early as 5 000 B.C and Far East around 2 500 BC. Copper was discovered in Zambia in the late 19th century, the first major phase of extraction of copper commenced in the early 1930s and in the 1950s the Zambian copper belt dominated global production of the metal. However, copper is very soft, it is mixed with tin to get harder and tougher materials such as mixing copper and tin to obtain Bronze. Zambia is the major producer of copper in Africa.

Mining centres: Zambia produce 10% of the World total copper while The Democratic Republic of Congo (DRC) provides 5%. Zambia is ranked the world's 7th largest producer of Copper . All copper deposits are concentrated in Katanga-

Zambia copper belt. The main mining centres includes Chingole, Kitwe, and Ndola in Zambia and Lubumbashi in Katanga, DRC, as shown in Figure 3.16. The inland location of the copper belt leads to high cost of transport. Copper is smelted and refined in the copper belt to reduce transport costs and enhance export value. Other centres include Chambishi, Mufulira, Luanshya and Chililabombwe.

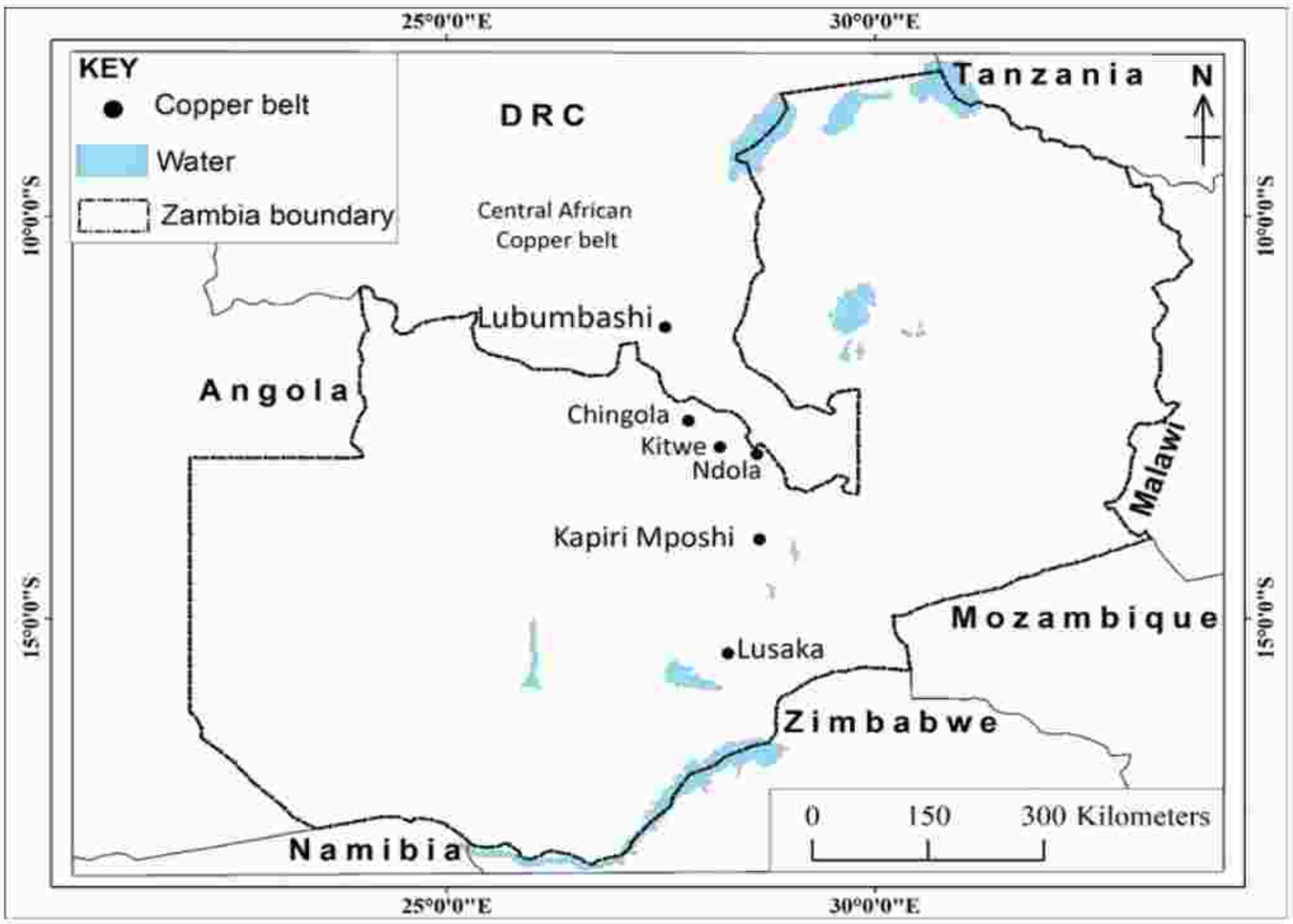

Figure 3.16: *Copper belt in Zambia*

Properties and uses of copper

Copper has many properties and uses. It has high conductivity, hence very important in electrical engineering industry for making of wires, parts in electric motors, transformers and generators. About 45% of the world's copper is used in the electric field, including the manufacturing of radio, television sets, refrigerators, cookers, and all household and office electrical appliances.

Copper has high ductility and malleability, hence a great industrial metal. It can be forged, pressed and spun into wires, cables, fittings, and metal pieces of any shape and size as shown in Figure 3.17. It is regarded as an ideal metal in the automobile, armament and machinery industries. It combines easily with many other metals to produce new compounds with desirable qualities for special uses. For example, when alloyed with 3% of tin (with traces of zinc), it produces bronze which is used for making coins in many countries.

Copper is widely used for making statues, ornaments, cooking, and domestic utensils like pans and kettles. When alloyed with 10% tin plus 0.3% phosphorus, copper produces phosphor bronze. This is especially suitable for the manufacturing of bearings which are used in rolling mills, moving bridges, turntables and gun-mounting rings. When alloyed with 20% of zinc (with traces of nickel), brass is created. Brass is widely used for making decorative ornaments, cooking utensils and cartridge cases. When alloyed with 35% of nickel and zinc, nickel-silver is formed. Nickel silver is used in making coins, and tableware. Copper is also very resistant to corrosion, hence it is often used for roofing, making tubes, pipes, pumps, radiators, and boilers. Lastly, because of its softness and malleability, it is useful in soldering, welding, and brazing. Its attractive appearance gives it a wide range of ornamental uses.

Figure 3.17: *Copper Ingots*

Source: https://www.dreamstime.com/copper-ingots-bars-background-d-rendering-

Importance of copper to the economy and development of Zambia

Mining industry has been the economic and social backbone of Zambia since the first major phase of exploitation of the copper belt's deposits which commenced in the early 1930's. Copper mining contributes to the economy of Zambia in the following ways; It contributes more than 822 USD million of the total export. It provides employment to Zambians and to people from neighbouring countries like Zimbabwe, Malawi, and Mozambique. More than 75 000 people are recently employed in Zambia extractive industry, representing 24% of country workforce. It also stimulates the development of infrastructure such as roads, railways, and communication networks linking copper belts and other places. It contributes to the development of towns like Kitwe, Ndola, and Mufulira, and it enhances development of power generation dams like Kariba and Kafue. It has also influenced the development of social services such as health centres, schools, water supply, and sports especially in Kitwe, Ndola and Mufulira and to the development of industries such as copper smelting and industrial activities in Kitwe.

Challenges facing the copper industry in Zambia

Despite its contribution to the economy, copper mining in Zambia encounter several challenges including; Insufficient capital which force the country to invite foreign investors and large mining companies. Occurrence of disasters related to mining activity such as landslides and rock falls leading to destruction of properties and deaths of people. Price fluctuation in the world market affects the income earned

and profit generated from copper mining. Low level of science and technology affect the productivity. There are also weather problems such as flooding in the mines which affect production stability. Lastly, there has been stiff challenges from the environmentalists as well as competition over land with other land users such as agriculturists and forest users.

Mining in Tanzania

Tanzania is endowed with various valuable minerals. Some of the minerals found in Tanzania are;

Gold

Tanzania is the fourth largest producer of gold in Africa after South Africa, Ghana and Mali. Tanzania's gold reserves are estimated at about 45 millions ounces (oz). The earliest organised mining in Tanzania began with gold discoveries in the Lake Victoria region in 1894 during the German colonial rule. Mining started at the Sekenke Mine in 1909, after gold was discovered in 1907. Currently, gold exploration is mostly concentrated in the greenstone belt around Lake Victoria. Gold exports accounted for USD 1.3 billion of the total value of Tanzania's exports in 2015.

Gold mines are found in Sekenke (Singida region), Chato (Geita district), Kiabakari, Chira, Kilimahewa, Buhemba, and North Mara (Mara region), Chunya (Mbeya region), Kahama (Shinyanga region), and other parts of the country. Gold is used as a measure of country's wealth and volume of currency. It is also used in making ornaments, electrical parts and plating of ornaments.

Uses of Gold

Gold has been known and used from the earliest days because of its high metallic lustre and its attractive yellow-reddish colour. Gold cannot be tarnished and it can be fashioned into beautiful ornaments and jewelleries. Gold occurs either in alluvial or placer deposits, or as reefs or lodes underground. In the past it was used as a form of exchange (money). Currently, the international monetary system is backed by gold. Governments keep a sufficient stock of gold bars or bullion in their treasuries to cover in part the value of the paper money (notes) which is in everyday circulation. The major use of gold is to produce jewelleries. It is alloyed with copper, silver, zinc and nickel to be fashioned into jewellery or ornaments. It is used as gold tooth fillings, gold-leaf for gilding, and making gold point for rockery. In chemical industry, gold compounds are retired in photographic materials.

The major gold mines in Tanzania include Bulyanhulu, Buzwagi, North Mara, Geita, and new Luika. Bulyanhulu gold mine is located in Shinyanga region. It is an underground gold mine operated by Acacia gold company. It started its operations in 2001. The Buzwagi gold mine is also located in Shinyanga and it is operated by Acacia, and it is an open pit gold mine which started its operations in 2009. North Mara gold mine is located in Mara region and it is also operated by Acacia. It combines both underground and open pit techniques in mining. It started its operations in 2002. Geita gold mine is an open pit mine that started its operations in 2000 as a joint venture between Anglo Gold and Ashanti gold companies. New Luika Gold Mine is located in Mbeya and

it started its operations in 2012. It is owned by Shanta Gold Company. Other gold mining companies such as the Golden Pride, Sekenke, and Tulawaka have closed their mining operations. Figure 3.18 presents mineral sites found in Tanzania.

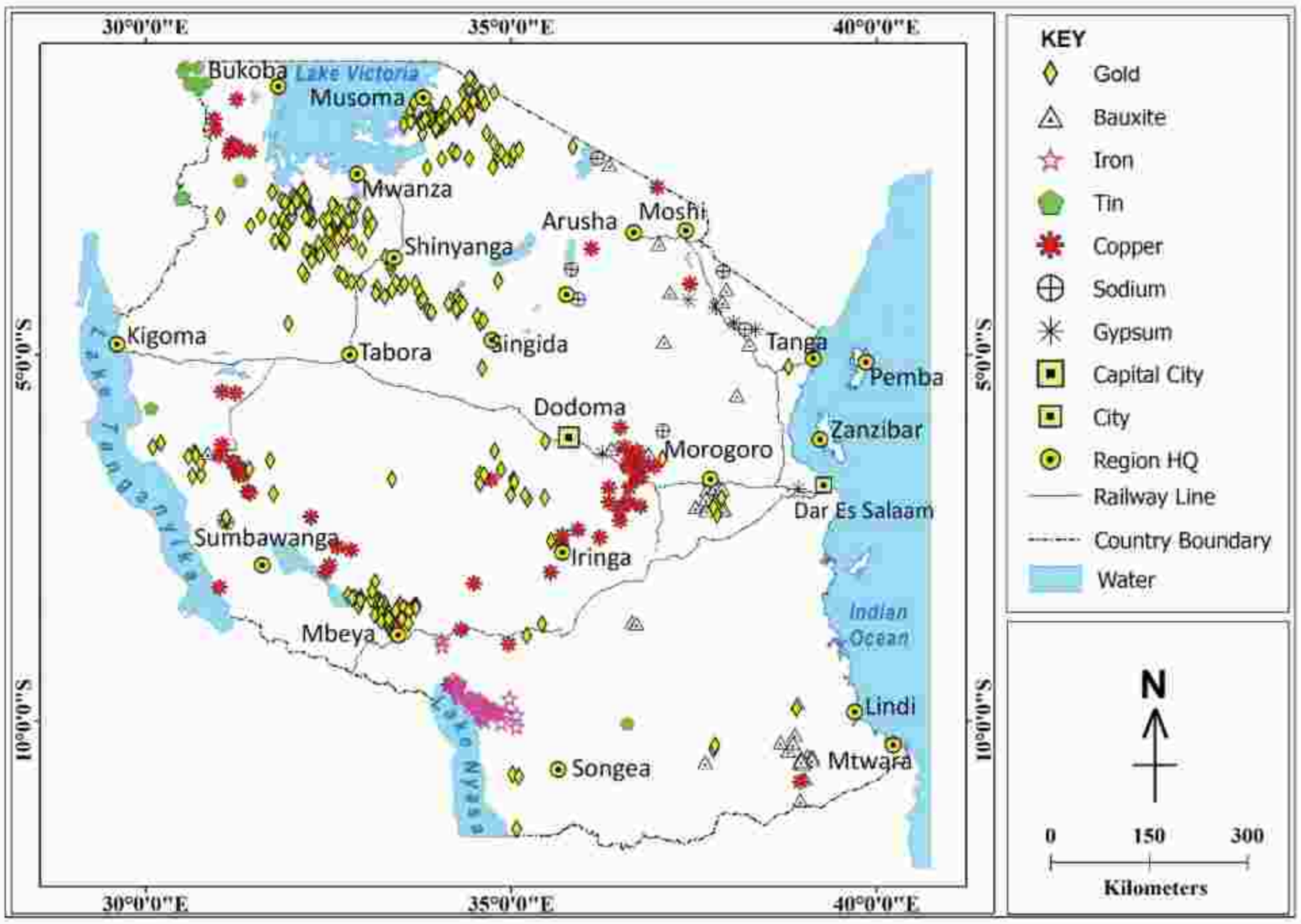

Figure 3.18 : *Mineral sites in Tanzania*

Tanzanite

Tanzanite is found in Mererani in Simanjiro district in Manyara region. Tanzanite is only found in Tanzania. Tanzanite as shown in Figure 3.19 is used in making valuable ornaments such as earrings, bracelets, and necklaces

Figure 3.19: *Tanzanite mineral*

Source: https://en.wikipedia.org/wiki/Tanzanite

Iron ore

Iron ore is found in Liganga-Njombe region, and is the largest iron deposit in Tanzania with proven reserves of 126 metric tonnes (126mt). It is also found in Itewe village in Chunya, Songwe. Some parts of Biharamulo in Kagera, Busi in Kondoa in Dodoma, Mbalala near lake Tanganyika, and Karema in the eastern shore of lake Tanganyika. Iron is used to manufacture industrial machinery and equipment, alloys, and to produce pig-iron and to create employment opportunities. All these in turn contribute in developing other industries and sectors such as transport, communication, and agriculture.

Tin

Tin is found in some parts of Karagwe district in Kagera region. Tin is used to make iron-sheets, cans, and electro-plating.

Nickel

Nickel is used to make alloys of stainless steel, various chemicals, and points. It is found in some parts of Magu in Mwanza, Ntaka - Masasi in Mtwara, Mpanda in Katavi, Kigoma, and Hanang in Manyara.

Diamond

Diamond is found in Mwadui, Kishapu, and Kahama in Shinyanga, and Loya and Usongo in Tabora. Diamond as shown in Figure 3.20 is used in making ornaments, cutting rocks and glass, and making rock drilling tools for highway construction and repair.

Figure 3.20: *Blue diamond*

Source: https://www.mining.com/petra-fetches-over-40m-for-39-carat-blue-diamond/

Mica

Mica is found in the Uluguru, Nguru, Ukaguru, and Mikese mountains in Morogoro, Mangalisa Plateau in Mpwapwa-Dodoma, Hombolo and Itiso in Dodoma, Bumbuli Hills in Tanga, and Tungwa Mbulu in Manyara. Mica is a raw material for making electrical insulators, fire proof materials, car tyres, car paints, tar, roofing, wall papers, lubricants, radio components, and heating aliments (cookers, stoves, furnaces).

Coal

Coal is found in Ngaka stream in Ruvuma. It is the largest operational coal site in Tanzania with an estimated amount of 367 million tonnes. Other areas with coal include Ruhuhu basin in lake Nyasa, Ilima and Kiwira in Mbeya as shown in Figure 3.21, Keteweka-Mchuchuma in Ludewa district, Njombe, Mbamba Bay in Nyasa district, Mpanda, and Rukwa. Coal is used as a source of energy in generating electricity in iron smelting industries, chemical industries, and in cement production as well.

Figure 3.21: *Coal mining at Kiwira*

Source: https://www.thecitizen.co.tz/tanzania/news/-kiwira-coal-mine-expansion-on-the-books--2557116

Limestone

Limestone is found in Pongwe in Tanga region, Ulyankulu - Urambo in Tabora,

some parts of Bagamoyo, Kisarawe and Rufiji in Pwani, Wazo – Hill (Tegeta) and Nzasa in Dar es Salaam, Mlale in Ruvuma, Kilosa in Morogoro, Hai, and Same in Kilimanjaro, and Mvumi and Chamwino in Dodoma. Limestone is used as a raw material in metallurgical industries, textile industries, kitchenware production, sugar industries, optical industries, and paper industries. It is also used in softening hides, glass bleaching, silica bricks making, grease water purification, and mineral treatment process. Moreover, limestone is commonly used as raw materials in cement production.

Natural gas

Natural gas is chiefly found in Songosongo in Kilwa district, Lindi region and in Mtwara. It is used in generation of power and as a raw material in chemical and fertiliser industries. Most of unprocessed natural gas contains at least trace amount of helium which also is found in Nyamusi-Rorya in Mara. Helium gas is used in space balloons and in the making of tube lights.

Phosphate

Phosphate occurs as a rock in sedimentary sequences or as phosphatic modules. It is mainly extracted in Minjingu near Lake Manyara. Phosphate is also found in Bahi in Dodoma region. It is used to manufacture fertiliser, animal feeds, human food, and soap. It is also used in textile industries for water purification.

Minjingu Phosphate rocks are used as raw material for the Tanzania Fertiliser Company (TFC) factory in Manyara, which is further processed into chemical phosphate fertilisers such as Single Super Phosphates (SSP) and Triple Super Phosphates (TSP). Minjingu Mines and Fertiliser Ltd. (MMFL) has been mining and processing the Minjingu ore into powder for direct use in farms and for the export market. Other minerals found in Tanzania are kaolin, gypsum, salts, uranium, beach sands, and clay.

Coal mining in China

China is the largest producer and consumer of coal in the world. She is the largest user of coal-derived electricity, generating 3 959 trillion watt-hours per year. By 2014, 74% of its electricity, was from coal. Both coal production and consumption peaked in 2013 but it has dropped continuously. Coal power has been the dominant source of energy used to fuel rapid economic development of China in the past two decades. China relies on coal power for approximately 70-80% of its energy. It is known that 45% of its energy is used for the industrial sector and the remainder is used to generate electricity for household use. Coal mining in China developed due to: availability of different types of coal, the use of advanced technology, availability of labour both skilled and semi-skilled, high demand of energy source which is cheap, and reliable and improved transport and communication.

Iron ore mining in USA

In USA, iron ore is mainly found in the Lake Superior region (Minnesota and Michigan) and it was discovered in 1844 and the mining started in 1848. For the past 50 years, Lake Superior range has

been producing 90% of the iron ore mined in the USA.

In Michigan, iron ore is mined in four open pits, while Minnesota provides the majority of the iron mined in 7 open pit mines. Iron industry in the USA has shifted from labour-intensive to a highly mechanised industry, and from underground mining methods to open pit methods, and a shift to larger but lower grade deposits.

About 5 750 people were employed in iron ore mines and iron ore treatment plants in 2014. The industry produced about 42.5 million metric tonnes of iron ore in 2015 which worth USD 3.8 billion. Iron was the third highest value metal mined in the USA (after gold and copper) in 2015 and from 9 active mines in Michigan, Minnesota, and Utah. Iron mining is well developed in USA due to the availability of all types of iron which are highly needed in the world market. The availability of capital, use of advanced technology, hardworking spirit of the people of USA as well as development of transport and communication have largely promoted development of this sector.

Exercises 3. 6

1. Describe five negative impacts of mining activities on the environment.
2. Analyse the socio-economic significance of copper mining in Zambia.
3. By citing examples, examine factors that affect exploitation of minerals in Tanzania.
4. Compare and contrast the surface and underground mining methods.
5. Explain six measures for reducing negative impacts of mining on the environment.
6. Describe the distribution of five major minerals in Tanzania.
7. Explain the main factors that determine development of phosphate mining in Tanzania.
8. Explain the significance of mining to the socio-economic development in Tanzania.
9. Compare coal mining industries in Tanzania and China.
10. Explain the factors for development of coal mining industry in China.
11. Compare the steel industry sector in USA and in Tanzania.
12. Discuss factors influencing the development of iron mining in the USA.
13. Explain the problems posed by iron ore mining in the USA.

Activity 3. 8

In a group, document and present different strategies used by the Tanzania Government to ensure that it benefits from being the only producer of Tanzanite minerals in the world.

Activity 3.9

Draw a map of Tanzania and show where Tanzanite, gold, and coal deposits are located.

Activity 3.10

Survey your surrounding environment and do the following;

(a) Identify the available mineral resources

(b) Identify and document the employment opportunities of mining industry in your surroundings

Sustainable use of forests

A forest refers to an extensive area of land which is mostly covered by trees of different sizes, species and other forms of undergrowth. It is the complex community of associated trees, shrubs, other plants and animals. A forest has a capacity to renew itself. The plants decay and release the nutrients into the soil and in turn they are reused. Animals consume plants or other animals for survival. Animals die and decay releasing nutrients to the soil for plant growth. Forests play vital social and economic functions including provision of goods and services. The goods and services provided are necessary requisite to advance sustainable economic growth. Some of the ecosystem services provided by forest are food, water, wood, energy, biodiversity, health, and air purification. These are critical for the well being of all of humanity. Over 1.6 billion people depend on forests for subsistence, livelihoods, employment, and income generation. Sustainable forest management is the process of managing forest to achieve one or more clearly specified objectives without diminishing forests ability to continue providing goods and services endlessly.

Importance of forest resources

Forests provide a variety of commodities such as timber, fuel wood, fodder, fiber, fruits, herbal products, cosmetics, medicine, and many types of raw materials used by different industries. A great variety of mammals and birds that live in the forests are useful living resources. Forests play a great role in soil formation and development, water conservation and regeneration of oxygen and climate moderation. The use of forests can be broadly categorised into three major groups which are economic, ecological and socio-cultural.

Social-economic use of the forest

Forests provide us with a wide range of socio-economic benefits. The provision can be through employment such as trade of forest goods as well as the use of forests as a source of energy. In general, all these contribute to the overall economic growth.

Energy source: Wood has always been used for fuel both for domestic and industrial purposes. Before coal was widely mined, wood was used in smelting minerals. Even today, in countries where coal or oil is not in sufficient supply, wood is used in industries to power railway

locomotives and to generate electricity. About 40% of the total timber extracted from forests all over the world is used as a source of energy. In Tanzania, it is estimated that more than 90% of the population, both in urban and rural areas, use biomass energy for cooking and heating.

Source of raw materials: Forests provide vital materials for building and construction industries. They also offer materials for furniture making. Forest products are used in their original form or after being processed. Moreover, wood contains cellulose which is essential in making synthetic fibers such as rayon and acetate, thus making wood an important modern industry. This demand and value increase alongside an increasing world population.

Food and medicine: Plants and animals of the forest are also key to numerous life sustaining products such as food. Forests provide a wide range of foods such as fruits (jackfruit, durian, salak, and mango), nuts (peanuts), vegetables (mushroom, petai, palm heart, jengkol, sago palm), honey, and spices. Food from forests is considered more nutritional and of high value. Some forest products are used in pharmaceuticals for insecticides and pesticides production. For example, quinine, coca, and heroin are among the important drugs found in forests. More than 28 000 plant species are currently recorded for medicinal use and many of them are found in the forest ecosystems.

Timber

Timber is a dominant forest product used widely. It has several uses as follows;

Construction: Timber is used for building and construction purposes. It is traditionally being used to build houses and, it is also required for ship building in many areas. Timber is used in the construction industry in three main ways:

Sawn wood: Timber is used for heavy duty construction works such as railway sleepers, piers and jetties. Tropical and temperate hardwoods are used in boats construction. Cabinet woods such as mahagon, rosewood, and ebony may be used too.

Plywoods and veneers: Wood may be cut into thin sheets which are subsequently glued together to form a light but strong materials called plywood which is much used for internal constructions such as doors, built-in furniture, and other uses.

Fibre board: Timber is also used in a form of fibre and particle boards. These are made from pulp or from saw dust and other waste materials which are by-products of saw-milling and pulping industries. These types of boards, such as hardboard and chipboard are used for furniture and internal construction of building including linings and ceilings.

Pulp and paper: In terms of value, the most important use of timber is in the pulp and paper industry. This industry is constantly expanding and it creates an increasing demand for timber. Paper is essential in the communication industry, commerce, and education. Because of this demand, its consumption in the world is rapidly expanding.

Synthetic textiles: Wood cellulose is the basis of the synthetic textile known as

rayon. Although cellulose is also extracted from cotton linter (burrs which remain attached to cotton seeds after ginning), the chief source of cellulose is spruce wood pulp.

Ecological value of forests

Forests play an important role in stabilising different ecological system. The ecological values are necessary for the continuity of economic values as well as social values. The following are important ecological values of the forests;

Protection of other resources (water/soil): Forests protect soil from being eroded. They intercept and retain moisture on the leaves, or absorb moisture into their roots and stems to ensure a more gradual transfer of water. Rapid run-off and flooding, cause too much water to erode the top layer of soil, thus, causing erosion. Forests reduce soil erosion by preventing the adverse actions of wind and water on the fertile top soil. Forests also prevent landslides and reduce the intensity of cyclones and floods. Through preventing soil erosion, forests reduce silting of water bodies including reservoirs. Forests are also vital in the protection of watersheds to ensure perennial supplies of fresh water. Protection of forests may thus lead to the protection of water catchments.

Moderation of global climate: Forests influence natural cycles such as hydrological and carbon cycles. These processes are necessary for rain formation and stabilisation of the global climate respectively. Forest cover helps in retaining water in the soil. Furthermore, forests regulate the atmospheric carbon dioxide level. Tree biomass holds carbon dioxide in a fixed level, causing the forest to act as a major source of carbon sink (ability to absorb carbon dioxide from the atmosphere). This process is called carbon sequestration. That is why afforestation is being adopted and emphasised as a measure to reduce greenhouse effect.

Protection of biodiversity: Forests are the greatest source of biodiversity on the land as they provide ideal conditions for the survival and growth of living organisms. Forests are homes to many wild animals and birds. They contain greater number of species per unit area than in any other terrestrial ecosystem. For example, the tropical rainforest covers for more than 50% of all known species. Rainforests also account for about 62% of all known plants.

Socio-cultural significance

Forests have been part of social and cultural character since the inception of civilisation. The signs of cultural bonds are in today's modern life. Therefore, forests have significant aesthetic, recreational, and spiritual values. They have beauty in themselves which may beautify the landscape. They are pleasant for picnics, nature walk, and other outdoor activities. This means, they make excellent parks, as it is the case with forests around Lake Ngosi which is the second largest crater Lake in Africa found near Tukuyu in Rungwe district in Mbeya region as shown in Figure 3.22.

Figure 3.22: *Forest recreation at Lake Ngosi*
Source:https://toucanslandmarks.s3.amazonaws.com/media/com_scatalog/images/listings/s/20200504111009236 54.jpg

In terms of fostering private employment, forests also provide various opportunities for private employment. Youths and other people can employ themselves as forest tour guides or in wood and furniture production.

Other uses of forest resources

Forest resources have a wide range of other uses such as dyestuffs and chemicals but many of these applications have been superseded by the development of synthetic chemical dyes and resins. Wood still yields materials for disinfectant and paint making industries. Trees also yield tannin, gums, resins, and drugs. Other forest products, apart from timber include the following;

Rubber and other gums: Rubber, though is now essentially a plantation crop, was originally a forest product which used to be collected from the Amazon, Brazil, and Congo. Until the present time, rubber and gums are still collected from forests but their production now is of little importance. Generally, rubber is used as an essential raw material in the creation of medical devices, surgical gloves, aircraft and car tires, toys, clothes, hair shampoos as well as in making soaps.

Naval stores: These are groups of products named from their importance in the ship building industry which include resin, pitch, tar, and turpentine. These products are derived from the resinous material extracted from coniferous trees. The materials is collected or systematically taped and processed in a variety of ways. These products are being used to make seams of wooden vessel water-tight.

Cork: Cork is a thick bark of the cork oak, which is found in Southern Europe and North Africa. Cork oaks are usually found in wild areas but many are now grown in plantations, especially in California. Cork is used to create floor, furniture, footwear and stoppers that are used to seal oil and wine bottles.

Tannin: Refers to a substance found in the bark of certain trees which is used in the conversion of raw hides into leather. It is found in a number of trees including the hemlock of North America and Europe, the oak and chestnut of the temperate hardwood forest, wattle of Africa, and Mangon species from the tropical coastlands.

Oil Palm and creeper products: Oil palm is a forest product though it is now mainly produced in plantations and smallholdings. Bamboo and vines or creepers such as rattan are used for making furniture and weaving baskets and mats.

Medicinal plants: A wide variety of medicinal plants are found in forests: forest dwellers extract both beneficial drugs and harmful narcotics.

World's forest distribution

Forests distribution on the earth's surface varies due to the amount of rainfall available and the lengths of wet and warm seasons per year. Two types of forests can be noted in the world which are natural forests and planted forests. Most part of the earth has forests of natural vegetation but some areas where the climate is too cold or too dry, forest growth is not supported. Forests cover 31% of the global land area but are not equally distributed around the globe. About half of the world's forests are found in five countries which are Brazil, Canada, China, Russia and the United States of America. Other countries rich in forests are Australia, Democratic Republic of Congo, Indonesia, Peru, and India. Figure 3.23 shows world forest distribution while Figure 3.24 shows eleven countries with the largest forest area by hectares in 2020. Tanzania has about 33.5 million hectares of forests. About two third of this area is covered by woodlands on public lands. Forest reserves (Gazetted) consist of 13 million hectares while 80 000 hectares are plantations, mainly consisting of *Pinus patula* and *Cupressus lusitanica*. The reserves include 1.6 million hectares which are managed as catchment forests. About 6% of the forests are within national Parks.

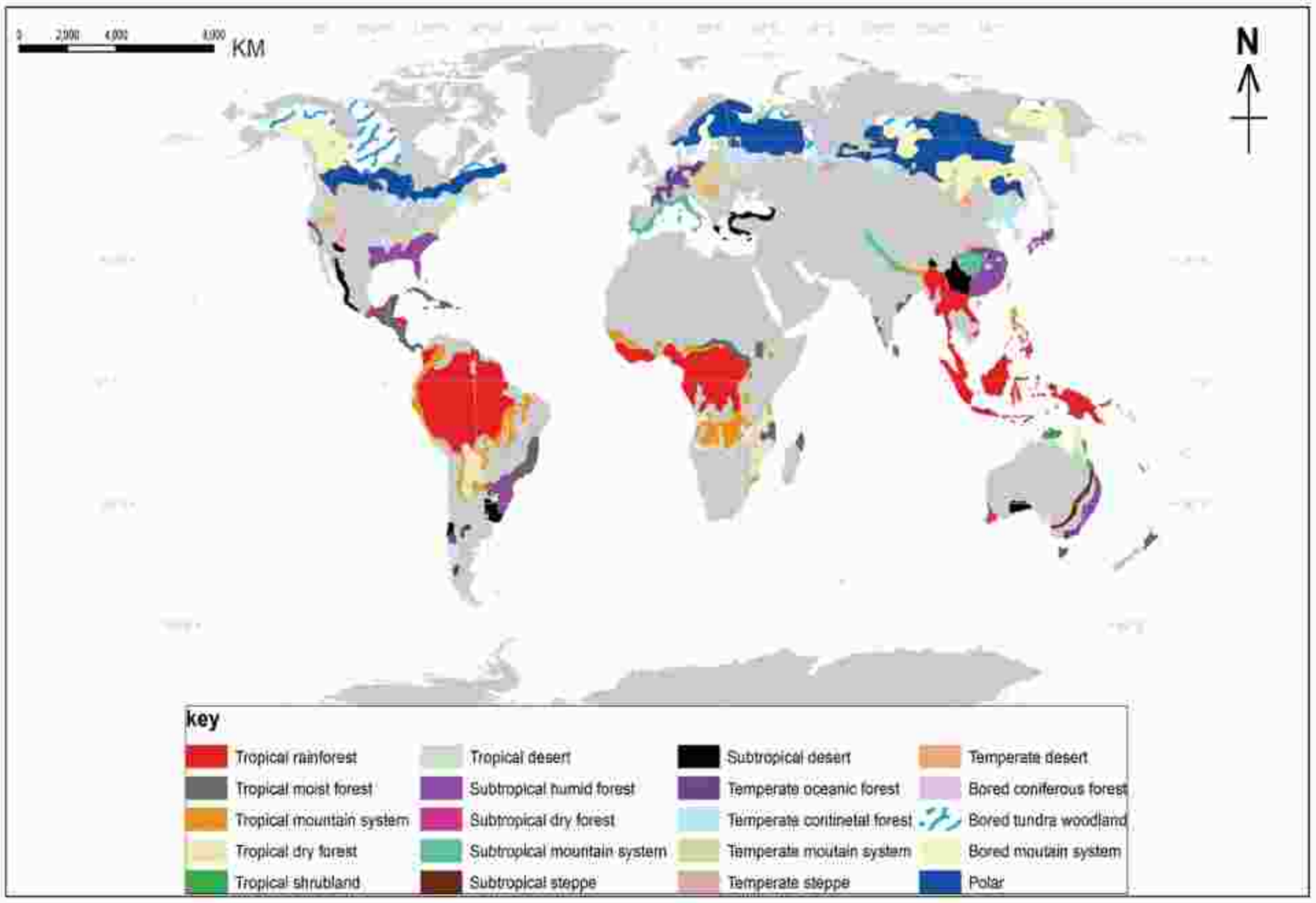

Figure 3.23: *Geographical distribution of forests in the world.*
Source: FAO (2020)

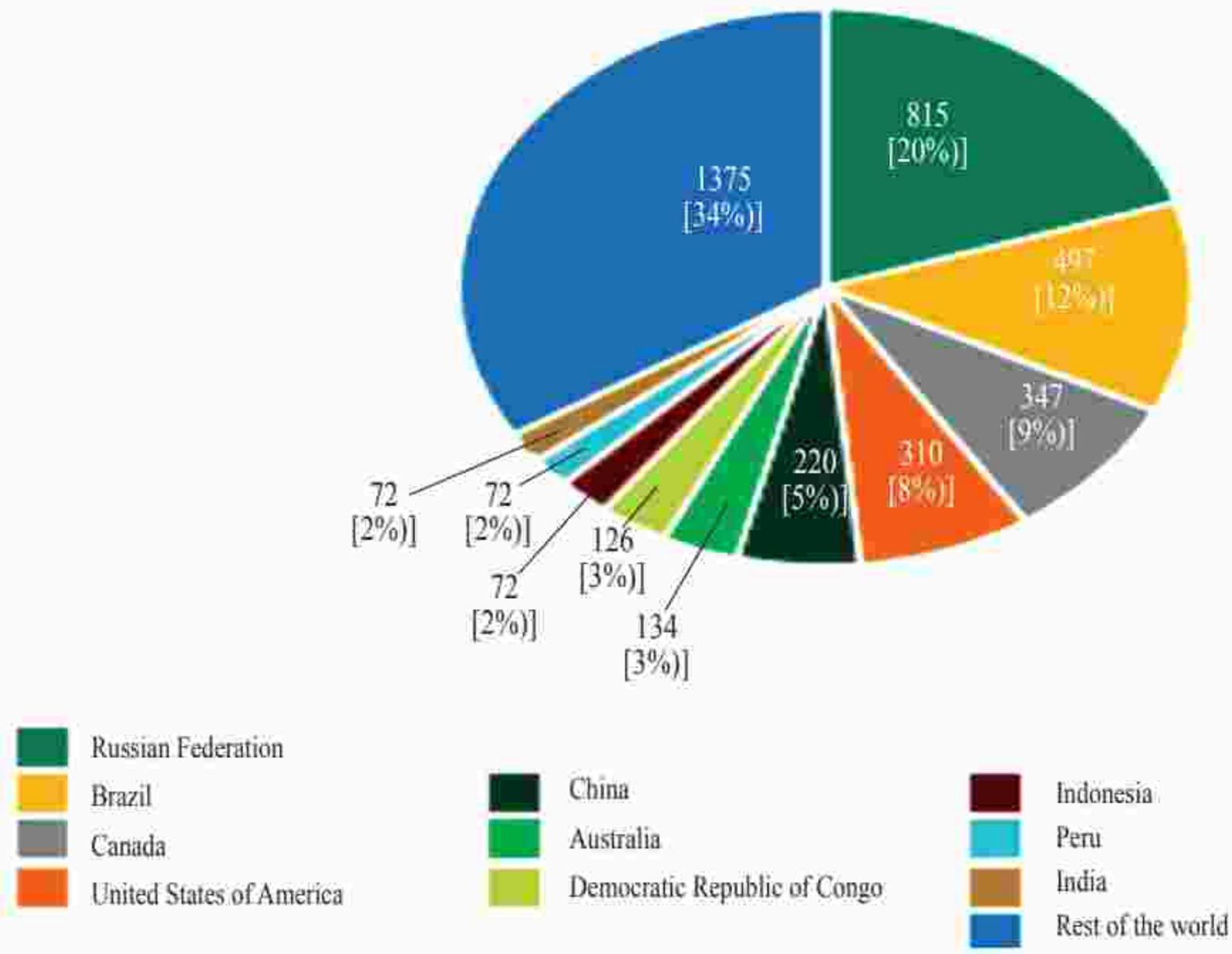

Figure. 3.24: *Eleven countries with the largest forest area by hectares and their percent in 2020*

Source: FAO (2020)

The largest part of the forest (45%) is found in the tropical boreal, temperate and subtropical domains. The domains above are divided into terrestrial global ecological zones. Almost 49% of the forest is relatively intact, while 9% is found in fragments with little or no connectivity. Tropical rainforests and boreal coniferous forests are the least fragmented. Subtropical dry forests and temperate oceanic forests are among the most fragmented. Roughly, 80% of the world's forest area is found in patches larger than 1 million hectares. The remaining 20% is located in more than 34 million patches across the world; the vast majority being less than 1 000 hectares in size. More than 34% of the world's forests are primary native species which are naturally regenerated from native tree species. In such forests there is no visible indication of human activity and the ecological processes are not significantly disturbed.

However, the exploitation of forest is critical. The concern rises due to the fact that population and economy are growing at a rapid pace. These increase pressure on the available forest resources due to increased demand of goods and services from the forests. According to the United Nations, forests cover 31% of the world land. In 2010, there were 4.33 billion hectares but, a decrease to 4.06 billion hectares was recorded in 2020. From 1990 about 420 million hectares have been lost by converting

forest land to other land uses. Forest fires, pests, diseases, invasive species, drought, and adverse weather events are also responsible for the loss of more than 100 million hectares of primary forest. The rate of deforestation annually from 2015 to 2020 was, therefore, estimated to be 10 million hectares compared to 16 million hectares in 1990. This loss justifies the need for sustainable use of forest resources.

Areas which cannot support forest growth;

The polar region: Forests do not grow where the growing season is short or where the ground is often frozen snow or ice covered. There also is limited growth where rainfall is very low to about 255 mm per annum.

The desert region: Desert regions receives very little rain of below 255 mm per annum. The region also has low atmospheric humidity, thin sandy or saline soil. Forests cannot grow in such areas because they need water, and nutrients.

The mountainous region: The upper slopes of mountains are often too cold or lack soil to support trees. These conditions affect the growth of forests.

The temperate and tropical grasslands: Such areas usually support few trees because of dryness or seasonal rhythm of the climate.

Types of forest

In a humid temperate and tropical areas of the world, there are three main types of forests. These types are differentiated by: climatic factors, dominant types of trees, and the type of wood they yield.

Tropical hardwood forests: These include both the evergreen rainforests of equatorial latitudes and the tropical monsoon forests. The climatic condition of the tropical hardwood forests is warm temperature around 27°C and heavy rain fall between 1 015 - 2 030 mm per annum. The majority of trees are broadleaved and they yield valuable hardwoods. Some of tropical trees are noted for their extreme hardwood such as teak, green heat, logwood, ebony, mahogany, and ironwood. These are the main commercial species. The tropical forests have several layers of vegetation which can be divided into three groups. The highest layer is composed of tanger trees which grow up to a height of 46 m (150 ft) and they have huge buttress roots and long straight trunks and they are ideal for timber. The lower layers consist of smaller trees about 9 – 15 m (30-50 ft) as high as palms, shrubs, feins and grasses. They also include bewildering plants that contains varieties of plants such as climbers, creepers, parasitic, and epiphytic plants. In tropical hardwood forests, a wide variety of species are found in one given area. Tropical hardwood forests are found in three main areas:

Latin America: The largest expanse of tropical forests is found in the Amazon basin of Brazil; extending from the Atlantic coast to the foothills of the Andes and from Guiana highlands in the north to the Tropic of Capricorn in the south. Tropical forests are also found on the pacific coast of Colombia and in the Central American countries from Pannonia to Mexico.

Africa: Tropical hardwood forests are found on the lowlands bordering the Gulf of Guinea from Sierra Leone in the west to Cameroun and Gabon in the east and in the Congo basin, especially in the low lands of the Congo and its major distributaries, the Ubangi and Kasai. They are also found in the eastern Malagasy and the coastal plain of tropical East Africa.

South–East Asia and the Indian Sub-continent: Rain forests are found in Malaysia, Indonesia, and Papua New Guinea, and in the coastal lowlands of south and south– East Asia countries.

Equatorial forests: The main characteristic feature of the equatorial forests is that trees often shed their leaves seasonally, but most of the trees retain their leaves for most of the time so that the forest appears evergreen. The main commercial species include teak, ebony green heart, logwood, mahogany, and iron wood.

Monsoon forests: The Monsoon forests have the following characteristics; Trees are deciduous, they shed their leaves in the dry season and produce new ones in the rain season. They are less luxuriant than equatorial forests because of seasonal drought but are characterised by thick undergrowth of shrubs, small trees, and dense thickets of bamboo. Monsoon forests are found in India, Thailand and Indo– China, and in some tropical forest of the northern Australia.

Temperate hardwood forests: The temperate hardwood forests are found between approximately 30^0 and 50^0 N and S, where temperatures and rainfall are moderate but where the seasonality of the climate though marked, is not as extreme as in the coniferous forest belt. The trees are mostly deciduous, shedding their leaves in autumn and remaining leafless throughout the cool winter, and they yield a wide variety of hardwoods.

Like the tropical forests, the temperate deciduous forests have a variety of species scattered irregularly through the forest including many shrubs and small plants. The hardwood, being very durable and strong, it is not usually as heavy or as difficult to work or extract as tropical hardwoods. The chief commercial species are oakash, beech, and poplar. The temperate hardwood forests have suffered greater destruction in the hands of man than any other forests due to the favourable mid latitude climate and the rapid expansion of population in these areas. Because of these factors, forests have been extensively cleared to make way for agriculture, industry, settlement, ship building materials, and fuel wood. The temperate hardwood forests are mainly found in; Northern China (including Manchuria) and Japan, West south and Central Europe, Eastern North America, Southern Australia especially in Tasmania, and Western Australia.

Coniferous forests: Conifers are tall, straight, evergreen trees, with narrow, needle like leaves. Conifers take their name from the cones in which they bear their seeds. They cover a broad belt of land in both North America and Eurasia, to the north of the temperate hardwood belt. They also grow on uplands and mountains or in areas of sandy or porous soil in the milder temperate areas. This is so because they are better adapted

to withstand cold and drought than the broadleaved trees. Most coniferous trees are light softwoods which makes them easier to cut and transport. Though they often grow to a height of 30 m (100 ft) or more, the coniferous trees do not have the wide buttress roots which makes tropical trees, so difficult to fell. The major commercial species are the pines especially the white scots pine and the spices, particularly the Norway spice and Red spice. Coniferous forests are located chiefly in the Northern Hemisphere in a belt between 50° and 70° North. However, there are some conifers too in the Southern hemisphere. The major regions where coniferous forests are found include;

Western North America: The moist maritime climate of Northern California, Washington and Oregon in the USA, British Columbia, Canada, and South Western Alaska contribute to growth of this type of forest. Usually the climate gives rise to a very luxuriant coniferous forest cover on the coastal plains and mountain slopes.

Central and Eastern North America: Coniferous forests extend southwards around the Great lakes and into the Appalachian mountains. The drier continental climate and the thin soil of the Laurentian shield support a less luxuriant and often more scattered type of coniferous forest which contains many valuable species such as red spruce, white pine, jack pine, pitch pine, hemlock, and balsam fir.

Southern USA: The dry sandy soils of many parts of the American South support coniferous forest growth rather than deciduous tree cover, despite the warm moist climate. The longleaf, shortleaf, loblolly and stash pines are found in Virginia and Texas.

Asiatic Russia: Much of northern Siberia, extending in a broad belt from the Urals to the Pacific coast, is forested with conifers. The forests are thinner on the northern and Southern margins where the climate is either too cold or too dry. There are also breaks in the forest where huge marshy or swampy areas intervene.

Northern Europe: The Scandinavian countries like Norway, Sweden, and Finland as well as adjacent areas of Northern Russia, support valuable coniferous forests. The chief trees are the Scots Pino, Norwegian pine, spruces and torches. Many upland areas in the far south such as Northern Britain, the German, and Central European upland and even parts of Italy, support coniferous forests.

Southern Continents: Two major areas of Southern America have coniferous forests. These are the Western coastlands of Southern Chile which is remote, ragged and is thus little exploited, and the Brazilian plateaus which is an important forest area which yields valuable parana pine. The North Island of New Zealand is noted for its Kauri pine. South Africa and Australia have only small areas of natural coniferous forests of local importance.

Lumbering

Lumbering is the extraction of timber from natural and artificial forests. Figure 3.25 shows logs extracted from forest for timber production. There are two

major forest zones where lumbering is conducted. These are tropical lumbering and temperate lumbering.

Figure 3.25: *Logs extracted from forest for timber production*
Source: https://pbs.twimg.com/media/EwMyQw6WEAgHoHr.jpg

Tropical lumbering

Lumbering in tropical forests faces several challenges especially extraction difficulties and lack of accessibility to major markets. The vast forests of the tropical areas are little used due to several difficulties. These are;

Numerous species: The occurrence of different species of timber in a relatively small area, some of which may be far more valuable than others makes the location and extraction of the more valuable trees difficult and expensive. This difficulty is aggravated by the fact that trees do not occur in stands. The understory vegetation and the tangled creepers and undergrowth make access to the desired tree difficult. Finally, the great size of the trees, which may be several feet in diameter, and the great weight of most of the valuable hardwood trees make them extremely difficult to handle, even with modern machinery.

Traditional methods of extraction: In most tropical areas, the volume of logs handled is small because of less use of modern machinery. Where the rate of extraction is small, it is not always viable to employ large extraction plants. The dispersed nature of the valuable trees also inhibits the use of machinery.

Jungle environment: Roads once built, are difficult to maintain because of rapid re-growth of the vegetation. Moreover, the jungle environment is far from being hospitable. The damp hot atmosphere, the presence of insects, pests, and a variety of wild animals such as tigers, lions, buffalos, elephants, and venomous snakes make lumbering difficult. There also is prevalence of a number of unpleasant tropical diseases which discourage the exploration of tropical forests.

Less elastic demand for hardwood: While some of the tropical hardwood species are very valuable and are in demand for constructional purposes as cabinet woods, they are not in demand for pulp and paper making. As yet, pulp making with hardwoods, though possible, is more difficult and expensive. Moreover, tropical hardwoods compete with temperate hardwoods which, though in short supply are both more accessible and more easily extracted. This factor has deterred tropical forest exploitation in the past.

Non-replacement of species: Tropical hardwood trees are large and take a long time to mature. Moreover, the pressing need is for softwoods which can easily be

turned into pulp and paper. Thus, many areas cleared of their original forest, have been replanted not with the original species but with pines and fast growing species of softwoods. This in the long run will make the forests less valuable as they are currently highly priced, cabinet woods and durable constructional woods will be exhausted.

Erosion: Erosion takes place rapidly in tropical regions, where the rainfall is usually very heavy and as soon as the tree cover is removed or thinned. This may impoverish the soil, preventing the re-establishment of the original species.

Shifting cultivation: Many forest areas in the tropics are rendered unsuitable for exploitation by shifting cultivation. The forests may degenerate in terms of species because of periodic burning or may be replaced by lalang grass or other useless vegetation or be exposed to serious soil erosion.

Transportation: The heaviness of the logs and the impenetrability of the forests and generally, underdeveloped nature of the areas, make the removal of felled logs difficult. Lack of communication, small labour supply and lack of basic local markets hinder development of tropical forests. In many areas, transportation of logs is by water which is relatively cheap than other means of transportation.

Access to markets: Most of the temperate hardwood and softwood forests are located close to major industrial areas and population centers especially in the Eastern USA and Canada. On the other hand, most tropical forests are situated in sparsely populated areas in countries which have relatively little industrial development. Thus, there are no local markets to encourage the exploitation of tropical timber resources. At the same time, the tropical areas are distant from the consuming countries which necessitates transport costs to be added to the high cost of extraction when timber is exported.

Temperate lumbering

Lumbering in the temperate forests is generally better developed than in tropical areas due to the following factors:

Stands of timber: Presence of considerable stands of a single species makes it easier to locate and extract the valuable types of timber. Lack of dense undergrowth in coniferous forests is also an advantage and lack of buttress roots makes it possible to cut trees at ground level.

Mechanical extraction: The great demand for timber has stimulated the modernisation of forestry and a wide range of machinery is now used including power saws, tractors, and other heavy plants for transporting logs, stripping branches, and propelling the logs on water.

Living conditions: The replanting and re-using of forest areas and advancement towards "tree farming" have led to the development of settled communities of forest workers. Thus, lumbermen do not have to face the hardships of the past as their way of life has became attractive as that of lumbermen in the tropics. For example, in Scandinavia, forests are owned as part of mixed farms and trees and are treated as a crop by settled farmers in those countries.

Steady demand for timber: The demand for softwoods is continually expanding. Conifers are the chief source of cellulose for paper industry and trees of lower quality, which cannot be used for paper, can be pulped for use as fiberboards or particle boards. Cellulose is also used in the synthetic textile industries. Moreover, major coniferous trees (forests) are located in or near areas which form the largest markets for pulp and paper products. At the same time traditional use of softwoods for constructional industries and for furniture are still important in spite of a greater use of alternative materials.

Transportation: Harmonised plant growth, relative lightless of the logs, and the ability to clear a fairly large area at once, make timber extraction in coniferous forests easier than in the tropical forests. Moreover, logs can be dragged easily over the seasonally frozen ground and can be floated down stream to pulp or sawmills.

Access to market: Almost all the coniferous forests are near major industrial areas where timber, paper and pulp products are all on constant demand. In some countries, such as Sweden, Finland or Canada, lumbering is a major activity and timber supply exceed domestic demand. Moreover, markets in Britain and in other European countries with little natural forest are easily accessible. On top of all these, much of the timber trade between advanced countries is carried out in the form of pulp and papers which are more easily transported than logs.

Factors affecting the location of the pulp and paper industry

Pulp and paper, especially newsprint, are usually manufactured in very large integrated mills, and through a process which is normally long. Pulp making is basically raw material oriented while paper making is more market oriented. The large integrated mills are found mostly in USA and Canada, where closeness of the forests to major population centres and good transport networks produce ideal conditions. The main requirements for pulp and paper production are:

Location of pulpmills: Pulp mills should be located as near as possible to the forests because this minimises the difficulties of transporting bulky logs. A river side site is ideal because the logs can be floated direct to the mill.

Water: To make a tonne of newsprint, about 100 tons of water are needed, and since it is essential to maintain a copious production, vast quantities of clear, chemical free, fresh water must be available. Most mills must, therefore, be sited on large rivers and in areas where pollution is negligible.

Power: A tone of newsprint may require about 2 000 kilowatt hours of electricity to produce, thus the need for sufficient power supply. Making HEP sites on the rivers could prove very advantageous. It is on this basis that enormous power potential of many Canadian rivers has been tapped to power the pulp mills. Moreover, coal, oil, natural gas and waste wood are used in some areas to fuel the

mills. The power is needed for heating and drying purposes as well as for driving the machinery.

Transport: Locating paper industry near raw-material sources minimizes the cost of transporting the logs. Due to this reason, mills are usually situated near rubber banks and sea coasts where logs can be floated to reach the sea and where paper or pulp can be loaded on ships for export.

Labour: Pulp and paper mills are highly mechanized thus, they require little man power. They can, therefore, be located in remote regions without experiencing labour shortage.

Capital: The capital intensive nature of the industry in terms of specialized and sophisticated machinery means that huge capital has to be raised to start pulp and paper mills or to modernize existing plants. This means the larger the mill, the greater the economies of scale but the huge the initial costs. Many small mills especially in Europe are, therefore facing difficulties: including staff competition and uneconomic production.

Factors accelerating deforestation and desertification

For thousands of years incidences of fire have been gradually diminishing the world's forest resources in various ways. Forest fires have been occurring due to natural causes such as spontaneous dry weather and lightening and due to human activities such as agriculture, honey harvesting and charcoal making. Other activities causing deforestation include shifting cultivation, pastoralism, tourism and construction of human settlements.

Forest destruction was also experienced in the 19th century when more wood was needed for railways construction. The coal mining industry consumed millions of logs as pit props. Demand of growing population and mechanization made forest exploitation both quicker and easier and commercial. For example, the carving industry dominated by the Makonde in Tanzania has increased the demand of forest products including *hymenaea verrucosa* (Mpingo) tree.

Apart from cutting of trees for various human activities such as agriculture, settlement, uses of firewood and charcoal and industrial raw materials for commercial purposes, there are other factors which accelerate the situation s

These are;

Low rate of replanting trees: This is due to the length of time taken for a tree to mature. For example, it takes between 50-70 50-200 years, for coniferous forest to produce hardwood tropical forests. Therefore, many people are discouraged by the fact that, they themselves cannot quickly benefit from planting the trees.

Poor supervision by the government: Despite the normal government control, developing countries experience lack of communication, difficult terrains, and remoteness of many forest areas, which make it very difficult to adequately supervise forest and protect them from being destroyed by shifting cultivators,

and harvesters who are after tree, fuel, honey, and timber.

Little forest research: There has been little research on erosional problems in tropical regions. Thus it is more difficult to know what conditions to impose on timber operators. Alternatively, country based policies and regulatory frameworks may be used as key sources of information in specific contexts.

Effects of deforestation

Treatment of forests as inexhaustible resources has raised many ecological problems. Deforestation has led to soil erosion hence the formation of gullies and occurrence of landslides. Flood and navigation problems have also been occurring, whereby soil removed from the land leads to siltation in the riverbeds, a situation which reduces the possibility of navigation. Climate change has also been experienced whereby, prolonged droughts and unchecked soil erosion turn some areas into semi deserts or deserts, such as, parts of north-west Africa which advances to the Sahara desert. There is also an effect on the hydrological cycle. The solar radiation heats the land directly due to the absence of forest cover and dries up the springs, streams, rivers and swamps. Furthermore, insects like bees and other species that inhabit the forests migrate causing scarcity of forest products such as honey. There is also destruction of biodiversity resulting from the use of fire to clear forests which affect all insects, animals and micro organisms which dwell in forests.

Scarcity and shortage of timber, firewood and charcoal is also experienced and it has affected various sectors. A good example of this effect is seen at household level where girls and women in some parts have to walk long distances looking for firewood.

Forest conservation and management

To ensure that forests are sustainable and the current use does not affect its sustainability, various conservation strategies need to be promoted. These include:

Afforestation: Nowadays forests felled for timber are almost always replanted with tree seedlings. In Germany, for instance, every tree cut, must be replaced by a new tree. This has dual advantage of ensuring timber supply and protecting the soil. In Tanzania, similar programmes and regulations must also be enforced and run to protect the forest ecosystem in various parts of the country.

Improved cutting practices: Forests stand a better chance of regeneration and survival, if cutting is selective, that is, if only mature trees or weak or diseased trees are removed. This will ensure that enough trees are left to prevent soil erosion and regeneration of species.

Forest protection: Both, natural and planted forests must be protected from natural hazards such as fires and pests. The best protection mechanism against fires to have a close system of surveillance and air patrol. Similar techniques have proven to be useful in USA and Canada. Insects and diseases must also be fought by regular inspection of forests and should be sprayed with insecticides to prevent the spread of pests.

Reduction of wastage: Another way in which timber shortages and forest conservation can be tackled is by reducing wastage in industrial plants. For example, the use of pulp which is not suitable for paper to make fibre and particle board for construction purpose and reuse of waste paper in the production of newsprint and other inferior paper products, should be encouraged. On the other hand, a great use of plastics rather than paper and cardboard for packaging purposes would ease the pressure on forests. Another way in which wastage could be reduced is by using trees more intensively. For instance, hemlock that is currently used exclusively as timber, could also be used to extract tannin from the bark. Similarly, quebracho, which is used to extract tannin, could also be widely used as a source of hardwood.

Controlled forest harvest: Controlled harvesting of forest resources has been introduced to prevent cutting down of trees. This is to encourage preservation of forests for sustainable use. Other measures taken include a change from exportation to importation of forest products, and introduction of soil conservation projects. In addition to that, there are programs for opening of new forest estates, training of foresters and game warden and establishment of game and forest reserves where hunting and harvesting of tree is completely restricted.

Awareness creation: Educating people through mass media such as radio, television programme, public meetings, lectures in schools and in other learning institutions on proper use of forests may significantly reduce human induced forests problems.

Use of alternative sources of energy: Community should be encouraged to use alternative energy sources such as solar energy and biogas to reduce negative impacts on forests. This can be done by reducing the cost of alternative energy sources.

Case studies

Forest Conservation and Management in East Africa

Forest guards have been trained at various colleges including Olmotonyi in Tanzania, Lordreani in Nakuru Kenya and Uganda forestry school. For instance, in Tanzania great forestation programmes with fuel species, mainly eucalyptus are being carried out in various parts of the country such as Iringa, Tabora, Shinyanga, Dodoma, Usambara and Kilimanjaro. Under the monitoring of local government, each family is required to plant a certain number of trees.

Furthermore, large plantations stocked with tree species suitable for pulp and paper making have been planted in many parts of Mufindi district, Kilimanjaro, and Tanga regions. Apart from that, the black wattle for Tannin extraction has been grown in Njombe and Kilimanjaro. In Kenya, new plantations are established mainly in Kikuyu highland while in Uganda, most of the timber plantations are mainly confined to the high and more temperate areas in the Northern and Western parts of the country. It is also believed that much waste could be avoided if forests could be under state control.

Timber in Gabon

Gabon is a country which is found in equatorial Africa. It borders Cameroon in the North, Congo in the East and the Atlantic Ocean in the West. A large part of the country is covered by tropical rainforest hence, one of the major occupations is lumbering. Chief species include okoume (for producing plywood and veneers) ebony and mahogany. Timber production is mainly undertaken by European companies and transportation is possible due to the presence of river Ogowe which runs through the forest to the industrial processing center.

Factors accelerating the development of timber industry

Factors which accelerated development of the timber industry in Gabon include; Good climate as the area receives very high rainfall which in turn maintains forest health status. Availability of capital due to the fact that most of timber companies are financed by Europeans. There is easy transport of logs through river Ogowe and railway line. There is also the presence of local and international markets there is a. There is a friendly support from the government and a good number of skilled and unskilled labour from different parts of Africa and worldwide.

Importance of timber to Gabon

Forest industry is very vital to the economy of Gabon due to the fact that it contributes to the country's earning foreign currency and encourages development of other sectors such as transport, communication, mining industry, and agriculture. The sector provides opportunities for employment to the citizens of Gabon. Timber has also stimulated the development of towns, cities, and ports such as Owendo port city which also contributes to the diversification of the economy. Timber helps also to stimulate oil industry which is the major sector in Gabon and the two sectors have jointly improved the economy of Gabon.

Challenges facing timber industry in Gabon

Gabon, like other countries with timber industries is subjected to many challenges such as deforestation, inadequate local market, transport problems due to equatorial rain and stiff competition from other major producers like Canada as well as fluctuation of prices in the world market.

Timber production in Tanzania

Tanzania has 1 863 623 hectares of forest reserves of which, 1 085 306 hectares are under public management. Local communities are directly involved in sustainable forest management and tree planting. Figure 3.26 shows the forest reserves in Tanzania.

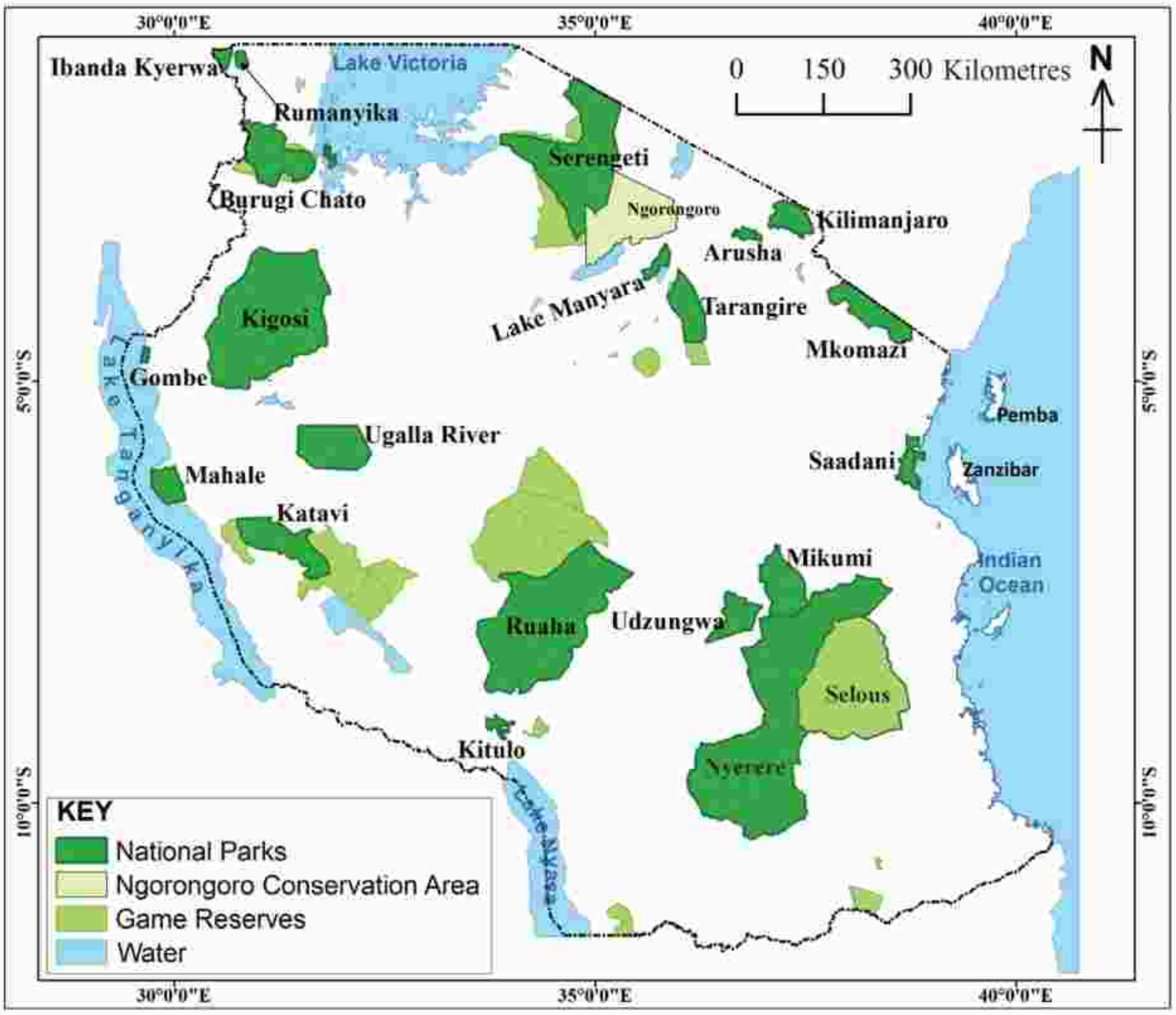

Figure 3.26: *Tanzania forest reserve areas*

Forest distribution in Tanzania

A small part of Tanzania is covered by forests, especially those areas which receive high rainfall such as Kilimanjaro, Lushoto, Iringa, and parts of Mbeya. Moreover, almost half of the country is covered by Miombo woodland such *as pterocarpus periocopsis, angolensis,* acacia among the hardwood species. Softwood species are black wattle, cypress and eucalyptus. The other part of Tanzania which is covered by forest is along the eastern coast. The coastal land is dominated by mangrove forests which contain species such as *Avicennia marina, Bruguiera gymnorrhiza, Ceriops tagal, Heritiera littoralis, Lumnitzera racemosa, Rhizophora mucronata, Sonneratia alba, Xylocorpus granatum, and Xylocorpus molluccensis*.

The distribution of forests in Tanzania can be looked at in two categories depending on the types of wood. These are hardwood forests and softwood forests. Hardwood forests are found in Mtibwa, Lunguza, Loliondo, and Kwamkoro forests while softwood forests are found in Matogoro, Rubya, Buhindi and Rubare forests. However, there are places in Tanzania where both hard and soft wood forests are found. These include Meru, West Kilimanjaro, Usa river, Sao hill, Magamba,

Kiwira, Ruvu, Shume, Kawetere, Rindo and Ukaguru.

Challenges facing timber industry in Tanzania

Timber industry in Tanzania faces various challenges such as low capital due to lack of serious investment in the industry, poor transport and communication system, inadequate supervision by the government, low level of extraction technology, high rate of deforestation and shortage of soft wood which are highly marketable.

Significance of lumbering activities in Tanzania

Lumbering, as a human occupation, has several advantages to the people and the country as a whole. These include employment opportunities through lumbering activities, forests, and industries. It is a source of foreign currency when products are sold outside the country. Income obtained by the government through charging taxes is channeled to infrastructure development. Lumbering also contributes to the development of other sectors such as furniture making, construction industry, as well as agricultural sector.

Lumbering plays a very crucial role in expanding electricity power network by serving as a source of electrical poles. It also capacitates local people whose livelihood depends on fishing activities by providing them with boats, dhows or canoes making raw materials.

Lumbering also contributes in paper making industry and it also promotes tourism through selling of traditional carvings by Makonde people which depends on forest for raw materials. Due to these opportunities and significance, forest resources and lumbering activities provide and trigger transportation and development of private sector.

Exercise 3.7

1. Using examples from Tanzania, explain the economic importance of forests.
2. What are the ecological functions of forests?
3. Account for the slow development of timber industry in Tanzania.
4. Discuss five major causes of forest degradation.
5. Describe four forest conservation methods practiced in Tanzania.
6. Explain five major factors that determine the global distribution of forests?
7. With examples, explain the role of timber and non-timber forest products.
8. Examine the problems that face timber industry in Tanzania and suggest the possible solutions.
9. Discuss different ways of managing forest resources sustainably in Tanzania.

Activity 3.11

Visit a nearby village or street and do the following;

(a) Identify forest energy products used by the surrounding community.

(b) Identify ways used to sustain the use of forest energy sources

(c) Recommend how the forest energy source(s) used can be improved

Activity 3.12

Describe the existing regulatory measures on forest management in Tanzania.

Activity 3.13

Draw a map of Tanzania and indicate the main forest reserves.

Sustainable fishing

Fishing industry refers to the process that involves extraction of fish and other aquatic animals and processing them for final consumption. Sustainable fishing refers to the process of proper harvesting of fish to ensure that the current use does not affect future use. Fish are a vital source of protein. Population growth over the world increases the demand for fish resources. These facts call for sustainable use of fish. It must be noted that fish and other marine animals are an inexhaustible resources.

There are different contexts where fishing is carried out. The inland catch or fresh water fisheries; including streams, rivers, swaps dams, lakes and ponds, and the marine catch or marine water fisheries including oceans and seas. As fish from different areas are being extracted, many factors affect their productivity. These include the depth of water, ocean currents, temperature, and salinity. By using speedy, highly powered boats, and extremely efficient and harmful weapons for harvesting fish, many parts of the world are facing a great decline. We need to adopt proper ways of fishing to benefit the present and the future generation and to conserve the environment as well. It is also wise to introduce aquaculture and mariculture projects to increase the quantity of fish. Aquaculture is a process where fish are produced in a controlled environment (fish farming). Mariculture is practiced in marine environment in enclosed section of the open ocean.

Factors affecting fishing

Fishing is determined by essential conditions which allow the survival of fish and the undertaking of fishing activity. These conditions include: existence of a continental shelf that provides shallow water and fish food (plankton), presence of long indented coastline to provide fishing grounds and sheltered harbours, presence of diversity of fish species to allow sustainability of the sector, availability of good transport and communication infrastructures such as advanced ports

and roads to allow the practice of modern fishing. Presence of strong support from the government, for example, training of experts, availability of markets in urban and rural areas, to promote fishing and lastly availability of power in fish processing factories for preservation of fishes and petroleum and gas for running fishing vessels are imperative for development of the sector.

Distribution of major fishing grounds of the world

Fishing is conducted along all coastlines, lakes, and in other fresh water sources. Currently, the principal fishing grounds of the world are located on the plankton rich bark of the continental shelves,and in cold and temperate waters of the northern hemisphere. There are 16 major fishing regions in the world; six in the Atlantic, six in the Pacific, two in the Indian ocean, one in the Mediterranean and one in the Antarctic as shown in Figure 3.27. Areas with the largest yields are found in the Pacific: Northwest and Asia's inland waterways. The top producers of fish are China, Indonesia, Peru, India, the Russian Federation, the United States of America and Vietnam. China contributes one-third of the world's yield of fish. In 2018, it accounted for almost 50% of the total global fish production.

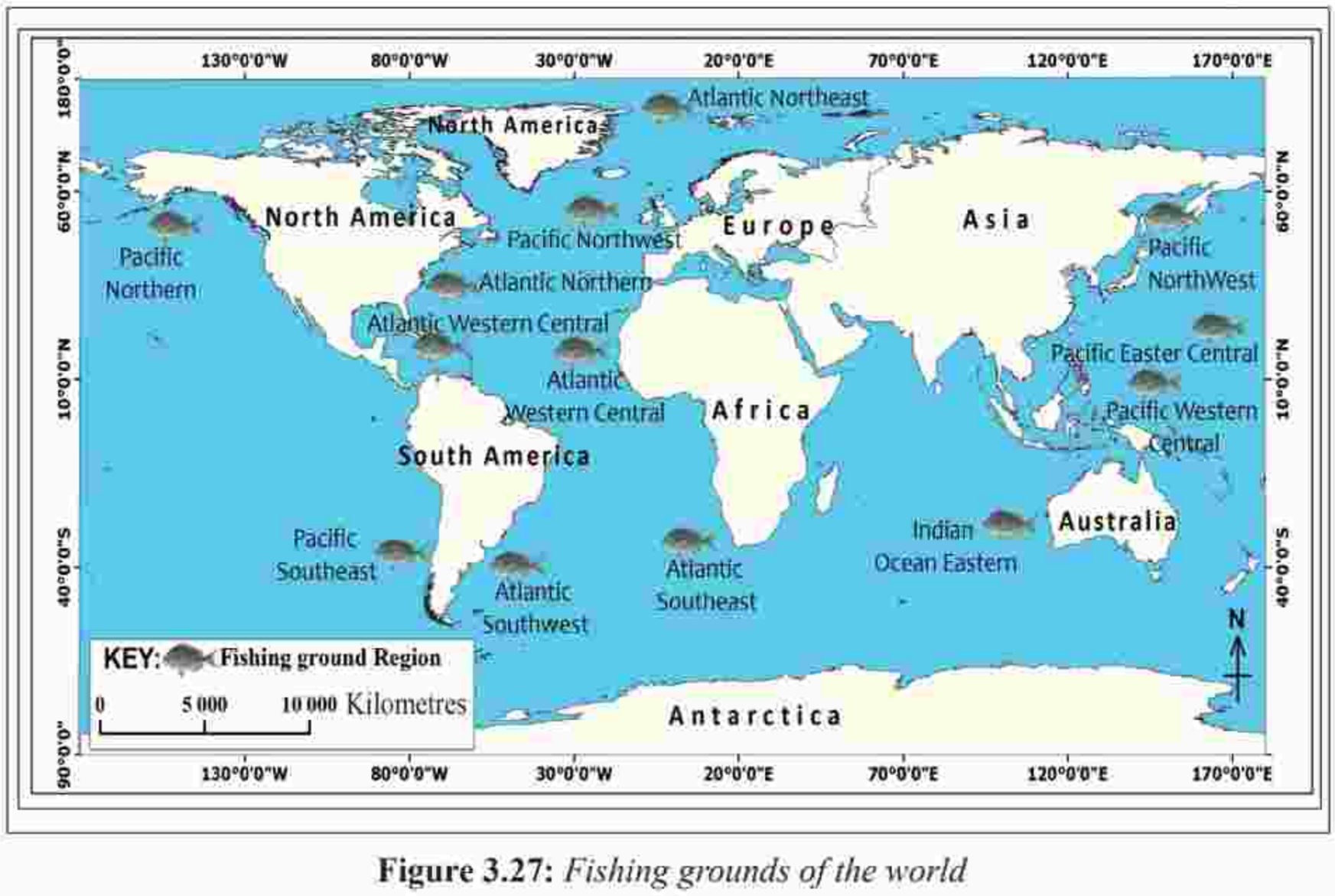

Figure 3.27: *Fishing grounds of the world*

Source: Rubenstein (2020)

The Atlantic fishing grounds

In this zone, there is the North West Atlantic ground. This is found on the North Eastern coast of North America and stretches from Canada to New England States. For example, Canadian province of Quebec lies within the fishing ground. North East Atlantic (North West Europe) starts from Iberian Peninsula (Portugal and Spain) and stretches northwards through

the North sea and the English channel to the Atlantic ocean. It covers the coasts of France, Germany, Denmark, Britain, Norway, Finland, and Southern Atlantic ocean. Other fishing grounds includes the Namibian coast (South West Africa). This covers the coasts of Namibia and Cape Province of South Africa, and the ground regions with presence of Benquela cold currents. Others area is the coast of Mauritania in the North West Africa.

The Pacific fishing grounds

It is found in the west coast of North America from Alaska, and southward through the British Columbia province in Canada, Washington, Oregon and California. For example, Cold California currents in North West pacific (north East Asia) stretches from the bearing strait southward up to the South Asia sea. The stretch comprises the fishing grounds of Russia, Japan, China Malaysia, and Indonesia. These form the world's largest fishing grounds.

Factors for the development of fishing in the pacific fishing grounds

Natural and man made factors influence fishing in the area. The cold Kamchatka and the warm Kuro siwo currents converge on these grounds. The warm current raises the temperatures, thus making the coast ice-free for most of the year. The cold current makes temperatures low and this favours the flourishing of plankton. Moreover, the densely populated countries of China, Japan, and Taiwan provide a ready market for the fish. Advanced technology in the area especially in Japan, such as the use of modern ocean vessels has encouraged the development of fishing industry. On the other hand, the numerous islands within the North Asia coast form good shelters for the breeding of fish while the extensive continental shelf favours the shining of several types of plankton.

Contribution of fishing to social and economic development

Employment: Fishing is a source of employment that includes self-employment as fishermen, employment in fishing companies; employment in fish processing and packing industries as well as in fishing related industries such as fish nets and hooks and fertiliser industries. The number of people engaging in the fishing industry and aquaculture varies by region. Currently, the highest number is recorded in Asia (85% of the world total), followed by Africa (9%), the Americas (4%) and Europe and Oceania (1% each). In 2018, it was estimated that 59.51 million people were engaged in the primary sector of fisheries and aquaculture in which, about 20.53 million people were employed in aquaculture and 38.98 million in fisheries with women accounting for 14 percent. The industry also creates numerous job opportunities to people living near the fishing areas who are not necessarily engaged in the fishing industry v directly. A good example is men and women who are attached to the fish value chain.

Source of food: Fish is food and provides important proteins. Seafood accounts for only 1% of all calories consumed by human beings and about 85% of captured fish is consumed directly by humans beings. In the past half-century, per capita consumption of fish had nearly

doubled in both developed and developing countries. For example, from 1960 to 2016, fish consumption increased from 27 million metric tons to 141 million metric tons. Currently, research shows the rate of fish food consumption has increased significantly. From 1961–2017, the average annual growth rate of total fish consumption was 3.1% , while the annual population growth rate was 1.6%. This is an indication that the demand for fish will continue, which calls for sustainable fishing management. High demand is also a potential indicator for overfishing and at the same time an opportunity to expand aquaculture or fish-farming. In Tanzania, fish forms a major dish in areas that are closer to fishing grounds such as in Lake Victoria region, Lake Nyasa, Rukwa, Lake Tanganyika, the Indian ocean, Mtera, and Nyumba ya Mungu dams.

Enhances industrial development: Fish processing industries are evolving in many countries. There is an increase in fish processing activities within the industry, which is a sign of expansion. For example, there is simple gutting, heading or slicing as well as more advanced value-addition such as breading, cooking and quick-freezing, depending on the commodity and market value. These have also increased the production of simple to sophisticated equipments (ships and boats). Other related industries such as fish nets and hooks, pharmaceuticals, fertiliser, animal feeds as well as fish research have been positively affected.

Source of medicine and oil: Fish provides some medicines and cooking oil. Nile perch fish is used for producing cold liver oil which alleviates chest problems. Other fish such as crustaceans are used as bioactive molecules for pharmaceutical industry while Chitin and Chitosan are used for water treatment and in the manufacturing of cosmetics, toiletries, food and beverages, agrochemicals, and pharmaceuticals.

Development of transport systems: Fishing industry has led to the development of feeder roads; connecting fishing areas and markets. Transport infrastructure such as roads are developed and connected with ports and other fishing areas for transportation of fish and people.

Source of various goods: Whale oil is currently used in the manufacturing of soap, margarine, paints, ink, linoleum, cosmetics, and perfumes. Before the discovery of oil, whale oil was the chief cap fuel and lubricant. Bones and fish meats are also used for making fertilisers.

Fishing methods

Various methods are used in catching fish but the most common methods used by commercial fish vessels include, nets by lines and traps. These methods are used for near surface breed such as herring, mackerel, pilchard, and tuna, and they are called pelagic.

Trapping

This is a fishing method, whereby boats called trawlers drag a large bag like net on the sea bottom to catch fish. Trapping is suitable for ocean fishing as shown in Figure 3.28.

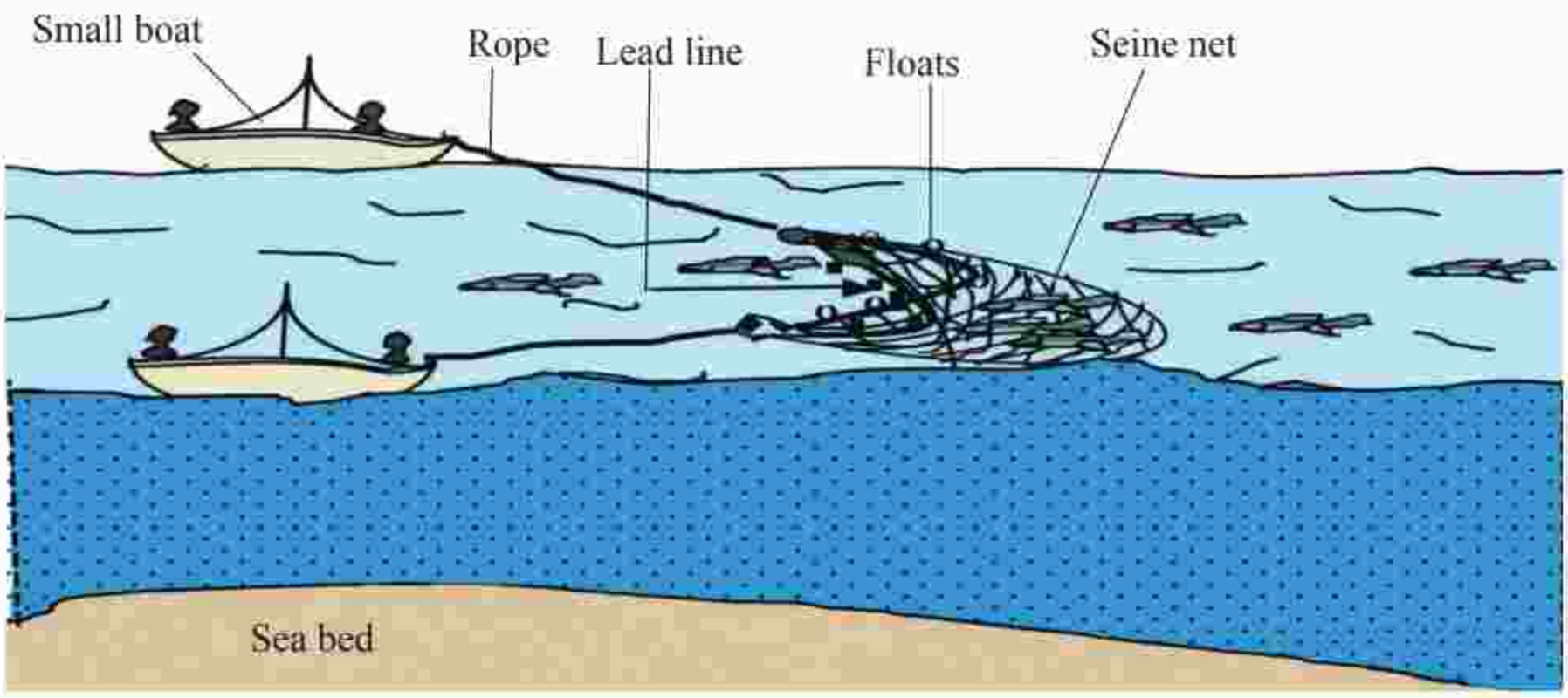

Figure 3.28 *Fish trapping*

Drifting

It is a method of hanging nets to catch fish. This is a traditional method used to capture small fish. It is also used with drift nets attached to a boat called drifters. Figure 3.29 is an example of drifting method.

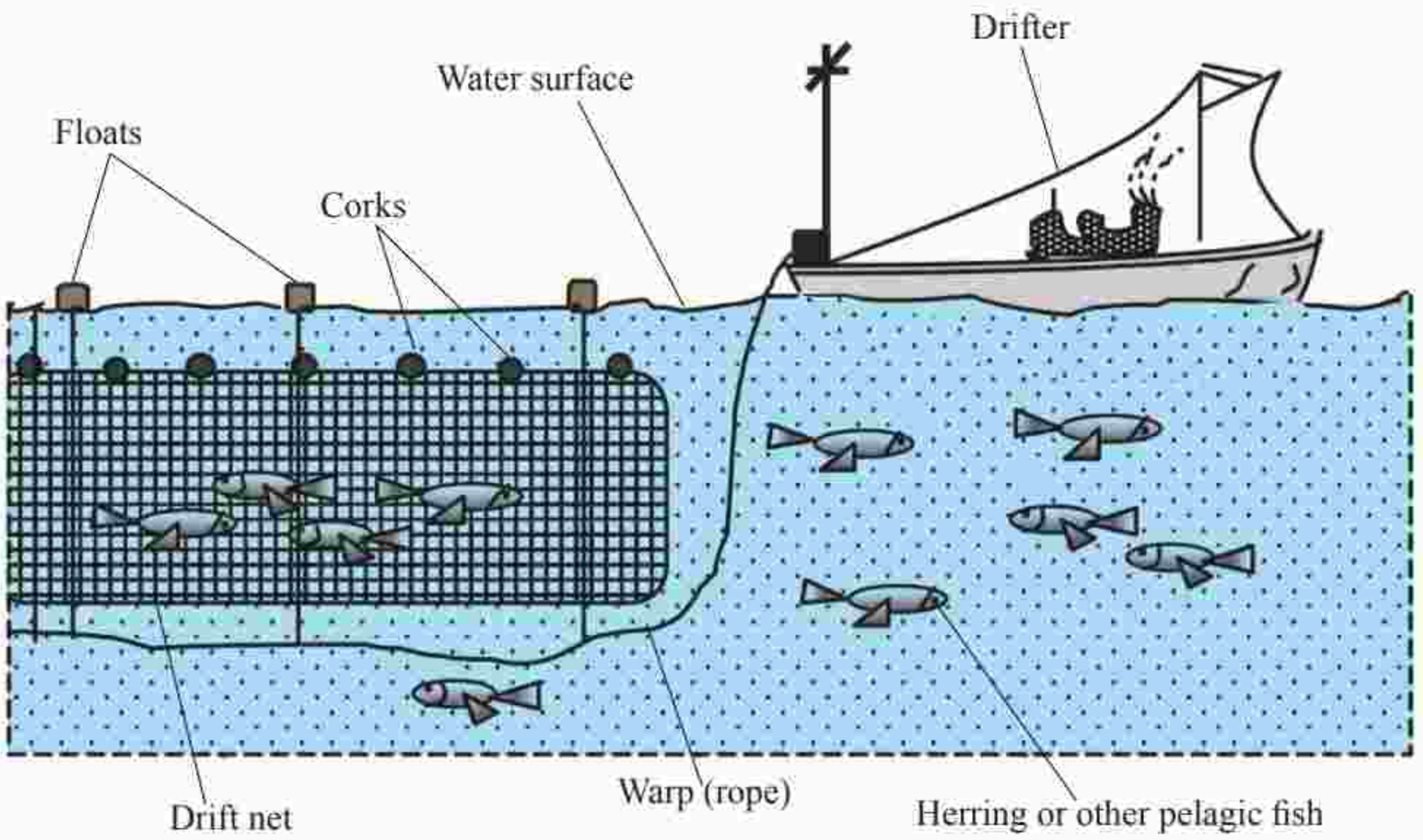

Figure 3.29: *fishing by drifting*

Line fishing: This is a method of catching fish by using fish boat with long lines having several hooks on them.

Seining: Seining (for pelagic fish) uses nets called seiners which encircle a shoal with a net whose bottom edge is held down and tightly by weights and its top edge floats to allow it to catch fish such as sardines. The nets are sometimes stretched between two fishing boats. Apart from using fishing boats, there are large fishing

ships which are used in deep sea and they are more modernised.

Harpooning whale: This method is used to catch blue whales, sealing whale and sperm whales using a harpoon fired from guns. After the catching, huge bodies of fish are dragged on board factory ship to be processed.

There are also some traditional methods of fishing including interposing by using spear, basket fishing that uses a basket in shallow water to catch shrimps, lobsters and crabs, the use of barricades in flood plain areas, and lastly, hand lines which is the oldest method of all used in shallow and calm water.

Fish processing and preservation

Fish preservation and processing techniques are needed to prevent fish spoilage (decay) and lengthen shelf life. There are two methods of preserving and processing fish which are traditional and modern. The most popular traditional methods are smocking, sun drying, and salting, while the modern methods include packing in ice, deep freesing, and canning.

Fishing in Tanzania

Tanzania is one among the countries endowed with fisheries in Africa. It is ranked in the top 10 countries in terms of total fisheries production. The fishery in Tanzania is both artisanal and commercial. The artisanal fishery consists of fishing in all the freshwater bodies including lakes, rivers, dams, ponds, wetlands as well as fishing for finfish in the territorial waters in the Indian Ocean. Commercial fishery is composed of prawn fishing in territorial sea water. Aquaculture is still evolving from subsistence to commercial level and is led mainly by the private sector.

Tanzania is endowed with significant water bodies which include oceans, lakes and rivers. All these play a big role to the economy in terms of fishing and associated activities. It has both marine and inland fisheries potential. Fisheries contribute about one third of animal protein or 30% of the total intake to the Tanzanian population. Marine fishing contributes 13% of the total fish caught mostly in the Indian Ocean. Major inland fishing grounds include Lake Victoria, Tanganyika, Nyasa, and Rukwa. Other small scale fishing grounds are dams such as Mtera and Nyumba ya Mungu. Fishing is also taking place in rivers. Tanzania is the leading fishing country in East Africa with a current estimation of 14 100 fresh water ponds scattered across the mainland.

Fishing in Lake Victoria

As a fishing ground, lake Victoria contains tilapia, Nile Perch, and other seafood like sardines.

Factors which facilitate fishing in Lake Victoria

Fishing boats are large and they carry large stocks of fish. Large boats enable the fishermen to sail into the deep parts of the lake where they are assured of a large haul. The neighborhood of the lake is densely populated with large towns and a city inluding Bukoba, Musoma, Geita ,and Mwanza which provide a ready market and processing facilities for fish.

Challenges facing fishing in Lake Victoria

Fishing in lake Victoria is affected by lack of a well-developed transport network and limited marketing of the fish in inland towns. Another challenge is associated with low skills on modern fishing methods and shortage of modern fishing gears for most of the fishermen. Moreover, most of the fishermen lack capital to purchase modern equipments for fishing. Water pollution, use of poor and unwanted fishing gear and inadequate patrol along the lake also affect sustainability of the resource.

Fishing in lake Tanganyika

Being a rift valley lake, it is deep and contains a lot of fish resources, making it the richest in Tanzania. Fishing is conducted by traditional methods by people living around the lake.

Types of fish found in Lake Tanganyika

The main types of fish are sardines, bathybarus, bathybates and ectodin which live in shoals. They are caught usually at night when attracted to light using special nets with small meshes.

Methods of processing

Some of the fish is smoked or dried and exported to Zambia. This earns the country a substantial amount of revenue.

Challenges facing fishing in Lake Tanganyika

The rough storms discourage fishermen from going far into the lake, thus fishing is concentrated along the shore. The sparse population around the lake does not offer readily available market. Markets are, therefore, sought in neighbouring countries such as Burundi, Zambia and Democratic Republic of Congo. Other challenges include poor equipment used in fishing, low capital for fishermen and low skills on modern fishing practices as well as occurrence of waterborne diseases.

Fishing in Lakes Nyasa, Rukwa and in rivers

Lake Nyasa, lake Rukwa and some rivers are other common fishing grounds in Tanzania. Big rivers like Rufiji, Ruvuma, Malagarasi, Kagera, and Mara also provide opportunities for some fishing activities. Fishing activities in these water bodies support some local and foreign demands. Nevertheless, fishing is operated at small scale in these areas

Efforts to improve fishing industry in Tanzania

The government of Tanzania has attempted to ensure that the industry is, both, sustainable and successfully. To this end, the government, has established the Ministry of Livestock and Fisheries as part of its efforts to manage the sector.

Establishment of colleges and universities related to the fishing industry: There has been an establishment of institutions dealing with fishery related activities whose main task is to train people and experts in the area. These include Sokoine University of Agriculture, the Colleges of Agricultural Science and Fisheries Technology at the University of Dar es Salaam, Nyegezi and Mbegani Fisheries institutions and Tanzania Fishery Research

Institute (TAFIRI) which was established for the same purpose.

Establishment of fish processing industries: Fish processing industries like Tanzania Fisheries Cooperation (TAFICO) and many in Mwanza and Musoma have been established. They all contribute in empowering fish processing activities.

Promotion of fishermen cooperative societies: Efforts to encourage fishermen to establish fishing cooperatives are being made. This aims at fostering market accessibility and sharing of fishing practices. Promotion of loan accessibility among small-scale fishermen is done by the government. This is done by encouraging the establishment of fishing community associations and self-help groups (SHGs). It is through these groups that fishermen can access loans.

Establishment of regulations and by-laws: Tanzania has introduced some regulations to guide fishing practices. These include protection of fishing grounds and restriction of destructive methods of fishing such as the use of dynamites, poisonous materials, and fishing nets with small mesh.

Research on fishing: The government has been undertaking various studies on new fish species like Nile perch in Lake Victoria. Studies on conservation of water bodies and fish census are also being conducted.

Management programs: The government initiated various environmental management programmes such as Lake Victoria Environmental Management Project (LVEMP) in 1996. Other initiatives include planting trees and containing sewage from urban areas.

Challenges facing fishing industry in Tanzania

The fishing industry in Tanzania encounters various challenges. The first challenge is the influence of ocean currents such as the Mozambique warm current which affects fishing. The second challenge is lack of sophisticated fishing equipment and storage facilities hence the sector is mainly dominated by artisanal fishing. There is also a challenge of insufficient capital for fishermen which has been prevalent in the country's fishing industry for so long. Another challenge is low skills for most of fishermen which hinders them to engage in modern fishing.

Challenges associated with fishing in East Africa

Tanzania and other East African countries have a lot of potentials for fishing. Unfortunately, several challenges have to be overcome to exploit the potentials of fishing. Among them is limited market size which is also not very reliable. Insufficient capital for many small scale holders' fishermen also affects productivity in the sector. Moreover, there is the use of simple and traditional tools and sometimes illegal methods of fishing. Inadequate modern processing and preservation facilities cause some fish caught to decay before reaching the market.

Additionally, most of the fishermen use traditional processing methods such as

smoking and sun drying. There is also inadequate infrastructure in most fishing areas, which affect transportation and processing of fish. Furthermore, some fishermen use nets with small mash, poison and dynamite which affect breeding of fish by catching juvenile fish as well as destroying fish eggs. Another challenge is pirate fishing where large fishing vessels illegally exploit marine resources including fish.

Strategies to address the challenges in the fishing industry

To ensure that fishing is sustainable, various strategies need to be adoptedp; First, there should be an implementation of fishing policy to restrict overfishing. Second, there is a need to register fishing vessels and fishing companies. This will help to solve the problem of pirate fishing. Third, improve fishing techniques from traditional to modern which should go hand in hand with capacity building to fishermen on the use of modern fishing equipment. Fourth, control of water pollution through law enforcement. These laws should target control of industrial chemical wastes, oil spills from ocean vessels and disposal of sewage. Fifth, the government should improve infrastructure to connect fish regions with markets. Sixth, government should seek both internal and external markets and reduce taxes on fish markets. Seventh, capacity building to fishing research institutes should be done. This will enable them to undertake research on preservations, breeding, marketing and value addition for fish. Lastly, access to loans for small-scale fishermen should be improved.

Fishing in Russia

Russia is famous for the fish industry. There are several factors of interest to learn from Russia. Large amounts of fish caught in Russian constitute Salmon from Kuriles, Sakhalin and Kumchatka. Others are Pollach, Tuna, Sardine cod, Mackerels sharks, and Whales. Russia is the leading whaling nation in the world and it is placed in the ninth position among the leading fishing nations. Russia also has access to three oceans (the Pacific, Arctic, and the Atlantic) and 12 seas. The offshore waters of Russia are reserved for commercial fishing. However, Russia, however was restricted to catch fish on the Japanese border in the Pacific Ocean. The agreement of High Sea Fisheries of the North West Pacific Ocean was made with Japan to restrict the freedom of open water fishing.

Factors for successful fishing industry in Russia

Fishing industry has succeeded in Russia because the government has been expanding fishing grounds. Moreover a lot of investment has been made on processing and marketing of fish products. Russia has a long coastline that supports fishing activities. There are also many fish varieties as a result of good cool waters in the ocean. Another reason is the availability of markets within and outside the country. Due to an increase in population, fish market is available. The use of advanced technology in fish process also contributes to the success of fishing industry in Russia where modern machine and large ships are used for deep sea fishing.

Fish farming (Aquaculture)

Fish farming refers to the rearing of fish in ponds, tanks or cages. Fish farming may be practiced in a form of aquaculture or mariculture. The former involves fish farming in fresh water while the later refers to fish farming that is practiced in enclosed section of the open ocean or sea.

Location

Fish ponds are built in areas with heavy clay or loamy soil, which are usually impervious. They may also be constructed in areas near rivers but unsuitable for growing crops or unsuitable for other land uses. Ponds can also be built using concrete. Fish can also be kept in cages. Cage fish farming involves the growing of fish in existing water resources while being enclosed in net cage which allow cage flow of water.

Characteristics of the ponds

Fish ponds must have inlets and outlets to allow entry and exit of water. Water should remain fresh in order to provide a natural environment for the fish. Each pond or tank should contain one species. In one fish farm, there may be several ponds or tanks each containing a different species.

Growing of fish

It is supported by hatcheries (place where young fish are hatched from spawn). From the hatcheries, farmers are able to buy fingerlings (fish babies) to rear on their own.

Types of fish

The main types of fish includes Tilapia, Trout, and Mudfish. Tilapia species are more popular as they breed fast and are resistant to diseases and can survive in different environments. Trout are suited to cool areas and they attract very good price.

Fish farming management

Most of the fish farms are owned by individual farmers and are mostly commercial and they operate on a large scale.

Fish handling

Fish farming needs careful attention. Fish must be suitably fed and ponds should be kept in clean condition. Fish must also be fed on aquatic plants such as water lilies and papyrus reeds. Such a situation provide oxygen as well as a habitat similar to those which the fish would normally find in lakes or rivers. Fish are also fed on grass (planktons), vegetables, grains termites, turd remains, earth worms and blood. Floating pellets are desirable for fish that feed from the surface layer of water. These foods help the fish to grow quickly.

Harvesting period

Fish in the ponds or tanks usually take about 5 to 6 months to reach marketable size. Harvesting may be done on a weekly basis involving removing only those fish which have reached a suitable size. It is advisable that harvesting is done by the use of suitable nets to avoid hurting juvenile fish. Fish is usually caught using nets with big meshes, to ensure that only

the big ones are caught. Small meshed nets destroy breeding/nursery grounds and threaten the survival of immature fish.

Significance of fish farming

The benefit of fish farming to the community includes the use of land which has already been exhausted. As a fishing ground is enclosed, pollution is controlled hence fish are protected from pollution. Fish farming increases the availability of fish for food and income. It also occupies less space than other activities such as livestock keeping. This practice creates job opportunities to people including building and management of the ponds. Unlike marine fishing, fish farming is free from inter territorial conflicts and disputes. This is an important activity especially today when the challenge of unemployment is growing. Youths can employ themselves in fish farming.

The decline of worlds fish stocks and its conservation

There are many reasons for the decline of the world's fish stocks. They include overfishing, indiscriminate fishing of immature fish and pollution of water by chemical plants and factories. Fish lay enormous numbers of eggs but many of these are destroyed and many young fish never survive to maturity due to different reasons.

Measures to be taken for conservation of fish

There are various ways to contain the effects of unsustainable fishing. These include;

Restocking of overfished waters

This involves not fishing in the overfished areas, introducing juvenile fish and/or new species in affected areas.

Restrict indiscriminate fishing and promote the right fishing gears

Promoting the use of proper fishing gears including standard size fishing nets should be done.

Artificial fertilisation of eggs

Artificial fertilisation of eggs in special hatcheries and transferring juvenile fish to the breeding ground should be done. This should go hand in hand with improving native stock by cross-fertilising the species to obtain hybrids.

Protection from pollution

Fish cannot survive in polluted water. Regular inspection of inland waters is essential. There should be an effective implementation and administration of fisheries Acts. A good example is Tanzania fisheries Act of 2003 which is meant to develop, protect, regulate and control fishing in the country.

International agreement on fisheries

Fish have no boundaries, it is essential to devise some forms of international control in order: to conserve ocean resources and minimise friction over fishing territories.

Researches in World's fisheries

Research should deal with innumerable fish species and their habitats, fish behaviour, food requirement, life expectancy, and migratory movement. All these, in the long run, may be helpful in fish conservation. In most cases, fishing research deals with

the following fields; oceanography, ocean salinity, water temperature, fertility of the micro-organisms or plankton, statistics of the number and types for fish caught, fishing methods, greater use of fish, sea mammals, and other marine products.

Exercises 3.8

1. Explain the importance of the fishing industry.
2. Examine six factors that contribute to development of the fishing sector in any country of your choice.
3. Differentiate between aquaculture and mariculture.
4. Explain the necessary conditions for developing a fish farming project.
5. Describe the global distribution and abundance of fishery resources.
6. Explain the significance of fish farming to Tanzanians.
7. Describe four methods of fish capturing.
8. With clear examples, explain the main factors for the development of fishing industry in the temperate regions.
9. Despite having many water bodies, fishing industry in East Africa is not well developed. Discuss
10. (a) Differentiate between sustainable and unsustainable fishing method

    (b) Explain six ways to contain the effects of unsustainable fishing on the environment

Activity 3.15

Draw a map of Tanzania and indicate the main fishing grounds.

Activity 3.16

1. In your own environment, suggest the location that is suitable for constructing a fish pond and justify your decision.
2. Identify materials that are used in the construction of a fish pond.

Natural resources use conflicts and conflicts resolution

Resources use conflicts are the disagreements and disputes over access to control and use of natural resources available in a particular area within a specified period of time. It is a struggle or contest between people with opposing needs, ideas, beliefs, values, or goals. The conflicts often emerge because people have different uses of resources such as forests, water, and land. Sometimes this occurs as a result of incompatible interests and needs or when the priorities of some user groups or stakeholders are not considered in policies or short-term plans, projects and programs. In recent years, the scope, and magnitude of natural resource use conflicts have increased and intensified. These conflicts, if not addressed, can escalate into violence and cause environmental degradation, disruption of projects, and undermine livelihood of people.

Actors in natural resources use conflicts

Natural resource use conflicts occur at various levels and involve a variety of actors. They range from conflicts within communities, conflicts among neighbouring communities, village, community-based organisations, domestic and multinational businesses, governments, international development agencies, and NGOs. People or communities may engage in conflicts over the use and management of natural resources.

Most of the conflicts are characterised by the presence of multiple stakeholders with varying interests. Known examples of conflicts over natural resources use in Tanzania include the conflicts between farmers and livestock keepers in Morogoro (Kilosa), Tanga (Handeni), Kilimanjaro (Same) and Mbeya (Mbarali). The conflict involved farmers and herders. There has also been a conflict between two groups of farmers in Kilombero, Tanga, and Mbarali whose conflict was over shortage of fertile land for growing crops as well as shortage of fresh water for irrigation. Another conflict has been between two groups of pastoralists in (Mwanza and Shinyanga) over shortage of pastureland and water. All these conflicts indicate that natural resources are scarce and if not well managed they may lead to intense conflicts and violence.

Types of natural resource use conflicts

There are about four types of natural resources use conflicts:

The interest conflicts

These are conflicts that result from conflicting interests from different people on the use of a certain resource. For example, fresh water resources, fertile soils, and minerals may result into conflicts of interests. The interests may differ because one resource may have multiple uses and if the uses or interests are not compatible, conflicts are likely to occur.

Value conflicts

These conflicts arise when there are opposing views as to what benefits or value the resource shall give and who will benefit from the resource. Human beings usually attach different values to natural resources, and the value of natural resources in one community may differ from the value of that very resource in another community. Sometimes the value of a resource can differ among individuals in the same community.

The cognitive conflicts

Cognitive conflicts arise when there are different understandings, attitude or perceptions over resources. It could be personal or community perceptions over a certain resource for instance the meaning and value people attach over resources.

The behavioural conflicts

Behavioural conflicts arise when human beings do not understand or have difficulties with accepting other people's behaviour over certain resources. It is a result of a failure of communication to find out a practicable solution on the use of a particular resource.

Causes of natural resources use conflicts

Conflict over natural resource use have always been with us due to multiple and competing demands on resources. Resource scarcity and abundance can create ripe environment for violent conflict. The following are the causes of natural resource use conflicts:

Population growth

Population growth or increasing consumption levels decrease the amount of limited natural resources available to each individual. Thus, people may compete for resources, such as, land, water, minerals, and forests.

Presence of inappropriate policies

Exclusion policies or policies imposed without local participation lack of harmony and coordination between bodies of law and legal procedures, uncoordinated planning, contradicting policies and Acts, inadequate or poor information sharing, limited institutional capacity and inadequate monitoring and evaluation of programmes may lead to conflicts.

Unequal distribution of land resources among the people

Unequal access to natural resources such as fertile soil, minerals, forestry, and water in a given society makes them scarce for large segments of the population. Some own more land than others particularly the poor ones. Government policies should ensure equitable distribution of revenues from the resources. They should protect the interests of both companies and local communities. Conflicting or incompatible sectoral objectives, tribalism or regionalism should be avoided.

Strategies for resolving conflict in resources use

There are different strategies that may be adopted in resolving conflict in the natural resources sector. These include; participatory planning and land use planning and zoning of various land uses to avoid unnecessary competition and overlapping interests. For example, Ngorongoro Conservation Authority where the area is divided into several zones to accommodate conservation, tourism, minimum agriculture, and grazing. This may involve demarcation of special zones for agriculture, settlement, tourism, scientific research, grazing, and industries. Adopting multiple use planning or an integrated natural resources management maximise and accommodates competing land uses in a given area.

Integrated planning for natural resources involves creating an environment where environmental related sectors may have a common understanding over their intended plans. This may help the interrelated institutions or sectors to pull resources together for effective and sustainable management of resources of interest. Formalisation may be done through giving people title deeds in order to strengthen their property rights. This promotes land security and reduces possible land grabbing

and competition over ownership, use, and control. Collaborative management approach can also be employed in order to accommodate divergent interests of various environmental stakeholders. A good example of this, is collaboration of government departments and villages in managing strategic natural resources like forest catchment.

Exercise 3.9

1. Explain the meaning and types of natural resource use conflicts.
2. Discuss five causes of natural resources use conflicts.
3. Examine five ways in which natural resource use conflicts can be resolved.

Activity 3. 17

In a group,

Choose a land use conflict that you are familiar with and do the following.

(a) Identify the causes of the conflict you have chosen

(b) Recommend suitable ways of resolving the conflict

(c) Highlight possible conflicts which are likely to happen over water use and suggest sustainable ways of managing the conflicts

Revision questions

1. Describe two major types of natural resources.
2. Explain the advantages of natural gas in Tanzania.
3. With examples, explain different types of fossil fuels found in Tanzania.
4. Discuss the causes of global energy crisis.
5. With vivid examples, discuss the challenges of HEP production in Africa.
6. Explain the effects of mining on the environment.
7. Explain why there are variations in the distribution of minerals.
8. Elaborate the challenges facing small-scale miners.
9. Discuss the strengths and weaknesses of alternative energy resources compared to fossil fuels.
10. Discuss different forest conservation methods.
11. Describe the distribution of tropical forests.
12. Describe the distribution of major global fishing grounds.
13. Evaluate the employment opportunities available in the fishing industry.

14. Compare and contrast fish farming in developing countries and in developed countries.

15. Discuss three dimensions of sustainable development.

16. Discuss the strategies used to resolve natural resource use conflicts.

17. Examine problems facing timber industry in the Sub-Saharan Africa and suggest various ways to resolve them.

18. Discuss different ways of managing forest resources.

19. Explain the contribution of the mining industry in Tanzania.

20. Describe the negative impacts of mining in the developing countries and suggest ways of mitigating them.

21. Discuss the role of alternative energy sources in industrial development.

22. Describe the importance of petroleum in the world economy.

23. Nuclear energy is a prosperous source of energy in the world. Discuss.

24. What problems are caused by fuel production on the environment.

25. Explain the significance of timber for industrial, commercial, and domestic purpose.

Chapter

Four

Environmentally friendly tourism

Introduction

Tourism is among the world's fastest growing industries that contributes to the socio-economic development and livelihood improvement of the people. In countries that are endowed with significant attractions, tourism has emerged as an impetus for economic growth. In this chapter, you will learn about the concepts of tourismand the principles of sustainable tourism and ecotourism. You will also learn about tourism attraction areas, challenges, contribution of tourism to economic development, and ways of practicing environmentally friendly tourism using Tanzania, South Africa,and Sweden as case studies. The competencies developed will enable you to engage in different opportunities in tourism and hospitality industry,and thus contribute to the country's sustainable economic development and sustainability of the tourism sector.

The concepts of tourism

The word 'tour' is derived from the Latin word 'tornare' and Greek word 'tornos' meaning a 'lathe' or 'circle'.Therefore, tornos means a departure with the intention of returning. When the word 'tour' and suffixes 'ism' are combined they suggest the action of moving in a circle. Tourism is a journey through different parts of a country or region or an activity in which you go through a place in order to see and learn. Ancient travels initially developed from nomadism and advanced into commercial, exploratory, and religious pilgrimage in Egypt and Mesopotamia. It later developed into leisure tourism in the Greco-Roman period. Organised travel with supporting infrastructures, sightseeing and an emphasis on essential destination and experiences were found in ancient Greece and Rome. After the coinage of the word tourism at the end of the 18th Century, modern tourism became a commercially organised and business-oriented set of activities originating from the industrial and post-industrial era. Tourism business grew internationally in the later half of the 20th Century as air travel was progressively advancing.

Tourism, leisure, hospitality and sustainable development

Tourism, leisure, hospitality and sustainable development are interrelated concepts, but they are not synonymous. In this section, the meaning and interrelationships of tourism, leisure, hospitality, and sustainable development are introduced to lay the foundation for understanding the central themes in the chapter. In promoting environmental friendly tourism, it is important to

understand the existing interrelationships in these concepts.

Tourism

Tourism comprises the act of traveling to, and staying in places outside the usual environment for pleasure or business in a period that does not exceed one year and not less than one day. Tourism can also be defined as the movement of people from their place of residence to other places of interest for leisure, pleasure or study for a minimum period of one day and a maximum of one year or less; while making use of the commercial provision of services. It involves visiting places of interest like wildlife sanctuaries, conservation areas, historical sites, museums, mountains, beautiful sceneries and beaches. Tourism is an example of a service industry which falls under the tertiary sector. Environmentally friendly tourism, means a type of tourism which aims at safeguarding both natural and built environments and capable of creating sustainable and enabling conditions for the community to share the economic and social benefits in a way that does not affect the natural surroundings (physical, social, and cultural conditions that affect the development of any creatures). As a form of business, tourism involves commercial organisation and operation of holidays and paying visits to places of interest. In practice, tourism is embedded in leisure recreation and hospitality.

Leisure

Leisure refers to an act of taking a break or resting after daily life routine. Leisure tourists usually enjoy beauty in nice hotels, resorts, and natural attractions like wilderness or atmosphere of beaches. The most popular activities of leisure tourism includes social tours, cultural tours, religious tours, family tours, sports tours, medical tours, and eco-tours.

Hospitality

Hospitality comprises the services offered by hosts to guests for the aim of creating a friendly reception and delivery of quality entertainment. The leisure and hospitality industry sector includes a broad category of fields within the service industry such as lodging, food services, event planning, theme parks, transportation and other tourism oriented products, and services. This sector is highly sensitive to economic and competitive market conditions and can have steep seasonal fluctuations during the year.

Tourism and sustainable development

In line with sustainable development goals,tourism is expected to contribute to sustainable development. Sustainable development is the development that meets the needs of the present without compromising the ability of the future generation to meet their own needs. Economically, tourism contributes to foreign currency earnings. It also expands the market for the local products. Some tourists travel far with their goods and some travel to look for market opportunities for their goods. The money obtained from the tourist industry can be invested in other productive sectors for development of a country. Tourism industry can be used in promoting culture, widening the market for local goods, providing

education, creating employment, and generating capital that can be invested in other economic sectors. It plays a role in socio-economic and political development in destination countries through offering employment opportunities, raising awareness on cultural understanding and enhancing global peace. Tourism earnings also provide incentive to protect environment, enhance ecosystem integrity, and conservation.

Characteristics of tourism

The main characteristics of tourism include movement of people to different destinations with two key intentions which are journey and the stay, both of which depict coming outside the usual area or place of domicile and work. The movement is also primarily of a temporary nature and for a relatively short duration making it different from migration. Moreover, the prime purpose of tourism is recreation and certainly not seeking permanent residence or employment in the visited places. Lastly, tourism is a pleasure activity implying the use of readily disposable incomes and of free time and one's own free will.

Tourism typology

A typology is a system of classifying things into different categories. Categories of tourism can be expressed in terms of form and type. The forms of tourism describe the nature or shape of tourism movements while the types of tourism reflect dynamic purposes and activities of tourists.

Forms of tourism

There are three basic forms of tourism namely domestic tourism, inbound tourism, and outbound tourism. These can be further grouped in: internal tourism, domestic tourism, national tourism, and international tourism.

National tourism: Involves domestic and outbound tourists. It is a total of tourism movement by residents of a particular country both within and outside a country. For example, it involves Tanzanian residents who have visited tourist attractions within the country and outside Tanzania.

International tourism: International tourism involves the movement of people in a foreign country. In order to travel to a foreign country, a tourist needs a valid passport, visa, health documents, and foreign currency. International tourism can be classified as *inbound* and *outbound* tourism.

Inbound tourism: Refers to tourists of outside origin entering a particular country (non-residents travelling in the given country). When a person travels outside the native country to another country they make the inbound tourism in that country of destination. For example, when a tourist of the South Africa origin travels to Sweden then it is the inbound tourism for Sweden because a foreign tourist comes from South Africa. Generally, when we use the term inbound tourism in Tanzania we are referring to the people from different countries travelling to and within the country.

Outbound tourism: refers to a state where tourists travel from the country

of their origin to another country. When tourists travel to a foreign country, they are involved in outbound tourism since they are going outside their country. For example, when a tourist from South Africa travels to Sweden, then it is outbound tourism for South Africa and inbound tourism for Sweden. Similary, when we use the term outbound tourism in Tanzania we are referring to the Tanzanian residents travelling out of Tanzania.

Domestic tourism: Domestic tourism is the tourism activity of the residents or people within their country. Traveling within the same country is easier because it does not require formal travel documents and tedious formalities like compulsory health checkup and foreign exchange. In domestic tourism, a tourist generally does not face language related problems or currency exchange issues. For example, when a citizen travels to another nearby tourist attraction or to other regions within a country, they are involved in the domestic tourism and can easily access necessary information from friends, relatives or fellow citizens who are familiar with the places they intends to visit.

Internal tourism: Involves domestic and inbound tourists. This classification aims at establishing total tourists movement in a particular country (both residents and non-residents within the territory of the country of reference.

Types of tourism on the basis of activities and purpose

There are different types of tourism; these are determined by activity and purpose of visit. The most important types of tourism includes recreational or leisure tourism, cultural tourism, sports/ adventure tourism, health tourism, and convention tourism.

Recreational or leisure tourism: Recreational tourism is a type of tourism which takes a person away from the humdrum of everyday life. Recreation refers to activities, events, and pursuits that are undertaken through choice. In this case, people spend their leisure time at different alternative areas like in the hills, sea, and beaches. Leisure is a broad term which is associated with free time from employment, at one's own disposal. In developed countries, with shorter working weeks and earlier retirements, many people have sufficient time which allows them to participate in recreational activities or events, and make pursuits that are undertaken through choice such as sports, gardening, fireworks displays, bird watching or video games. Figure 4.1 shows beautiful scenery of Ngorongoro Serena Safari Lodge as it blends with nature.

Figure 4.1: *Ngorongoro Serena Safari Lodge*
Source: https://www.kuoni.co.uk/tanzania/ngorongoro-crater/hotels/ngorongoro-serena-safari-lodge

Cultural tourism: This is a type of tourism which satisfies cultural and intellectual curiosity and involves visiting ancient monuments and places of historical or religious importance. It involves traveling for the purpose of resting and relaxing, pleasure, curiosity or study tour. Cultural tourism attractions in Tanzania include Tengeru cultural tourism, Rau Eco cultural tourism, and Dsotwa tourism initiatives. A person may travel to other places in order to study foreign cultural aspects which are different from his or her own country.

Sports/Adventure tourism: Sport tourism refers to a form of traveling which involves either observing or participating in a sporting event. It is a tourist activity that includes physical observation, cultural exchange, or nature based activities. Adventure tourism is about connecting with a new culture or a new landscape, and being physically active at the same time. These are trips taken by people who intend to play golf, skiing, and hiking. Others travel for adventures exercise like mountain climbing.

Health/medical tourism: Health or medical tourism refers to the practice of traveling outside the country of ones residence for the purpose of receiving medical care. Originally, the term referred to the travel of patients from less-developed countries to developed nations in pursuit of treatments that are not available in their homeland. This is the type of tourism which allows them to pursue medical treatment or visit places where they can be cured such as hot springs, spa and yoga. Health tourism offers medical options for the comfort of patients and their families.

Business tourism: Business tourism is a type of tourism which encourage people to travel within a country or overseas to attend conventions that relate to business, profession or personal interest. Business tourism include travelling to attend meetings, conferences, trade fairs, and exhibitions. Examples of business tourism includes participating in the Dar es Salaam International Fair Trade (Sabasaba), and similar events. This type of tourism is increasingly becoming an important component in the tourism sector.

Astronomical tourism: Astronomical tourism involves public participation in viewing the night sky and various astronomical objects. It represents a segment of sustainable tourism where a dark night sky is the main underlying resource. It may consists of solar viewing during the day, multimedia evening programs, and night time stars gazing with telescope. Astronomical tourism may also involve using Tanzania's geographical location near the equator which offers 95% of the view of stars in the night.

Culinary tourism: Culinary tourism also referred to as gastronomy tourism, it focuses on food as an attraction for explorations in a destination. There is a variety of culinary format and products such as culinary trails, cooking dishes, and food ingredients.

Atomic tourism: Atomic tourism has recently emerged whereby tourists learn about the atomic energy by travelling to significant sites in atomic history such as museums with atomic weapons, military sites, vehicles that carried atomic

weapons or sites where atomic weapons were detonated as shown in Figure 4.2.

Figure 4.2: *The Black Hole Los Alamos, New Mexico*

Source: https://colorwhistle.com/types-of-tourism/

Space tourism: This is probably the most recent and most expensive kind of tourism. It involve human orbital, sub-orbital or lunar space travel for recreational purpose. In 2021, three private company SPACEX, Virgin Galactic and Blue Origin Pioneered practical human travel to space. Plans are to take the travel cheaper. SPACEX has announced to take three passenger for the international space station in 2022 at the cost of 55m dollars per person. At this cost, space tourism remains the thing of the world richest.

Geothermal tourism: This type of tourism can take place where the thermal features such as hot springs or geysers are accessible like yellowish national park in United States of America (USA). It has a long history in various parts of the world where by tourists are interested in geothermal attractions which includenatural features. For instance, tourists may come to bath in thermal waters and see geysers, springs, mud pools, terraces, and lakes as shown in Figure 4.3.

Figure 4.3: *Geothermal tourism at the yellowstone National Park USA*

Source: https://colorwhistle.com/types-of-tourism/

Environmental friendly tourism practice

Environmental friendly tourism and ecotourism concepts are used interchangeably to represent sustainable tourism. In practice, environmental friendly tourism includes community based tourism, responsible tourism, ecotourism, and cultural tourism. Eco-tourism helps create jobs, offers incentives for environmental conservation, and reduces poverty to create a more resilient and inclusive economy. It is important to ensure tourism contributes significantly to promote sustainable development. Although the sector contributes positively to growth, without a sustainable approach, there is a likelihood of an increase in pressure on the ecosystem and biodiversity due to the expanding tourism industry.

Sustainable tourism and ecotourism emerged with the environmental movement during the 1970s and gained popularity in the late 1980s due to a rise in awareness of people about the environment.

Gradually, financial empowerment and employment opportunities grew, along with an understanding of the negative impacts of conventional tourism. By the 1990s, environmental friendly tourism spread across the world with a major role in cultural tourism, nature-based tourism, adventure tourism, and heritage tourism. Governments and tourism authorities developed strategies in the protected areas for protecting undisturbed biodiversity and the natural environment. Along with supporting the recreational activities, the focus was on maintaining the protected areas to add value as an eco-tourist attraction.

The principles of environmentally friendly tourism

Governments and businesses initially advocate environmentally friendly tourism without an understanding of its basic principles. With time tourism stakeholders developed a set of the following nine principles to advocate environmentally friendly tourism practices; First, negative impact on nature and culture which could damage the destination should be minimized. Second, travelers should be educated on the importance of conservation. Third, importance of responsible businesses (ones which work cooperatively with people and local authorities for meeting their needs) should be stressed on. Fourth, revenues should be directed towards management and conservation of protected and natural areas. Fifth, emphasis should be on need for regional tourism zoning and visitor management plans designed for regions or areas slated to become eco-destinations. Sixth, emphasis should be on social and environmental base line studies along with long term monitoring plans. Seventh, strive to maximize economic benefits for communities, local businesses, and host country especially for the people living adjacent or in protected or natural areas. Eighth, tourism development should not exceed social and environmental limits of acceptable change. Ninth, reliance should be on infrastructure developed in harmony with environment including to minimize fossil fuel use, blending natural and cultural environment, and conserving local wildlife (animals and plants).

The significance or importance of environmentally friendly tourism

Environmental friendly tourism practice serves as an effective tool for promoting endangered species conservation and providing financial empowerment to the villagers or their local communities by providing employment opportunities. It is a viable way for the creation of social and economic benefits at the national and local levels. Its benefits include the following;

Revenue generation for conservation: Revenue generation for conservation through mechanisms like entry fees, concession fees, fees for use, license and permits, and voluntary donations, funds are collected which further support protection and conservation activities.

Empowerment of local community: Empowering of local community participation in planning processes or running a business is increased, hence empowering the host community.

Contribution to environmental protection: Contribution to environmental protection and preservation by protecting natural areas from undergoing alternative development is produced. It favours environment-friendly practices of resource utilisation and promoting heritage conservation for future generation.

Environmental awareness and cross cultural exchange: This involves environmental awareness and cross cultural exchange for promoting cross-cultural understanding between eco-tourists and host community, eco-tourism generates awareness among destination stakeholders and visitors about the environment.

Generally, developed and developing economies are improving practices to minimise the negative impact of tourism on the environment economy, and society.

Community based tourism

Currently, because of the increasing changes and demand, another form of tourism called community based tourism has emerged. Participation allows decisions to be controlled and driven by the community. Community participation accommodates cultural exchange where tourists meet with local communities and witness aspects of their lifestyle. In some tribes, it may involve cultural dances and showcase. Remote ethnic communities may be vulnerable to outside influences. As such, communities make decisions about the way tourists are hosted to promote sustainable tourism. The aim of community based tourism largely depend on the issues or problems and needs of the community.

The merits of community based tourism include generation of a sense of pride in the local population, generating income for maintaining or upgrading cultural assets such as archeological ruins, historic sites, and traditional crafts production. Community based tourism also serves as a tool for conserving and improving the quality of life. It further serves as a means for unifying the local communities in consulting, discussing, and working together in solving community problems. Moreover, it provides an opportunity for exchange of knowledge and culture between tourists and the community, and helps to provide supplementary income for individual members of the community which foster community development.

Responsible tourism

Responsible tourism is the form of tourism that assigns tasks to tourism organisations to take care of tourist destinations and the provision of visitor satisfaction. This aims to ensure that resources are conserved. Further, it denotes care for the environment and cultural resources, and opportunity for local people in terms of employment or other kinds of involvement, sufficient information regarding local resources for visitors, and implementation of the policy of corporate social responsibility.

The main features of responsible tourism include introduction of programs that minimises the negative aspects of conventional tourism on the environment and prioritisation of programs that enhance the cultural integrity of local people. Moreover, responsible tourism

evaluates environmental and cultural factors. Another main feature is the promotion of recycling, energy efficiency, and water conservation. Lastly, it creates economic opportunities for the local communities and places emphasis on the need for the tourism sector to be responsible to the environment, local people, and their livelihoods.

Ecotourism

Ecological tourism, commonly abbreviated as Ecotourism involves traveling to relatively undisturbed or uncontaminated natural areas for the purpose of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestation. This is done with a focus on preserving fragile environments and ecosystems found in these areas. It is also defined as a responsible travel to natural areas which conserves the environment and improves the well-being of local people. Ecotourism is a nature based practice that involves education and interpretation of the natural environment.

An eco-tourist travels to enjoy the world's amazing diversity of natural life and human culture without causing damage. Ecotourism prioritises an appropriation of returns to the local community and long term conservation of the resources. Moreover, it involves visiting natural areas in the remote wilderness or urban environment which include programs that minimise the negative impact on the environment and enhance the cultural integrity of local people. Ecotourism efforts include building tourist facilities that have minimal impact on the natural environment, like adopting the use of environmentally friendly products such as compost toilets or solar-powered electricity. Ecotourism meets three criteria; providing for environmental conservation including meaningful community participation, making profits, and promoting self-sustenance.

Characteristics of ecotourism

Today, ecotourism is committed to make impact on the natural environment and local culture, while helping to generate income and employment for local communities. The characteristics of ecotourism include travelling to natural destination, minimizing impact, raising environmental awareness, providing direct financial benefits for conservation, providing financial benefits, empowering local people, respecting local culture, recognising nature, and raising sensitivity to host countries. These characteristics can be further clarified as follows;

Travelling to the natural destination: These destinations are often located in remote areas, whether inhabited or uninhabited, and are usually under some kind of environmental protection at the national, international, communal, or private travel.

Minimising impact: Since tourism causes damage, ecotourism strives to minimise the adverse effects of hotels, trails, and other infrastructure by using either recycled or available local building material, renewable sources of energy, recycling and safe disposal of waste and garbage as well as prioritising environmentally and culturally sensitive architectural designs.

Raising of environmental awareness: Ecotourism encourages the provision of education and preparation of special awareness raising programmes for both tourist and residents. Before the tour begins, tour operators should supply travelers with reading material about the country, environment, and local people, as well as a code of conduct for both the travelers and the industry itself. Ecotourism projects should also help to educate local communities, school children and the general public in the host country.

Provision of direct financial benefits for conservation programmes: Ecotourism helps to raise funds for environmental protection and conservation programmes in the destination sites. Availability of funds is made possible through a variety of mechanisms, including park entrance fees and taxes paid by tour companies, hotels, airlines, airports, and many other voluntary contributions.

Provision of financial benefits and empowerment to local people: Ecotourism holds that national parks and other conservation areas will survive only, if there are happy people around the perimeters. The local community must be supported to generate income from available opportunities and access tangible benefits such as potable water, roads, health clinics, schools, small scale investments in the conservation area, and availability of tourist facilities.

Respect local culture: Ecotourism is not only a "greener" but also a less culturally intrusive and exploitative than conventional tourism which encourages prostitution, black markets, drug abuse and other illegal activities. Ecotourism strives to be culturally respectful to the human population of a host country.

Respects nature and wildlife: Ecotourism recognises that nature is a central element in practicing ecofriendly tourism. Ecotourism ensures that wildlife is not harassed. It establishes strategies that are important in the conservation of nature.

Supports human rights and democratic movements: Ecotourism as a sustainable practice encourages recognition of culture and human rights. It also promotes peace, social wellbeing, and rights of individuals and social groups to access available benefits in various ways.

Principles of ecotourism

Ecotourism attracts people who wish to interact with the environment and, in varying degrees, develop their knowledge, awareness, and appreciation of nature. To achieve functional ecotourism the following principles need to be observed;

First, use visionary leadership and promote small groups to ensure minimum group impact on destination. Second, ensure that managers, staff and contract employees know and participate in all aspects of company policy to prevent negative impacts on the environment and protect the local culture. Third, offer site based accommodation services that are not wasteful of local resources or destructive to the environment. This provides ample opportunity for learning about the environment and sensitive interchange with local communities. Fourth, avoid negative impacts that can damage or

destroy the integrity or character of the natural or cultural environment that is being visited. Fifth, educate the travelers on the importance of conservation. Sixth, direct revenues to the conservation of natural areas and the management of protected areas. Seventh, create economic benefits and direct revenues to local people living adjacent to protected areas such as providing competitive local employment in all aspects of business operation. Eighth, emphasise the need for planning and sustainable growth of the tourism industry, and seek to ensure that tourism development does not exceed the social and environmental carrying capacity. Ninth, retains a high percentage of revenues in the host country by stressing the use of locally owned facilities and services. Tenth, places emphasis on increasing reliance on infrastructure that has been developed sensitively in harmony with the environment. Lastly, places emphasis on minimising the use of fossil fuels, conserving local plants and wildlife, and the surrounding environment.

Tourism demand and supply

Tourism demand and supply refer to the complex mix of various tangible and intangible services. Demand means requirement of tourism products (goods and services) at a particular place or market in a given time while supply refers to provision of variety of tourism products at a particular place or market in a given time. Unlike the conventional industry, in tourism the market is mobile while the product is fixed in a particular geographical area. Tourism product is a combination of tangible and intangible elements, such as natural, cultural, and man-made resources. This combination involves attractions, facilities, services, and activities around a specific center of interest which represents the core of the destination marketing mix and creates an overall visitor experience; including emotional aspects for the potential customers. A tourism product is priced and sold through known distribution channels. Development at a tourism destination is shaped by the demand for tourism in that particular country.

Exercise 4.1

1. Describe the following concepts;
   (a) Tourism
   (b) Leisure
   (c) Hospitality
   (d) Pleasure
2. Explain the dominant types of tourism in Tanzania.
3. Differentiate international from domestic tourism.
4. Explain at least six characteristics of tourism.
5. Differentiate tourism supply from its demand.

Activity 4.1

For each of the examples given in Table 4.1, write the kind of tourism according to the forms and types of tourism discussed earlier. Note that, some examples might fit into more than one category.

Table 4.1: Examples, forms and types of tourism

Example	Form of tourism	Type of Tourism
Ndlovu is going on Holiday to Cape town. He lives in Kwazulu Natal.		
Standard 4 pupils at Kigurunyembe Primary School are planning to visit Mikumi National Park for the day.		
Mloka and Daudi are going to Arusha for a weekend break. They live in Morogoro.		
Mary is a Sales Director for a Tanzanian company. She is participating in a sales conference in Nairobi.		
The Baraka family is going on holiday to Disney Land, Paris.		
Jerome lives in Songea. He visits his father in Uganda every Christmas.		
Miriam is visiting the UK from Tanzania to undertake a language course.		
Joyce is taking a holiday in Sweden. She lives in Tanzania.		

Activity 4.2

In a group, arrange and conduct a visit to the nearby tourist attraction. Then, describe the services offered and the type of tourists who visit the tourist attraction of your choice.

Activity 4.3

Use web resources to present different forms of tourism in the world.

Reasons for promoting environmentally friendly tourism

Being one of the world's largest industries, tourism has its significant social, environmental, economic and political impacts. There is a clear and growing body of evidence suggesting that the impacts of tourism development are far more complex than what policy-makers usually suggest and that, they occur not just at the destination but at all stages of a tourist's trip.

Broader social and environmental changes also shape the form, growth and experience of tourism development. Tourism can provide jobs, foreign currency, improve the wealth of an area and promote conservation of natural and cultural resources. Many developing countries are keen to develop tourism in order to become richer and to improve the quality of life for their people. However, when large numbers of visitors go to one place, they attract mass tourism. This has both positive and negative impacts in the visited sites. Some countries rely heavily on tourism and this can be a problem, if tourists stop coming. Sometimes, the

number of tourists falls due to natural disasters such as floods or because of wars, social unrest, and global pandemics. For example, some countries suffered from a fall in tourism after the 2004 Asian Tsunami. In other incident, tourists were encouraged to leave Tunisia and Egypt during the protests and social unrest in 2011, while COVID-19 pandemic halted tourism paradoxically from 2020 onwards. Based on the reasons provided earlier in this chapter, it is important to promote environmentally friendly tourism.

To promote environmentally friendly tourism is a deliberate measure that needs to be taken for minimising environmental impacts. The benefits of tourism attained provide an important reason for developing interests and supporting sustainable tourism. However, the impacts vary widely as a result of differences in the quality of attractions, access, visitors leisure interests, and other factors. Therefore, any intervention need to consider the specified aspects or reasons.

Environmentally friendly tourism is meant to address sustainability challenges facing mass or conventional tourism. Mass or conventional tourism refers to the movement of a large number of organised tourists to popular destinations for recreational purposes. Despite the fact that there are ongoing efforts to attract sustainability in the tourism sector, there are challenges that are associated with the movement of a large number of tourists to popular destinations for recreational purposes. The industry also creates opportunities which may allow visited countries and local people to share income and advance the social wellbeing of target communities.

Oppotunities of tourism indusry Specified opportunities of tourism industry include available opportunities in the tourism sector such as fiscal impact resulting from taxes, fees and expenditures, revenue sharing and the revival of local traditions and crafts. These are further described as follows;

Fiscal impacts (taxes, fees, expenditures): Tourism does not only generate government revenues through business and other general taxes but also through industry-specific channels such as payment of occupancy and departure taxes, fees, and expenditures. It also provides income and returns to various businesses.

Revenue sharing: In some ecotourism destinations, residents benefit from revenue-sharing programmes that either provide cash payments or more commonly, funding for community projects such as construction of wells or schools. Revenue obtained can help to pay for the preservation of archaeological sites, historic buildings, and supporting community projects for health, education, and water supply services.

Revival of local traditions and crafts: Despite the criticism about the alteration of cultures to unacceptable levels, the sharing of cultural knowledge and experiences can be beneficial for hosts and guests from other countries and may revive local traditions and crafts. Tourism also allows local people to

travel to the natural destinations, it builds environmental awareness, it provides direct financial benefits for conservation activities, and it offers financial benefits which are essential for local peoples' empowerment. The rapid development of tourism provides a win–win path for ecological and environmental protection and sustainable economic development. However, environmental problems are increasingly prominent in ecotourism destinations, which seriously hinders their sustainable development.

Challenges of tourism indusry

Apart from the opportunities that can be accessed from the tourism industry, the following challenges may also be experienced;

Displacement of local people: Although ecotourism as a form of tourism may help in preserving and advancing local peoples settlements, evidence shows that the establishment of protected areas has caused local people to lose their homes oftenly without compensation. This has caused them to move into marginal lands that have harsh climate, poor soils, and lack of water. A good example is the incident which took place in Kazimzumbwi forest in Kisarawe and Ngorongoro National Park in Arusha, Tanzania.

Commercialisation of culture: From a cultural perspective, tourism can cause erosion of the traditional values of community's and their ways of life. In other ways, it may cause commercialization of culture, which may lead to pseudo-cultural activities (entertaining tourists) hence, at extreme, may cause dilution or disappearance of indigenous culture commonly known as commodification. Tourism may also create antagonism in the host population by lowering traditional values such as dressing, religion, type of food, and drinks.

Reduced access or user rights to consume resources: Tourism utilises various resources as input to the products and services provided to visitors. One of these products is the land that harbours natural resources which are partially or totally preserved such as nature reserves. Preservation of natural areas often involves reduced local access to the forest products such as wood or medicinal plants. It also causes reduced access to the cultural services such as rituals and initiations which are normally carried out in forests.

Inflation: An increase in the number of tourists in a country can cause the demand for domestic goods and services to rise. This contributes to high consumption of goods and services, causing a high aggregate demand. As a result, the prices of goods are likely to increase, ensuing inflation. Many destinations have experienced increased price for goods, services, and land due to tourism development and this is a cost borne by residents of the area who purchase these items. High inflation is a significant factor that affects the tourism sector in developing countries. The consequences of inflation on tourism can arise in several different ways. Retailers in tourist areas often raise their prices in the knowledge that they will continue to find a market among affluent tourists. Inflation in

tourist destination areas is also caused by land values, with tourism generating additional demand for the land. Providing employment opportunities (chef, porter, tour guiding, food vending, supply of fruits, vegetables, fish and the like to tourists) to the local people can offset inflation costs in a long run. The income collected from the visitors for services such as short-stay accommodation, provision of food and refreshments, recreational activities, and the sale of goods produced in the adjacent rural areas, should be used in offsetting inflation.

Environmental degradation: The construction of social amenities such as lodges, camps, sanitation facilities, and the use of firewood may lead to deforestation and habitat deterioration. Such activities may also lead to destruction of the natural environment and wildlife habitats in the marine, coastal, and terrestrial areas. They may also accelerate the clearance of natural vegetation and loss of ecosystems, leading to environmental degradation in the tourist sites.

The construction activities on virgin territories like wilderness to provide tourists access to roads and accommodation disrupt land cover and cause serious effects on plants and animal species. Construction of tourists facilities such as roads, lodge and air ports, cutting trees for construction, firewood and mining accelerates soil erosion and deforestation. Excessive pressure of tourists leads to water, air, land, noise and visual pollution and a breakdown in social services supplies. These actions, in many ways, can result into loss of biodiversity and destruction of natural environment and wildlife habitats.

The lack of adequate sanitation facilities in East African parks encourages the disposal of campsite sewage in rivers hence contaminating water used by wildlife, livestock, and people. All these leaves behind garbage and pollutants which affect terrestrial and aquatic species as well as natural resources. Tourism practices that involve wildlife viewing can scare away animals and disrupt their feeding and nesting sites. Driving off-track also harasses the wildlife. It may as well promote wild animals poaching and trafficking for the purpose of wildlife farming in other non-native environment.

Inequality and leakage: Tourism enhances diversion of government expenditure from other areas of the economy. Governments may also divert labour and resources from non-tourist regions and thus affect less endowed areas, leading to out-migration of local people to tourist resort areas. These cause regional inequalities between tourist growth areas and less developed peripheries. Sometimes, foreign human resource and companies tend to dominate managerial and higher paid posts hence reduce opportunities for local people.

The significance of sustainable tourism

Sustainable tourism takes full account of the current and future economic, social and environmental impacts and addresses the needs of visitors, the industry, the environment and host communities. It envisages the management of all resources in such a way that economic, social, and

aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, and biological diversity, including life support systems. It embraces ecological and socio-cultural carrying capacities and local community participation in tourism planning, management, and development. Under sustainable tourism, activities are integrated to match current economic development growth policies in order to mitigate negative socio-economic and ecological impacts of mass tourism. Sustainable tourism development meets the needs of present generation (tourists and host regions) while protecting and enhancing opportunities for development. The tourism sector has guidelines and management practices that are applicable to all forms of tourism and in all types of destinations, including mass tourism and the various niche tourism segments.

Objectives of sustainable tourism

Sustainable tourism has four main objectives; First, to conserve the natural, historical, cultural, and other resources for tourism and for sustainable use and at the same time, benefit the present generation. This can be achieved by ensuring optimal use of environmental resources that constitute tourism development, maintaining essential ecological processes, and helping stakeholders to conserve natural heritage and biodiversity. Second, to ensure that the tourism development is planned and managed in a manner that does not allow occurrence of serious environmental or socio-cultural problems in the tourism area. Planned and managed tourism has sustainability elements since it is guided by sustainability principles and procedures. Third, to ensure that the overall environmental quality of tourism areas is maintained and improved. In this case, a high level of tourist satisfaction is maintained so that tourist destinations can retain their marketability and popularity. It also seeks to respect the socio-cultural authenticity of host communities, conserve their built and living cultural heritage and traditional values, and contribute to inter-cultural understanding and tolerance. Fourth, to ensure that the benefits of tourism are widely spread throughout the society. It is also meant to ensure viable, long-term economic operations, access to socio-economic benefits to all stakeholders that are fairly distributed including stable employment and income-earning opportunities, provision of social services to host communities, and contribution of the sector to poverty alleviation.

As the objectives indicate, sustainable tourism development requires active participation of all relevant stakeholders, as well as strong political leadership to ensure wide participation and consensus building. In ensuring that sustainable tourism is a continuous process which requires constant monitoring of impacts, there is a need to introduce necessary preventive and/or corrective measures. Sustainable tourism should also maintain a high level of tourist satisfaction and meaningful experience.

Principles of sustainable tourism

Tourism industry is guided by the sustainability principles. These emphasise the need to integrate tourism

with environmental, economic and socio-cultural aspects. The principles also insist on the need for the specified aspects to attract assured long term sustainability. There is also insistence on proper management of natural and human resources to maximise tourist enjoyment and at the same time benefit local communities by minimising the negative impacts in the destination sites.

Sustainability principles address environmental, economic and socio-cultural aspects of tourism development and insists on the need to balance the specified three dimensions in order to guarantee the long term sustainability in the industry. Hereunder are some of the guiding principles that need to be considered in the implementation of sustainable tourism.

Use resources sustainably: Conservation and sustainable use of natural, social, and cultural resources is crucial and can attract long-term impact in the tourism sector.

Reduce consumption and waste: Having a proper plan for reducing unnecessary resource consumption and proper management of waste may attract sustainability in the tourism sector and help in avoiding the costs of restoring environmental damage and contribute to the quality of tourism.

Maintain diversity: Promoting natural, social, and cultural diversity is essential for sustainable tourism, and creation of resilient base for the industry.

Integrate tourism into planning: Integration of tourism development into the national and local strategic plan frameworks may increase the long-term viability of tourism as an overriding sector.

Supports local economies: Establishment of initiatives that promote sustainable tourism should consider the need for supporting and empowering local communities that live in the tourist destinations. The rendered support should incorporate a wide range of local economic activities taking environmental costs and values into account, by protecting economies and avoiding environmental damage.

Engage local communities: Promoting participation of the local communities in the tourism sector does not only benefit them and the environment in general, but also, improves the quality of tourism practices.

Consult stakeholders and the public: Stakeholders, particularly, local people possess sufficient knowledge and experiences that may be useful in strengthening tourist practices in the country. Engaging them through consultation may potentially add value to existing plans and improve the tourism sector. Consulting between the tourism industry and local communities and other institutions are essential, if they are to work alongside each other and resolve potential conflicts of interest.

Train staff: Staff training which integrates sustainable tourism into work practices, along with recruitment of personnel at all levels, improves the quality of the tourism product and hospitality services.

Market tourism responsibly: Providing tourists with the full and responsible information, increases respect for the natural, social, and cultural environment in the destination areas and enhances customer satisfaction.

Undertake research: Understanding research and putting emphasis on effective data collection, processing, and analysis are essential procedures in solving emerging problems in the tourism sector. Research reports can easily identify gaps and help decision makers to intervene.

Exercise 4.2

1. Explain the four key elements of community based tourism.
2. Examine the relationship between sustainable tourism and sustainable development.
3. What is the rationale for promoting sustainable tourism?
4. Explain at least three factors that need to be considered in ensuring that sustainable tourism is practiced.
5. Explain the importance of ecotourism to society.
6. What makes alternative tourism different from responsible tourism?
7. Describe the concept of community based tourism.
8. Propose the principles you would uphold in promoting sustainable tourism in your country.
9. What is the difference between mass tourism and environmentally friendly tourism?

Activity 4.4

With the help of your subject teacher, visit a nearby tourist destination and do the following;

(a) Prepare a list of guiding questions to evaluate whether the tourism practice is sustainable

(b) Observe activities taking place and interview the management

(c) Prepare a report and present it in your class

Conditions necessary for growth of tourism

Sustainable tourism addresses long-term impacts through provision of awareness, sensitising visitors on environmental issues and arranging site visitations. Tourism operations start in a small scale and widens depending on the number of visitors in the destination sites. For the tourism sector to grow, local people should be given priority, fully involved, and encouraged to participate actively in development activities from the planning level to the implementation of tourism initiatives. Tourism plans should prioritise and accommodate conservation, protection, and preservation programs to protect the environment and natural tourist attractions for the present and future generations.

Regulations and accreditation should be in place to nature tourism projects. There is a need to avoid destructive green-washed operations like underwater hotels, helicopter tours, and wild life parks. Canoeing, camping, photographing, and wildlife observation may be encouraged. Regulations and guidelines on how to manage or run ecotourism plans/projects need to be provided and reviewed from time to time. Political stability and peace or a peaceful relations with other practitioners around the world is a necessary condition for the development of tourism. Flexible laws related to tourists or visitors are also needed. Less visa restrictions are likely to attract more tourists. Moreover, taxes generated from tourism should be well spent to develop tourism centres, infrastructure, and the surrounding community.

Social harmony and justice attract relaxation of human mind and increase the desire for revisitation. Areas with a strong tourist image, linked to nature and social-cultural traditions, are more likely to attract tourists. Cultural heritage preservation and education based on destination history and culture, promote business to a great extent. If the destination is of great historical or cultural significance, tourists will certainly like to visit it. Attractions such as monuments, castles, forts, ancient architecture, sculptures, caves, antic paintings and utensils, clothes, weapons, ornaments, and other allied heritage increase curiosity and the leisure to conduct frequent visits. Proper planning and effective implementation of planned activities will promote culture, generate interest and increase the knowledge on the value of the area. Examples of the world famous places of historical and cultural importance are Kilimanjaro mountain and Olduvai Gorge in Tanzania Figure 4.4(a) and Figure 4.4(b), House of wonders in Zanzibar, Taj Mahal in India, Began City in Burma, Pyramids of Giza in Egypt, and Timbuktu in Mali.

Figure 4.4(a): *The vast area of Olduvai Gorge*
Source: https: https://artofsafari.travel/what-to-do/best-tanzania-safaris/northern-tanzania/olduvai-gorge-serengeti/

Figure 4.4(b): *Two Species Monument at Olduvai Gorge*
Source: https://dailynews.co.tz/news/2020-07-215f16945010341.aspx

Development of transport, communication, and accessibility plans are an important factors for the growth of tourism. It is important to ensure that all tourist centres are easily accessible by various modes of transportation like roads, railways, air, and water. Increasing the possibility of short trips over long distances and improving the standards of service in transport

create the conducive environment for passengers and tourists. The road transport industry in Tanzania is responsible for the development and maintenance of all the roads in the country. Nowadays, people have unlimited access to information about tourist destinations. Most of travel decisions are made by people who have never been to the place before due to availability of sufficient information. This makes media coverage crucial in strengthening the tourism sector. Figure 4.5(a) and Figure 4.5(b) shows the types of cars used for tourist purposes.

Figure 4.5(a): *Standard cars for tourism purposes*

Source; https://www.safariquestions.com/safari-vehicles-frequently-asked-questions/

Figure 4.5(b): *A tourist car carrying tourists*

Source; https://www.safariquestions.com/safari-vehicles-frequently-asked-questions/

Economic growth and income growth in developed countries allow people to spend money on travel expenses. Similar processes are taking place in the developing countries, especially when the country's economy is doing well and people can afford to spend money on leisure,the tourism progresses.

A natural heritage or resource that is available to the tourists is one of the most important features of attraction in any tourist place. Pleasant climate with warmth and ample sunshine attracts tourists who come from the temperate and colder regions. Flora, fauna, proximity to water, comfortable and attractive scenes, indigenous culture, religious centres, beautiful natural sites, and historical sites are also likely to attract more tourists.

Accommodation and recreational facilities are mainly built to meet the needs of tourists in terms of amenities such as hotels. A type of accommodation required by tourists depends on their life styles, standard of living, capacity to spend money, and nature of expected services. Figure 4.6 shows a beautiful *PalumboKendwa* hotel in Zanzibar which is built in a historical design and which attracts many tourists. Generally, tourism mostly prospers in areas where good lodging and food facilities are available at reasonable prices.

Figure 4.6: *Palumbokendwa Hotel in Zanzibar*
Source:*https://stuklopechat.com/puteshestviya/93278-otel-palumbokendwa-tanzaniya-kendva*-foto-i-otzyvy-turistov.html

Tourism and hospitality industry

Tourism and hospitality industry is an umbrella covering several career opportunities such as provision of food and beverage services and music festival events. The travel and tourism industry contributes to 9.8 % of the global GDP, and it is still growing. Hospitality and tourism career opportunities are numerous for energetic youths who are self-driven. It is time to explore opportunities that are available in the hospitality and tourism industry and get involved in careers that are readily available in hotel operations, event management, travel, and tourism products development.

Hotel operations

Employment opportunities are available in banquet and conferences, food and beverage services, front office reception, resort handling operators, restaurant and SPA and wellness service provision.

Food and beverage services

Food and beverage service providers are responsible for all things that relate to food and beverage (from ordering products to hiring staff and balancing profit and loss sheets).The career requires exceptional social and analytical skills. The ideal candidate is supposed to be organised, calm under pressure, service oriented, and business minded.

Front office reception

From the very first moment of a guest's arrival, the front office serves as the face of the company and its standards of service. Individuals serving as front office receptionists are supposed to be knowledgeable not only about the products they offer, but also on how to offer friendly, customer service oriented hospitality which give insights on the surrounding area.

Resort handling

Resort managers or operating service providers oversee all operations in the various departments from the front desk and security to housekeeping, food and beverage. They are responsible for the overall success of the facility. This is a very diverse position that manages a wide variety of people. A strong leader that is both, service and business oriented, will exceed in this management role.

Restaurant

Restaurant operator requires a dynamic position such as leading a team of employees, and servicing food and beverages. Individuals who assume such roles should assure that food services are

supplied to the client on time. They are also responsible for the overall function of the operation, inventory, ordering, and budgeting.

SPA and wellness

SPA and wellness service provider is responsible for the day-to-day operations of a health or beauty SPA. Based on the size of the operation, the position can be customer service focused or more business based, handling all the marketing, schedules, and training.

Event management

There are various events such as wedding receptions, concert festivals, conferences, and exhibitions that require dynamic service providers.

Concerts, festivals, conferences and exhibitions

Event planning and management are normally operated in a large scale. This role involves studying the brand, identifying the target audience, devising the event concept and coordinating all the technical aspects before launching or hosting an event.

Wedding coordination

Wedding events bring together people from different contexts and of high and low profiles. They are centred on building relationship, planning and organising services for wedding events. Such roles require creativity, self-discipline, and integrity. Brides want to have confidence in their wedding coordinator and in doing so this individual needs to be extremely organised. Wedding coordinator should be able to execute special events with many moving components, balancing a need for both structure and creativity in the workplace. It is a rewarding career for the right individual, making lasting memories.

Other areas of business opportunities

Other areas of employment opportunities in tourism and hospitality businesses include airlines, amusement parks, or leisure centres, casinos, catering, cruises, consulting, tour guiding, tour operations, working with national parks, museums, and other tourism related conservation organisation/institutions.

Airlines

Atmosphere in the airline is made attractive by flight attendants. These are responsible for managing the inflight services, food, beverage, duty free, and other customer service requests.

Amusement parks

Amusement arrests the attention of children and their parents or guardians. The amusement manager controls all the desk selling tickets, supervising a food and beverage outlet or controlling the rides.

Casinos

The gaming service industry is huge and jobs are typically found in casinos or at the racetrack. Someone interested in this career may work as a dealer, slot machine attendant, pit boss or an overall operations manager dealing with the activities, in addition to any lounges or food and beverage outlets offered to the players.

Catering

Catering is a fun and vigorous career. This position is constantly on-the-go fielding queries and giving instructions. It is a great position incorporating sales with event planning and management.

Cruises

When you cruise you are floating from one port to another. This carrier involves working in sales, food and beverage, housekeeping, maintenance or security.

Consulting

Consulting allows you to work for a firm or start your own business. It is a carrier that requires a base of experience in order to advise your clients. Whether in hotels, restaurants or travel, becoming an expert in your trade will allow you to give a sound guidance.

Start your own business

Tourism industry encourages individuals and private entities to collaborate with public institutions in advancing the sector. Encouragement is made for any creativity from opening a restaurant in your hometown or village to offering sightseeing tours. With good business sense and creativity, it is possible to start and own a company and scale to great magnitudes. Employers are looking for competent individuals with both knowledge and experience in the trade. Curiosity, innovation, and flexibility offers advanced insights into the tourism industry and provide students with the opportunity to develop their knowledge and interests within the field.

Travel and Tourism

Jobs in travel and tourism industry include porters, tour guides, tour drivers, tour operators, travel agents, cruise directors, sales managers, and tour managers. These professionals are in charge of all factors that involve traveling. This can include booking travel, overseeing guest entertainment, managing staff, budgets, sales, and marketing. Tour guide, tour operators, hotel operators, and investors can also form various associations to promote and protect professional and sector interests. This include tourism operations and management institutions at various levels of government and private sector enterprise as well as conservation institutions or authorities.

Exercise 4.3

1. Provide five reasons for promotion of eco-tourism in Tanzania.
2. Describe five ways through which eco-tourism impose foreign ethics on other cultures.
3. Analyse the necessary conditions that are necessary for the growth of tourism in Tanzania.
4. Discuss four contributions of corporate social responsibility programmes to the development of ecotourism.

Activity 4.5

In a group, examine two of the following titles and present your findings in the plenary or class.

(a) Tourism encourages conservation

(b) The impact of tourism in socio-economic development of Tanzania

(c) The advantages of investing in ecotourism

(d) Engaging youths to tap on employment opportunities in the tourism industry

(e) Harmonization of tourism and environmental protection

Case studies

Tourism in Tanzania

Tanzania is endowed with a wide range of tourist attractions which include wildlife, sandy beaches, historical sites, mountains, nature and landscapes. It is home to the Ngorongoro Crater which is the largest intact volcanic caldera and home to strong populations of lions, leopards and hyenas, wildebeests, buffaloes, and zebras. Other attractions include the Serengeti National Park that hosts the world's largest terrestrial mammal migration (the wildebeest migration); the Kilimanjaro Mountain National Parkwhich is the highest mountain and the world's highest free standing mountain and the Selous National Park which is one of the largest game reserves in the world. These attractions are visited by tourists from all over the world.

Majority of the tourists who visit wildlife attractions are from the United States of America, Germany, United Kingdom, and France. Apart from these, there is also an increasing number of tourists from Asia, the Pacific, and the Middle East.

The revised National Tourism Policy, published in 1999, places emphasis on the promotion of private sector investment, environmental conservation and consumer protection. The main objectives are; to maximise the contribution of tourism to the country's development through increased foreign exchange earnings, employment creation, human resources development and rural development, and to ensure the conservation of tourism attractions, preservation of the environment, and sustainable development of the tourism industry.

In Zanzibar, tourism has been encouraged as a main source of foreign exchange and the sector that contributes to the economic growth. Both local and foreign private companies and individuals are encouraged to invest in the sector.

Factors for development of tourism in Tanzania

Factors that contribute to the development of tourism in Tanzania include;

Availability of natural and man-made attractions such as architecture, museums, and handcrafts: Tanzania citizens are well known for their hospitality to foreigners, which influences visitors to visit the country regularly. Improved transport and communication systems, peace, security and safety attract more tourists to the country.

Transportation: In the case of air transport, there is an improvement in international air accessibility. Currently, Air Tanzania Company Limited (ATCL) has added a number of its flights outside the country. Royal Dutch Airline (KLM) is flying daily in and out of Tanzania. There are many other flight companies such as SWISS Air, Emirates, Qatar Airways, Turkish, British Airways, and Kenya Airways (KQ). These air routes have increased the number of tourists in the country. Flight services are supported by the presence of many international and national airports in the country. These include Julius Nyerere International Airport, Kilimanjaro International Airport (KIA), Arusha International Airport, Mwanza International Airport, and Zanzibar International airport. There are also long distance bus services between Tanzania and Kenya, Malawi, Rwanda, Mozambique, Zambia, and Uganda. Figure 4.7(a) shows the front view of Julius Nyerere International Airport, Terminal 3, and Figure 4.7(b) shows a section of the departure lounge, at Terminal 3

Figure 4.7(a): *The front view of Julius Nyerere International Airport Terminal 3*
Source: https://twitter.com/mydaressalaam/status/1181127903716753409

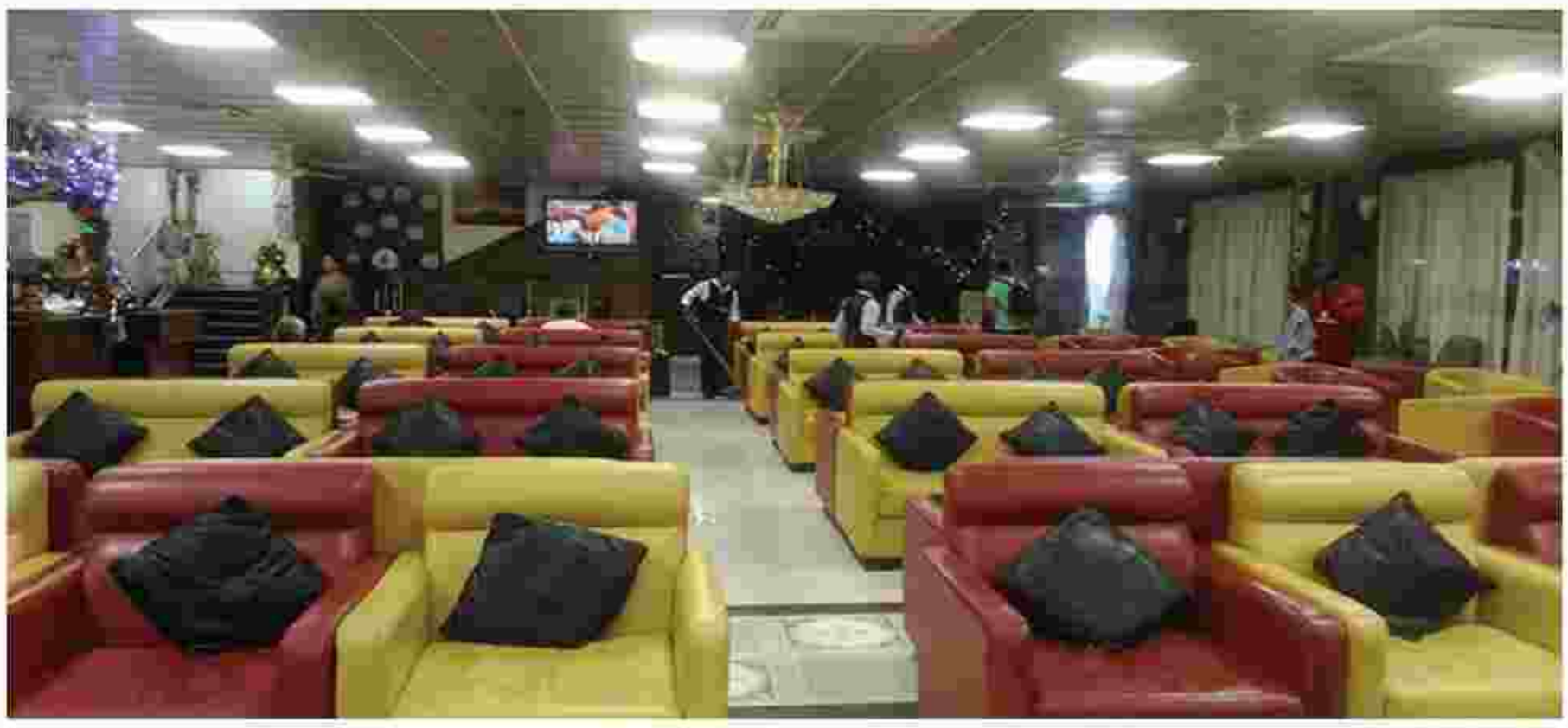

Figure 4.7(b): *Tanzanite lounge at Julius Nyerere International Airport (JNIA)*
Source:https://www.minhasalavip.com.br/reviews/africa/dar-tanzanite-lounge-julius-nyerere-intl-airport-dar-es-salaam/

Hospitality: Tanzanians have a long standing history in hospitality. They depict open and jovial senses of humour, friendly approach, and generosity to foreigners. The people are endowed with a wealth of culture, history, and artistic talents which make the country one of the leading nations in that respect.

The government support: The Government of Tanzania views tourism as a significant industry in terms of job creation, poverty alleviation, and foreign exchange earnings. Today, tourism is receiving a greater attention than before from international development agencies and the central Government. Therefore, the Government is committed to support the growth of tourism sector by increasing the number of flights, building the capacity of tour guides, organising international tourism exhibitions outside the country, encouraging the private sector to operate tourism, promoting tourism through sports, improving infrastructure, establishing of Tanzania safari TV channel, and maintaining peace and security to attract tourism.

Natural attractions: Available natural attractions in Tanzania include Serengeti National Park, Ngorongoro Crater, Lake Manyara and Africa's highest mountain. Kilimanjaro in the north (see figure 4.12). Other attractions include Mikumi, Udzungwa and Ruaha National Park, Selous Game Reserve, Usangu Game Reserve in the south, and Gombe National Park in western Tanzania. Additional natural attractions include the sandy beaches in the north and south of Dar es Salaam and the excellent deep-sea fishing at Mafia. Mount Kilimanjaro which is the Africa's highest mountain attracts a lot of tourists from all over the world. It takes about a week to climb, and reach the summit (Uhuru Peak). Similarly, there are natural stone pillars, erosional features such as Isimila which are attractive to local and international tourism as shown in Figure 4.8. In addition, Zanzibar has gorgeous beaches, romantic Islands as well as a fascinating capital which was called stone town, built by Arab slave traders and spice merchants. This makes Tanzania a unique destination. Generally, good climatic condition/conducive climate (cool and warm) attracts the tourists.

Figure 4.8: *Natural pillars at Isimila Stone Age site, Iringa*

Source: https://commons.wikimedia.org/wiki/File:Isimila_Stone_age_3.jpg

Rich heritage: Tanzania has a rich heritage of archaeological, historical, and rock painting sites, which have been designated as the World Heritage Sites. At Olduvai Gorge, in the interior rift

valley, it is the site of discoveries of the traces of the earliest man. The remains of settlements are also found along the Indian Ocean such as at Kilwa, Mafia, Bagamoyo and Stone town in Zanzibar. Others include rock painting sites at Kondoa and around Lake Victoria. Tanzania offers interesting culture and crafts, most notably the Maasai culture and art, the Makonde sculptures, and carvings. Figure 4.9 shows one of the Makonde carvings.

Other factors include; unspoiled environment and beautiful scenery, safe destination due to peace and security, accompanied by a stable government, and the unique African experience.

Figure 4.9: *Makonde Sculptures and carvings*
https://kandilivilla.wordpress.com/2012/02/03/the-makonde-art-in-tanzania/

Major seasons in tourism

Tourism seasonality is the temporal imbalance in the phenomenon of visitors, expenditure of visitors, traffic on highways and its effects on transportation, employment and admissions to attractions. Tourism seasonality is generally seen as a challenge in most of the main destinations in the world. Tourism activities are conducted in two major seasons depending on the number of tourists arriving at a particular time. These are high (peak) and low seasons. Hotels often offer a low season and a high season rate. This seasonality may affect the decision of tourists to travel since it has cost implications

High or peak season

High season is the time when the number of tourists, especially from outside of Tanzania increases, compared to any other time in the year. This time of the year fits in with many annual holidays, especially families with school children, and it combines perfectly with sufficient time spent on safari. The peak season is normaly experienced between June and October. During this period the landscape is beautiful green and lush, days are warm and evenings are cool. There are lovely warm days, cooler nights and normally, very little rain. Due to higher number of tourists, places like the Ngorongoro Crater become crowded. In this season, hotel rates are high. Visitors need to book well in advance.

Low season

This is the time when the number of tourists, especially from outside Tanzania decreases than in any other period of the year. In Tanzania, the low season is during March to May when rainfall is

high in many parts of the country. As visitors volume decreases, low hotel rates are expected. In this literal, wet season, many baby animals are around and it is the good time for bird-watching. Some hotels operators use low season to renovate facilities and release employees for leave.

Best season to visit Tanzania

The best season for a Tanzania safari depends on where visitors want to go and what visitors want to see. For first-time travellers, the best time to visit Tanzania is usually during the dry season. This is when it is easier to track and spot wildlife.

Major tourist zones in Tanzania

Areas visited by tourists in Tanzania differ depending on their nature and geographical location. The highly visited areas include the Stone Town in Zanzibar, Mount Kilimanjaro, Serengeti National Parks, and Ngorongoro Crater. The country's three major tourism zones include the northern, southern and eastern circuit (including the coast lines and the marine sea scape of Mafia and Zanzibar) as shown in Figure 4.10.

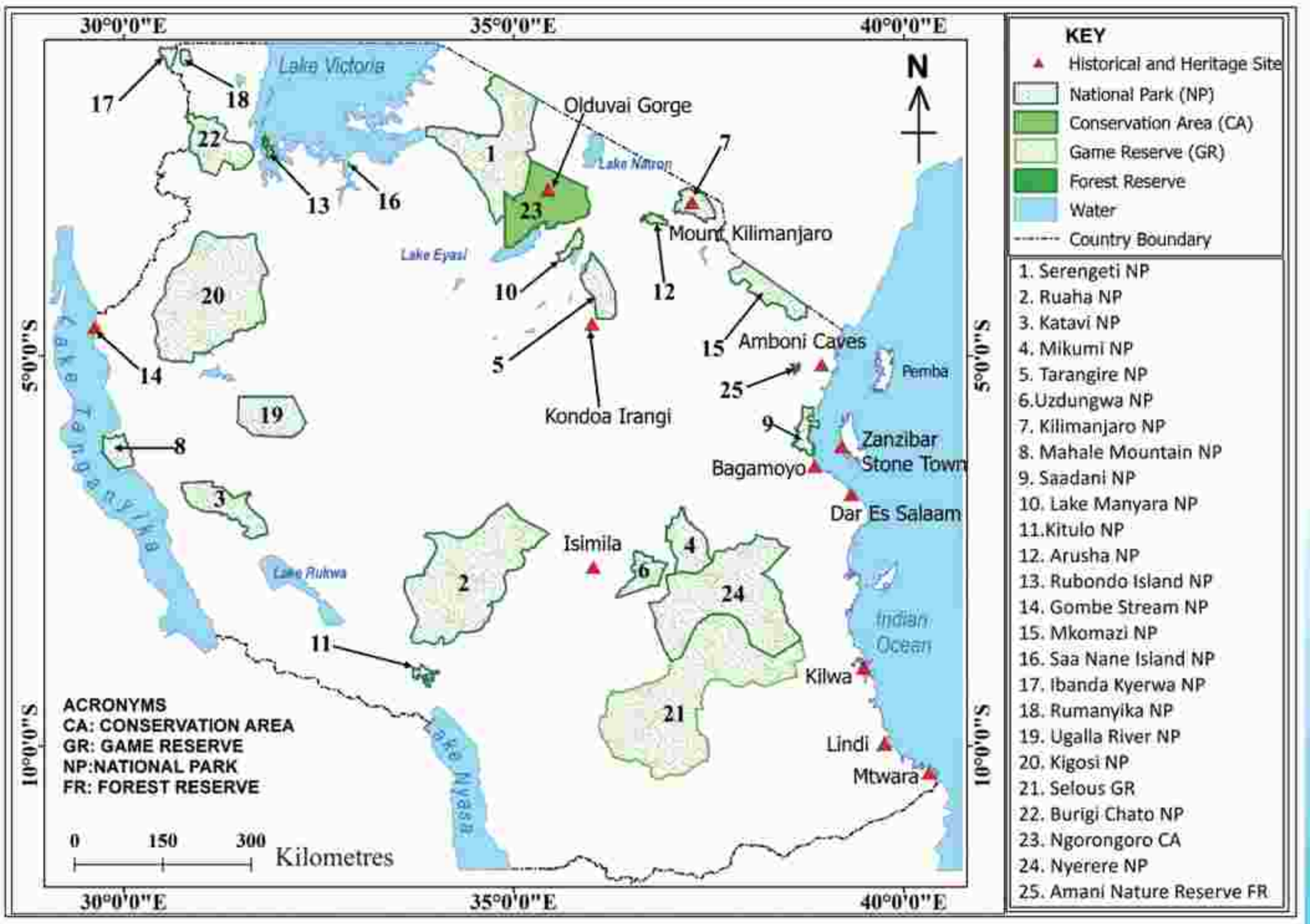

Figure 4.10 *Distribution of some Tourist attractions of Tanzania*

Source: Cartography and GIS lab, University of Dar es Salaam

The northern circuit: The northern circuit includes Serengeti, Lake Manyara National Park, Ngorongoro Conservation Area (NCA), Mount Kilimanjaro, Tarangire, Mkomazi, and Arusha National Parks.

The southern and eastern circuit: The Southern and Eastern circuit includes Zanzibar Stone town (see figure 4.11), Mikumi, Ruaha, Selous, Udzungwa, Mafia Island and Kilwa Kisiwani, Amani nature reserve in the eastern usambara mountains, and Julius Nyerere National Park.

Figure 4.11: *The Old Fort of Zanzibar*

Source: httpsen.wikipedia.orgwikiOld-Fort-of-Zanzibar#medialFileOld-For…

Other tourist areas: Other tourist areas comprises of Katavi, Gombe, Mahale, and Rubondo National Parks, and Lakes such as Victoria, Tanganyika, Nyasa, Rukwa, Natron, and Manyara

Efforts made to promote tourism in Tanzania

Tanzania's tourism industry is prospering and continues to be among the key sectors that generate foreign exchange. Deliberate efforts have been made to promote tourism in Tanzania. These include;

Promotion and marketing of tourism sector: Tanzania launched a new five –year International Tourism Marketing Strategy in November 2012. The strategy is a joint initiative between the public sector (led by Tanzania Tourist Board) and the private sector (led by Tourism Confederation of Tanzania). The main objectives of the strategy are; to increase Tanzania's market share in all key markets that manage tourist arrivals, to reposition Tanzania in the international tourist market and to draw lessons from Brazil, Russia, India and China in order to develop a strong future tourism market for Tanzania. The country also intended to introduce a more focused and targeted market approach through the use of modern techniques in promoting and marketing Tanzania's tourism products, and building a wide base of ownership and partnership among key stakeholders.

Cultural tourism programmes: In 2012, the Tanzania Tourist Board (TTB) through its cultural tourism programmes registered six new cultural tourism enterprises countrywide, bringing the total number of registered enterprises to 47. Community based cultural tourism has gained popularity in the recent past, with tourists getting an opportunity to engage in various traditional activities.

Training of personnel and community empowerment: In line with cultural tourism programmes, efforts have been made to build capacity among the local

communities. For instance, a training of 30 local tour guides was conducted in Engaresero village, Arusha in June 2012 under the TTB Cultural Tourism Programmes. The training aimed at equipping the local tour guides with basic tour guiding skills and eco-tourism. Personnel trainings also takes place at Musoma Utalii College.

Promotion of campaigns through sports

The Tanzania Tourist Board (TTB) has intensified tourism promotion through sporting social events. In this regard, TTB and the United States, Washington - based Seattle soccer LLC signed an agreement in July 2012, to display Tanzania's tourist attractions during the major league soccer events of the season. TTB also renewed its campaign contract with Lantech Service Limited of London to carry over the tourism promotion activity in the English premier league, from August 2012 through May 2013. Recently, the Ministry of Natural Resources and Tourism also signed an agreement with the giant football clubs in Tanzania (Simba Sports Club and Young African Sports Club) to advertise tourist attractions found in Tanzania through international league such as CAF Champions league, through the slogan of 'VISIT TANZANIA' and TANZANIA is the land of Zanzibar and Kilimanjaro.

Tourism trade fairs and exhibitions: In 2012, Tanzania participated in 12 international tourism exhibitions outside the country, for the aim of promoting itself as a quality tourist destination. These exhibitions included the Trade Fair in Yeosu Korea, World Travel Market (WTM) in London, the International Tourism Bourse (ITB) in Berlin, INDABA in South Africa, Arab Travel Mart (ATM) in Dubai, and Borse Internationale de Tourism (BIT) in Italy.

Domestic and international flights: In 2012, there was an increase in the number of flights by both existing and new air lines providing services in the country. Regarding domestic flights, in November 2012, Fast-jet airline introduced low cost flights flying from three air ports in Tanzania, covering the routes between Dar es Salaam, Mwanza and Kilimanjaro, Fast-jet which operated Airbus A319 flew twice a day from Dar es Salaam to Mwanza and Kilimanjaro. The airline offered the lowest fares in the market, in addition to pay-as-you travel in extra arrangement. This gave passengers the flexibility to pay for additional baggage and refreshments. The introduction of these flights increased passenger choices and made domestic travel to some of the major tourist attractions more affordable, hence contributing to the increase in the number of tourists visiting the attractions located in the northern circuit. Furthermore, the introduction of low cost fares increased competition between the airlines flying for those destinations, leading to reduction on fares for passengers travelling between Dar es Salaam, Mwanza, and Kilimanjaro.

Regarding international flights, Ethiopian Airlines made its inaugural flight of Boeing 787-800 Dreamliner to Kilimanjaro International Airport in August 2012. The Ethiopian Airlines also inaugurated Dreamliner "Flyover" which

carried 270 VIPs including diplomats, government officials, travel industry, representatives and the media.

Another international airline flight is the Qatar Airways which launched a new daily flight to Kilimanjaro(the Tanzania's leading tourist northern circuit) in July, 2012. With the introduction of this flight, Qatar Airways now makes two daily flights to Tanzania giving visitors from Europe, America, and other parts of the world a wider range of options to reach Kilimanjaro. This makes it easier for tourist to access the unique tourist attractions in Kilimanjaro, Tanga, Arusha and Manyara regions.

The Oman Air resumed its flights to Zanzibar International Airport, which has been re-named as Abeid Aman Karume International Airport (AAKIA), from Muscat, Oman three times a week. There were no direct flights between the two destinations and most of the passengers connected lines through Kenya. Emirates and KLM had also an interest to fly to Zanzibar upon the completion of the new international passenger terminal. Currently, Tanzania has invested in the airline industry to allow smooth access to the local and international destinations. About 11 new airlines have been purchased and upgrading and improvement of landing sites is ongoing.

Infrastructural development: Efforts to improve infrastructure are among the strategies to promote tourism in Tanzania. For example, Zanzibar secured a loan for building new facilities at AAKIA, including a new passenger terminal, a small power station, and a bigger airport. The new terminal was expected to be operational in 2014, but construction work delayed due to financial and technical reasons. The new terminal 3 was inaugurated in September 2020 and is currently operating. It is meant to serve international flights while terminal 2 is currently serving the domestic flights. Terminal 3 is equipped with modern CCTV, baggage scanners and level aero-bridges for bigger aircrafts. The airport has the ability to hold three airplanes at a time and able to serve three million passengers annually.

Meetings and conferences: The Government of the United Republic of Tanzania, through the Ministry of Natural Resources and Tourism and the World Tourism Organisation organised the first Pan-African Conference on Sustainable Tourism Management of National Parks and Protected Areas. The conference was held in Arusha in October 2012, focusing on promoting "Park tourism" as one of the core components of overall national park management in Africa. It also aimed at acquiring an overview of the current challenges in terms of demand and supply chain. Furthermore, the conference focused on new partnerships and business models for park management structures, in order to maximise the economic and social benefits to the local communities.

Extension of tourism services to designated development zones: In order to extend tourism services to various parts of the country, special development zones were designated. The issue was determining which attractive areas or

groups of contiguous areas are supposed to be designated as Tourism Development Zones. In determining these Zones, the following factors were taken into consideration; location of the national parks, game reserves or conservation area; topography of the area, natural boundaries, natural and man-made tourist attractions and their spatial relationships. Also, a range of tourism products that could be developed; the existing volume and quality superstructure of hotels, lodges, camps; and the logic of their geographical grouping or 'clustering', which enable them to be accessed and serviced from a common centre. Other include access in respect of time, distance and cost from the main 'gateways'; the existing and planned level of infrastructure, particularly roads and utilities; the potential to create a composite product for marketing and image building purposes and security from health hazards, and civil disturbances.

After the identification of the criteria, actions regarding the establishment of designated tourists development zones were made as follows; first, there was an extension of the northern wildlife area eastwards through the Usambara mountains, Mkomazi, and north coast arc of Tanga/Pangani. Second, there was the development of a strong southern circuit comprising the wildlife areas of north Selous, Mikumi, Udzungwa and Ruaha. Third, the Coastal Zones involving beach resort tourism, including Mafia and other offshore islands.This zone also encompasses the historical centre of Bagamoyo, the Saadani National Park to the north and Kilwa to the south. Similarly, for Dar-es-Salaam and the environment around it, there was an emphasis on the urban water-front and the offshore islands from Ununio in the north to Ras of Kimbiji in the south, and Islands of Mbudya, Bongoyo, Panganvini, Mwaktumbe, Kendwa and Sinda. Lastly, the development of the link corridor between the northern and southern areas. Furthermore, these mapped areas were termed as tourism development zones as shown in Table 4.2:

Table 4.2: *Tourist development zones*

Tourism Development Zones	Description
Northern Wildlife	National Parks of Serengeti, Lake Manyara, and Tarangire, and the Ngorongoro Conservation Area
Kilimanjaro -Arusha	Kilimanjaro and Arusha National Parks and Gateway Service Centres
North East Mountains & Coast	arc through Mkomazi Game Reserve, Usambara Mountains and North Coast to include Tanga and Pangani.
Coastal	Narrow Coastal Band along the 'Coastal Zone Administrative Area' excluding the Dar-es-Salaam Urban Area - from Saadani Game Reserve in the North (including Bagamoyo), and from Ras Kimbiji to the Rufiji Delta in the South.
Dar-es-Salaam and Environs	Urban Waterfront from Ununio (North) to Ras Kimbiji (South), and Islands of Mbudya, Bongoyo, Panganvini, Mwaktumbe, Kendwa and Sinda
Southern Coast and Islands	from Southern Coastal Zone Boundary to Mozambique Border including Kilwa, Mtwara and off-shore Islands of Mafia and Songo Songo
Southern Wildlife	Mikumi, Udzungwa and Ruaha National Parks, and Selous, Rungwa Game Reserves.
Southern Highlands	Poroto and Livingstone Mountain Ranges of Lake Nyasa.
Lake Tanganyika	Gombe, Katavi and Mahale Mountain National Parks
Lake Victoria Hinterland	Rubondo National Park and Burigi – Chato National Park, Rumanyika Orungundu - Karagwe National Park, Ibanda – Kyerwa National Park and Kigosi National Park.

Other efforts: There have been significant new investments in accommodation, restaurants and other facilities of International Standard; Institutional reorganisation has taken place, in particular the setting up of the Tourism Confederation of Tanzania to represent the interests of the private sector. Considerable emphasis has been given to development planning and conservation; valuable ground work has been undertaken in the field of human resources development and training; visitor facilitation has been improved and a national tourism website has been established. Monetary services have been improved and the National Network Fibber has been installed. The programme of 'Royal Tour'; featuring president Samia Suluhu Hassan as tour guide. The public broadcasting service is planning to air the Royal Tour from the United States in 2022. The aim is to promote tourism in Tanzania.

Tourist attractions in Tanzania

Mount Kilimanjaro National Park

Mount Kilimanjaro National Park is home to Africa's highest mountain peak

and one of the most frequently visited attractions in Tanzania. It is not visited for the wildlife but for the chance to stand in awe of the majestic snow-capped mountain and, for many, to climb to the summit. Mount Kilimanjaro can be climbed at any time, although the best period is from late June to October and during the dry season.

Mount Kilimanjaro, a World Heritage Sites (Figure 4.12), was formed over 1 million years ago by volcanic eruption. Three points which include Shira, Kibo and Mawenzi were formed about 750 000 years ago. The highest point is Uhuru Peak on Kibo, which is one of the seven summits of the world. The mountain rises from farmland on the lower level to the rainforest and alpine vegetation and then to the barren lunar landscape at the peak. Some animals such as buffaloes, leopards, monkeys, and elephants have inhabited the slopes of the rainforest. The alpine zone is where bird watchers will find plenty of birds to view.

Figure 4.12: *Mount Kilimanjaro National Park*
Source: https://www.focuseastafricatours.com/

Ruaha National Park

Ruaha National park is the least accessible park in Tanzania and as a result, the landscape remains relatively untouched. There are over 400 species of birds that are not found in northern Tanzania where bird-watchers can enjoy, and attractive scenery of the river, spectacular gorges and majestic trees appeal to photographers. As Tanzania's first and Africa's second largest park, Ruaha has large herds of buffalo, elephant, and gazelle. The groups of elephants are some of the largest in Tanzania. The Great Ruaha River is the main feature of Ruaha National Park; providing magnificent wildlife viewing on the banks. The river also provides much of the electricity to Tanzania through a hydroelectric dam at Kidatu.

Serengeti National Park

'Serengeti' means an 'extended place' in the Maasai language. Serengeti National Park is a vast treeless plain with thousands,

even millions of animals searching for fresh grasslands. As the leading national park in Afirca, the Serengeti attracts thousands of tourists each year. The best months for wildlife viewing are between December and June. The wet season is from March to May, with the coldest period from June to October. The annual migration of millions of Zebra and wildebeest takes place in May or early June. Wildbeast migration is one of the highlight of Serengeti National Park. This is one of the seven wonders of the world that happens annually in different sections of Serengeti. The most recognised migration is the one of trans destinations between Tanzania Serengeti and Kenya Maasai Mara National Reserve passing through the Mara river, East of Grumeti River through Lobo. This migration is one of the most impressive natural events and the primary draw for many tourists as shown in Figure 4.13.

Figure 4.13: *Wildebeest Migration in Maasai Mara*
Source: https://cdn.tourradar.com/s3/tour/1500x800/143070_cfc4adbc.jpg

Large herds of antelopes, lions, leopards, cheetahs, hyenas, bats, eared foxs, hunting dogs, and jackals are also found in the Serengeti National Park. Nearly 500 species of birds have been recorded in the Serengeti. Many of these are attracted to the swamp area.

Ngorongoro Conservation Area (NCA)

The Ngorongoro Conservation Area (NCA) is located between the Serengeti and Lake Manyara and it is the place where the famous volcanic Ngorongoro Crater is found. It is one of the Tanzania's most popular wildlife viewing area. This huge volcanic crater has a permanent supply of water which pulls all kinds of animals stay in this area rather than migrating (see Figure 4.14). Visitors come here primarily for viewing large game and bird watching. One of the interesting experience in the Ngorongoro conservation area is also the Olduvai Gorge. This important archaeological site has revealed ancient skull and bone fragments that have delivered critical information about early mankind.

Figure 4.14: *Ngorongoro Conservation Area*
Source: https://www.ngorongorocratertanzania.org/top-10-amazing-facts-

The Ngorongoro Crater is the largest intact ancient caldera in the world with nearly three million years old. The Ngorongoro

volcano was one of the world's tallest mountains before it exploded and collapsed. Thousands of wild game can be seen on the crater floor, including lions, elephants, rhinos, Thomson's gazelles, and buffaloes, but wildebeests and zebras account for over half of the animals that inhabit the Ngorongoro Crater. Bird watching is superb; especially around Lake Magadi, which attracts flocks of flamingos to the shallows. Hippos spend most of their time in water during the day and then graze in the nearby grass in the evening.

Olduvai Gorge

The Olduvai Gorge is an archaeological site situated on a series of fault lines, where centuries of erosion have revealed fossils and remnants of early mankind. As early as 1911, a German professor named Louis Leakey found some fossil bones while looking for butterflies in Olduvai Gorge. In a later expedition, the Leakey's collected skull fragments, a skull, and bones determined to be approximately 2 million years old. Tools and hunting weapons from 1 to 1.5 million years ago were also discovered in the Olduvai Gorge. Another exciting discovery was the famous footprints of a man, woman and child at Laetoli, near Olduvai as it is shown in Figure 4.15. These and other discoveries provide more evidence to the theory that at least three hominid species were in this region over 2 million years ago.

Figure 4.15: *Footprints at Laetoli near Olduvai Gorge*

Source: https://www.tanzaniatourism.go.tz/en/destination/olduvai-gorge-and-laetoli

Tarangire National Park

Tarangire National Park was established in 1970. It is best visited in the dry season from July to September, when the animals gather along the river. During the dry season, Tarangire National Park has one of the highest concentrations of migratory wildlife. Wildebeests, zebras, buffalos, impalas, gazelles, hartebeests and elands crowd the lagoons. One of the most noticeable highlights of Tarangire National Park is the baobab trees that dot the grassy landscape. The park is excellent for bird watching, with more than 300 species. These species include buzzards, vultures, herons, storks, kites, falcons and eagles.

Lake Manyara National Park

Lake Manyara National Park is comprised of forest, woodland, grassland and swamps. Two –third of the park is covered by water. Lake Manyara is a host to thousands of flamingos, at certain

times of the year, as well as other diverse bird life. The highlight of Lake Manyara Park is the large population of elephants, tree-climbing lions, and hippos that can be observed at a much closer range than in other parks. This park is also a home to the largest concentration of baboons in the world. Wildlife drives, canoeing (when water levels are high enough), mountain bike tours, and bird watching are the most popular activities in Lake Manyara National Park.

Zanzibar beaches

The Zanzibar archipelago consists of the islands of Unguja and Pemba. The island of Zanzibar is a major holiday destination known for its beautiful beaches. This island has some of the best beaches in the world with varying surf, depending on what side of the island you are. Visitors will find soft white sand and clear shallow water, along with traditional boats. Best beaches in Zanzibar are found in Bwejuu for relaxation and reef safari, Michamvi with a remote coral lagoon, Nungwi - a lively beach for night owls, Kendwa - sunsets and swimming, Kiwengwa Pwani Mchangani - white sand and water sports, Kizimkazi - for authenticity and dolphin safaris, and Matemwe - for local culture and scuba diving.

Mafia Island

Mafia Island draws divers and snorkelers from around the world to the undersea world protected by the Mafia Island Marine Park. The best months for diving are October to March but the best weather on Mafia Island is May to October. March and April are months of heavy rains. Mafia Island Marine Park has excellent coral gardens, an abundant variety of fish and a relaxed diving atmosphere. Countless birds and over 400 species of fish can be seen in the area. Mafia Island is also a traditional breeding site for the green turtle, which are unfortunately close to extinction.

Mafia is also a desirable location for deep sea fishing, especially tuna, marlin, sailfish, and other bit game fish. This island was therefore, the paradise for the first settlers in the 8th or 9th century, but Mafia became a more important settlement during the 12th to 14th centuries when it held a key position in the East African trading routes.

Pemba Island

Pemba Island is the northernmost island in the Zanzibar archipelago. Around Pemba, are many desert islands and some of the best scuba diving in the Indian Ocean, with visibility that is unparalleled. Lush coral gardens, colourful sponges and sea fans are all found in the underwater haven. The town of Chake Chake, the main centre on Pemba, is a popular base for scuba divers. Pemba is less visited than Unguja and as a result has a more laid-back atmosphere. From December to February, visitors can watch traditional bullfighting; a sign from the days of Portuguese dominance in the 16th and 17th Centuries. Pemba Island has high deep valleys, so it has become popular with mountain bikers who are drawn to the 1 000 metre peaks. Pemba is a major world clove producer and it is also well known for the traditions of medicine and magic.

People come from throughout East Africa to learn from the black magic voodoo and traditional healers or seek a cure.

Selous Game Reserve

Selous is the largest game reserve in Africa, established in 1922. It covers 5% of Tanzania's total area. In 1982, it was declared a UNESCO world heritage site, thanks to its rich diversity of wildlife and uninterrupted nature. The Southern area is a forbidden zone that is undeveloped, heavily forested, and contains a series of steep cliffs. Travellers are limited to the area north of the Rufiji River. This area of the Selous Game Reserve has large open grassland, woodlands, rivers, hills and plains. The best time to visit the reserve is July through October. The Rufiji River bisects the Selous Game Reserve and has the largest catchment area than any river in East Africa. The river is an important feature of the reserve, providing the opportunity to watch the diverse water based wildlife. A broad range of game can be found including elephants, hippos, and rhinos as well as buffalos, antelopes, giraffes, warthogs, lions, wildebeests, leopards and cheetahs. The diversity of bird life in Selous includes over 350 recorded species.

Stone Town

Stone town is the cultural heart of Zanzibar and little has changed in the last 200 years. The grand old Arabian homes lining the narrow streets and winding alleys give the city its own unique charm. The majority of homes in Stone Town were built in the 19th C when Zanzibar was one of the most important Swahili trading towns in the Indian Ocean. Visitors will notice the bras-studded, intricately carved wooden doors on many of the houses. As the world's oldest functioning Swahili city, many of the landmarks in Stone Town have been restored to their original glory. Some of the historic buildings are now museums which can be visited. The town also has a couple of interesting old churches of historical significance such as Christ church cathedral (Anglican Cathedral) in stone town, which was built from 1873 to 1879. Some of the other key highlights include; the Forodhani gardens, the Old Dispensary with its carved wooden balconies, and the former home of the sultans known as Beit el-Saleh or the People's Palace, the Hamamni Persian Baths built in 1888, and the oldest structure in Stone town, the Old fort as shown in Figure 4.16.

Figure 4.16: *Old Fort in Stone Town – Zanzibar*

Source : https://zaa.go.tz/stone_town_city

Arusha National Park

Arusha National Park, although smaller than most national parks in Tanzania,

has a range of habitats that consist of the forest of Mount Meru, Ngurdoto Crater in the Southeast section of the park and Momela Lakes, a series of seven crater lakes. Black and white Colobus monkeys are easily spotted in the forested area while the marshy floor of the crater is dotted with herds of buffalo, zebra, and warthog. Momela Lakes is a home to a large selection of resident and migrant water-birds. People come here to see wildlife and also to climb Mount Meru. Mount Meru is one of the most beautiful volcanoes in Africa and the second highest mountain in Tanzania. The summit is reached by a narrow ridge, which provides stunning views of the volcanic cone lying several thousand feet below, in the crater. The ascent is steep but the route passes through parkland, forest, a giant heather zone and moorland.

Katavi National Park

Katavi National Park is located in a remote location offering unspoiled wilderness. A predominant feature in Katavi is the enormous flood plain, split by the Katuma River and several seasonal lakes. The lakes support enormous groups of hippos, crocodiles and over 400 species of birds. One of the attractive events in Katavi is when as many as 200 hippos try to squeeze into a pool of water. The male rivalry heats up causing territorial fights. The dry season brings Katavi National Park to life, herds of impala, reedbucks, lions, zebras, and giraffes can be seen at the remaining pools and streams. An estimated 4 000 elephants and several herds of buffaloes converge on the park when the flood waters retreat.

Gombe Stream National Park

Gombe Stream National Park is primarily for those who want to get a little off the beaten track and see chimpanzees. This is the smallest national park in Tanzania and is famous for the work of Jane Goodall. This British researcher arrived in 1960 to study the wild Chimpanzees and her work turned into what would become the longest running behavioural research program of its kind in the world. Guided walks take visitor into the forest to observe chimpanzees in the wild, Figure 4.17 shows one of the Chimpanzee found at Gombe Stream National Park. Many species of primates and mammals live in the park. Over 200 bird species have been recorded in the tropical forest; including barbets, starlings, sunbirds, crowned eagle, kingfishers and the palm nut vultures. Hiking and swimming are other popular activities; a trail leads into the forest to a waterfall in the valley.

Figure 4.17: *Chimpanzee at Gombe Stream National Park*

Source: https://www.climbkilimanjaroguide.com/gombe-national-park/

Lake Victoria

Lake Victoria is the largest freshwater lake in Africa and is bordered by Kenya, Tanzania and Uganda. This lake is the source of the White Nile and provides an income for millions residents along its shores. The Tanzania section of Lake Victoria is one of the least visited regions in the country, however the towns of Bukoba, Musoma, and Mwanza city have a number of attractions and some have become wildlife sanctuaries. Bird watching and fishing trips are popular excursions, and boat trips or hikes can be arranged to explore the lake. Rubondo Island National Park, which includes several other smaller islands is on the southwest shores of Lake Victoria. Rubondo is the Africa's largest island national park, covering 26km long and up to 10km wide. More than 75% of the island is covered with pristine equatorial rainforest.

Other tourist attractions

Other tourist natural attractions in Tanzania include Amani Nature Reserve, Julius Nyerere National Park, Chato Burigi National Park, Ibanda Kyerwa National Park, and Rumanyika National Park. The largest National Park in Africa, Nyerere National Park (formerly called the northern part of Selous Game Reserve) is a newly established Park in the country. The name of the Park is given in honour of the founder of the Nation, the Late Mwalimu Julius Kambarage Nyerere. Amani Nature Reserve is a protected area located within Muheza and Korogwe Districts in the Tanga Region of Tanzania, in tropical East Africa. The nature reserve was established in 1997 in order to preserve the unique flora and fauna of the East Usambara Mountains. Amani is very rich with water falls, beautiful view point which you can also see sun set and conduct night walk, forest hiking, mountain biking and bird watching. Apart from outlined activities, one can enjoy the beauty of Tanga Amboni caves and the beautiful town of Pangani which is a small town in East Africa's coast that lies 50 kms South of Tanga with a long history and culture. The town has a historical influence of Arabic, German, Asian, and British Colonial rules.

The contribution of tourism to socio -economic development in Tanzania

Tourism contributes to the socio-economic development in the country by increasing the National Domestic Product(GDP), creating employment opportunities, increasing visitors exports, enhancing investments, improving infrastructure, maintaining international reputation, and improving social welfare. These aspects are described as follows;

Increase in GDP: The total contribution of tourism and travel to the GDP was TZS 13 097.8 billion, 13.3% in 2016, and it was forecast to rise by 4.1% in 2017, and by 6.8% of GDP in 2027. Tourism activities increase the tax-revenue of the government. Many types of taxes are included in tourist-related goods and services. All tourist earnings increase many economic activities in the country acting as big sources of taxable earnings for the government.

Creation of employment: A significant number of people are employed in campsites, lodges, tourist hotels, and restaurants. This is an indicator that tourism activities are important for the livelihood of local communities. In 2016, the total contribution of tourism to employment, including jobs indirectly supported by the industry was 11.6% of total employment equivalent to 1 389 000 jobs. This was expected to rise to 2 117 000 jobs in 2017. The sector created 1 550 100 jobs in 2019, which is equivalent to 11.1% at the countries total employment. COVID-19 outbreak has however, challenged tourism employment creation potentials in the country and the world at large.

Increase visitor's export: Visitors' exports generated TZS 5 455.5 billion, 21.4% of total exports in 2016. This was forecasted to grow by 2% in 2017 and by 6.9% from 2017 to 2027, which is TZS 10 799.9 billion, 21.6% of total. With the COVID -19 outbreak, monthly tourist arrivals declined drastically in 2020 towards 2021.

Investment enhancement: Investment in tourism in 2016 was TZS 2 658.4 billion, 8.7% of the total investment. It is expected to rise by 6.6% over the next ten years to TZS 5 226.8 billion in 2027, 9.2% of the total. Tourism related investment generated about 2.4 billion USD in 2018. Tanzania with the seven world heritage sites offers a wide range of investment opportunities in natural and cultural tourist attractions.

Construction and improvement of infrastructure: Tourism necessities help in creation of infrastructure utilities and amenities, which are not only used by the visitors but become valuable to the local population as well. Tourist arrivals in a country increase the demand for infrastructure facilities. An attempt must be made to develop infrastructure in a planned manner so as to avoid congestion, overcrowding, and damage to the environment. The contribution of tourism to the nation can easily be seen when the country connects all regions with paved roads and hotels of international standards are built up especially in major tourist towns or cities.

International reputation: Visitation by reputable and famous individuals such as Bill Gates in 2017, gives the country an international recognition. Bill Gates spent some of his time doing philanthropic work and enjoyed some leisure time as well. He visited Mnemba Island Lodge in Zanzibar. Other reputable tourists or celebrities include Harrison Ford who stayed at Greystoke while visiting the Wild chimpanzees in Gombe National Park and Oprah Winfrey who stayed at Grumet Game Reserve in Serengeti, and Timberlake who took a private hot air balloon ride over the plains of the Serengeti.

Help to improve social welfare of host community: The tourism industry is a highly labour intensive service industry, hence it is a valuable source of employment. It provides employment through different types of business firms such as hotels, motels, restaurants, transport agencies, travel agents, tour operators, gift shops, car drivers, and

guides. It employs large number of people and provides a wide range of jobs, from unskilled to highly specialised ones. There are other supporting industries, small and large which cater for the needs of tourism industries either directly, or indirectly by providing and supplying necessary needs to the tourists. These include food services, entertainment, accommodation, automobile transportation, and travel companies.

Challenges and recommendations for improving tourism sector in Tanzania

The condition of some infrastructure in the country, particularly roads that are in the national parks, is still a challenge. This implies that the government should continue with her efforts to improve roads, including those leading to the national parks and other natural and man-made attractions in order to attract more visitors. Visa processing at entry points is also a challenge. In this regard, there is a need to increase transparency and efficiency in Visa processing. In addition, the quality of the services rendered to visitors, particularly in hotels is an issue of concern. Efforts need to be made to address these concerns. Such efforts should include designing tailor made programs focusing on customer care services. There is also a problem of insufficient automated teller machines at some tourism establishments and unreliable internet access. This calls for the need to sensitise hotels and other tourism establishments to invest more in these facilities, including credit card usage and internet services.

Moreover, traffic jams in major cities is a challenge to the prosperity of the tourism sector. However, this has been addressed by the introduction of the rapid transport bus system, construction of flyovers in the city of Dar es Salaam and diversification of transport by using city passenger trains. The state of some historical and cultural heritage sites is also an issue of concern that needs to be addressed. Encroachment of indigenous people in reserved area is another challenge since this habit tends to damage the natural environment and ecosystem.

Exercise 4.4

1. Describe the following concepts:
   (a) Environmentally friendly tourism
   (b) Eco-tourism
2. Account for the promotion of environmentally friendly tourism in Tanzania
3. Assess the impact of tourist activities to the indigenous people in Tanzania.
4. Analyse the contribution of tourism to the socio-economic development in Tanzania.
5. Examine how the COVID-19 pandemic has affected tourism in Tanzania.
6. Evaluate the role of local people in eco-tourism.

Activity 4.6

1. Visit a nearby tourist office and ask for a two year collected data of visitors; then do the following:
   (a) Compare and contrast the statistical difference of the collected data for two years
   (b) Give reasons for the differences observed, taking into consideration the climate of the area, infrastructure, political situation, and health reasons such as COVID-19. Present your observations to your teacher.
2. Walk around your village or nearby town and then identify natural features that if developed, can attract tourists. Show how the identified features can be used to promote sustainable development of the area.

Activity 4.7

Study the map provided as shown in Figure 4.10. Then describe the types of tourist attractions presented on the map.

Tourism in South Africa

The Republic of South Africa offers a friendly atmosphere for flourishing of tourism in the continent. South Africa is located on the southernmost tip of the African continent, and is marked by distinct ecosystems. Visitors can learn about the nation's turbulent history in Cape Town; one of the world's most beautiful cities; in Durban, a melting pot of cultures and cuisines; at the poignant museums and galleries in Johannesburg and in Soweto, where Nelson Mandela lived from 1946 to 1962. Kruger National Park is a famous destination in South Africa for many international tourists. Each year more than half a million visitors are registered. The Western Cape offers beaches, lush wine lands around Stellenbosch and Paarl, Craggy Cliffs at the Cape of Good Hope, forest and lagoons along the Garden Route, and the city of Cape Town, beneath flat-topped table Mountain. The vision of tourism in South Africa focuses on sustainable tourism development for inclusive economic growth.

Factors for successful tourism in South Africa

Some of the factors which make South Africa in an incredibly attractive tourism position include accessible wildlife, varying and impressive scenery, unspoiled wilderness areas, and diverse culture (traditional and township African cultures). The country has well-developed infrastructure and virtually unlimited opportunities for special interest activities such as whale-watching, wild water rafting, hiking, bird watching, bush survival, deep-sea fishing, hunting, and diving. In addition, unique archaeological sites and battlefields, the availability of excellent conferences, and exhibition facilities. Other attractions include; a wide range of sporting facilities, good

communication, and medical services. Some of well-known sites such as Table Mountain, Cape of Good Hope, Sun City, Garden Route, and Maputaland draw attractions of many tourists. There also are regionally and internationally known attractions such as the Victoria-Falls and the Okavango Swamps, which make South Africa an attractive tourist destination. Involvement of best practice in ecotourism global leader companies in the sector and political transformation (from Apartheid regime to Democratic regime) of 1990s has opened up the country's tourism potentials to the rest of the world, boosting the country's name internationally.

The role of tourism in South Africa's economy

Over the recent past years, tourism in South Africa has emerged as the leading economic growth sector. It is one of the largest contributors to the Gross Domestic Product (GDP) and it offers significant employment and enterprise development opportunities.

Tourism is the fastest growing economic sector in South Africa contributing close to 7.1% of the GDP. It is a labour-intensive industry that brings in foreign revenue and stimulates a broad range of other industries. Tourism has successfully promoted impoverished communities living in areas of high tourism potential, to middle income earners through investments in both tourism infrastructure and products.

Tourism has stimulated improvement in infrastructures such as roads, railways, airways, and waterways. The links with the rest of the world are rapidly being established. Moreover, tourism has helped to improve social welfare through improvement of social facilities such as hospitals, schools, electricity, and water supplies. The local communities are involved in the manufacture of handmade products, hence improving their living standards.

Constraints in South Africa tourism sector: One of the constraints into the tourism industry in South African is inadequate budget allocation to the sector. Greater part of the budget is used just for marketing and providing market access to South African. High crimes rates in major cities reduce tourist arrivals in South Africa. There is still limited integration of local communities in tourism activities. Poorly developed infrastructure in rural areas also limits development of the sector. Moreover, an immediate problem facing the industry is the growing level of crime and violence on visitors.

A marked decline in the total tourist arrivals in South Africa was in the period January to March 2021 when it went down by 84,1% from 2 429 177 in 2020 to 386 937 during the first thee month in 2021. The decline is largely attributed to the adverse effects of the COVID-19 pandemic, which also affected many other tourist destinations in the world. Another constrain is inadequate labour supply caused by labour mobility from tourism sector to mining sector. Figure 4.18 shows the Table Mountain, one of the tourist attractions in South Africa.

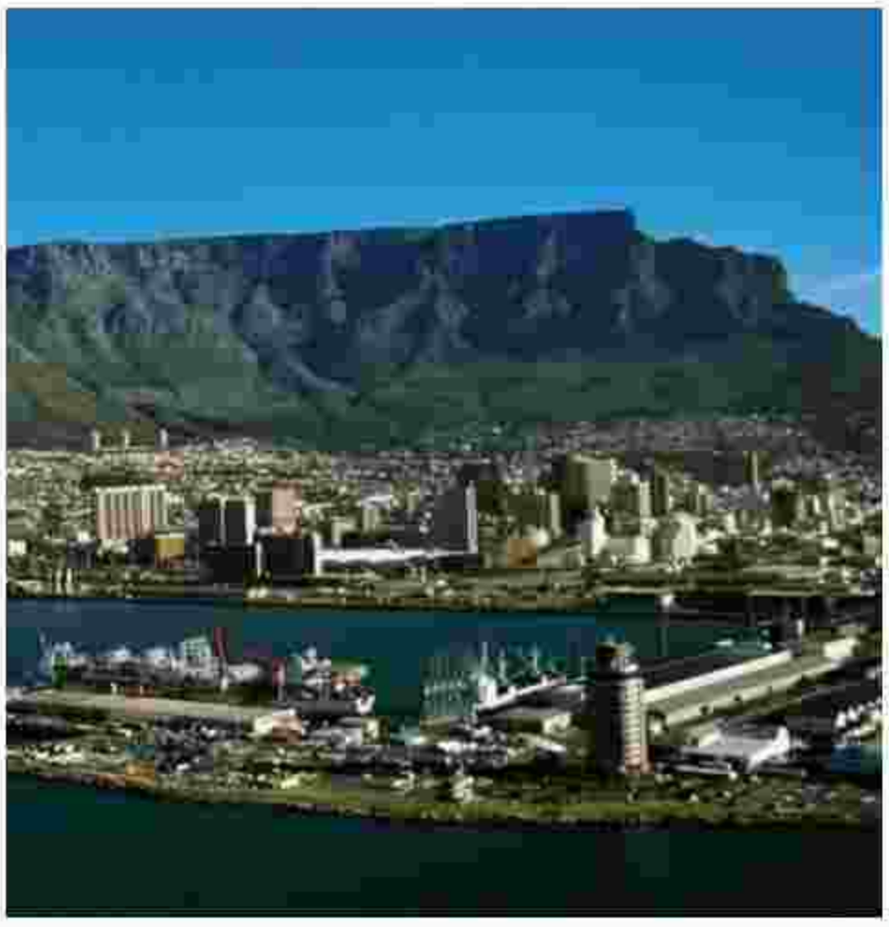

Figure 4.18: *Table mountain of South Africa*
Source: https://www.britannica.com/place/Table-Mountain-South-Africa

Exercise 4.5

1. Explain six factors for the success of tourism industry in South Africa.
2. Account for the constraints of the tourist sector in South Africa.
3. Describe possible measures to solve the constraints facing the tourist sector in South Africa.
4. Choose one tourist area in South Africa and explain how it contributes to the economic growth of the country.
5. Examine the lessons that Tanzania can learn from the South Africa tourism industry.

Activity 4.8

In a group, use online sources to find articles that cover information on tourism industry in South Africa and in the SADC region. Then use the accessed information and this text book to respond to the following questions;

(a) Compare and contrast the performance of tourism industry in Tanzania and South Africa.

(b) Present tourism industry contribution to the socio- economic development of South Africa.

(c) Suggest ways of resolving the challenges facing tourism in South Africa.

Tourism in Sweden

Sweden is a Scandinavian nation with thousands of coastal islands and lakes along vast boreal forest and glaciated mountains. Swedish tourist resources include its large, unspoiled forests and lakes, beautiful countryside setting, varying coast sizes, their folk customs, and dances. The central lake region contains many lakes; the two largest ones, Venner and Veter, are linked by a 190 km long Gota Canal. The Southern Baltic coast of Sweden enjoys exceptionally long sunshine hours. Facing the North Sea, is the 'golden coast' with 1 400 km of white 'midnight sun' located along the Gulf of Bothania. It is also the gateway to Lappland, the largest unspoiled wilderness in Europe. Sweden

is under the constitutional monarchy. It undertakes ecotourism and attracts three million visitors annually. Its principal cities; the eastern Capital Stockholm and South-western Gothenburg and Malmo are all located along the coast. The aim of the Swedish tourism policy is that Sweden should be a highly attractive tourist destination with competitive long-term tourism, contributing to sustainable growth and increased employment throughout the country.

Tourist attractions in Sweden

Drottningholm Palace: Drottningholm Palace is found on the island of Lovö and is a UNESCO World Heritage site. It lies about 11 km west of Stockholm city centre. The palace dates back to the 17th Century. It is now the official residence of the Swedish Royal Family. The palace is built in Baroque style; it is unaltered theatre building, completed with fittings and furnishings and a stage scenery which is still in use. It has Chinese style pleasure in the grounds, unique of its kind and also in a good state of preservation.

Vasa Museum in Stockholm: It is Sweden's most popular museum and now attracts around a million visitors annually. In 1628, the pride of the Swedish Imperial battleship sank on its maiden voyage. The ship lay below the icy waters for more than three centuries; it was rescued from the seafloor in 1961. Now visitors from across the world come to see this fascinating time capsule. Figure 4.19 shows the rescued ship.

Figure 4.19: *Vasa Museum (Swedish Imperial Battle Ship-1628)*

Source: httpswww.afar.complacesva-museum-stockholm

Stockholm Archipelago, Stromma Boat Tours: Stockholm is often referred to as the Venice of the North. Water is everywhere and around 30 000 islands lie in Stockholm's wondrous archipelago. There are distinctive red and yellow timber summer houses in the islands which remain unspoiled for many years. The tour boats are quick and comfortable to popular islands such as Sandhamn, Grinda, Moja, Finnhamn and all the islands in between. All meals served on board are prepared by ship chefs during the trip with only the finest groceries.

Djurgården Park: The Park has many wonderful amenities. There are traditional cafes, restaurants, snack-bars, and even hotels. The Abba Museum is found here and the open air museum and zoo. Like no other place in Stockholm, it collects many of the city's most famous museums and cultural attractions (the Vasa Museum,

Gröna Lund, the Abba museum, and Skansen with green nature, parks, and family-friendly activities. Djurgården can be reached by bus, tram or ferry from central Stockholm.

Sigtuna: This is Sweden's first ever town founded in 980 AD, the last century of the Viking era. This town is situated alongside Lake Malaren. Its amazing history is to be found in the medieval churches, ruins, rune stones, and buildings that remain to this day.

Visby, Gotland: Visby is a walled town brimming with ruined churches which date back to some 700 years in Gotland Island. It is the pearl of the Baltic and UNESCO World Heritage Site. The town is full of history, nature, culture, good food, and good beaches. Located in the Baltic Sea, this fairy-tale town is a national treasure and is characterised as having "outstanding universal value". This well-preserved medieval Hanseatic town dates back to the 12th Century and contains a number of remarkable church ruins from the period such as the St. Clemens, St. Nicolai, and Drottens ruins, or the St Karin church ruin with its high arches. Visby contains a number of historic churches as well as the Sankta Maria Cathedral built at the end of the 12th Century. Visby also has a well-preserved 3.5 kilometre long medieval ring wall with many of its original towers from the 1 200s still intact. The wall encircles the center of Visby and was originally built for protection against both foreign enemies and Swedish assailants from the countryside.

The Göta Canal: Often described as the Sweden's greatest feat of engineering, the canal dates from the early 19th Century. The Canal connects several lakes including the Baltic Sea. It has 47 bridges and 58 locks.

Kiruna, Lapland: Kiruna is the Sweden's northern most town; sharing the same latitude as central Greenland. It is the chief town of the largest commune in the country, which borders both Norway and Finland. The midnight sun is visible here from mid-May to mid-July. The world's first ever Ice Hotel is about 17km outside the city.

Abisko National Park, Lapland: In summer, this is the Land of the midnight sun, with 24 hours daylight, lasting several weeks. Abisko is more than 200km inside the Arctic Circle within the auroral oval, a particular area where there's a higher chance of seeing the Northern Lights.

Liseberg Theme Park, Gothenburg: The Park has a huge range of attractions from children's carousels (Figure 4.20) and a fairy-tale castle to adrenalin-pumping rides for speed demons, bumper cars, and four roller coasters. Liseberg is one of the most popular destinations in Sweden and each year, the park records more than three million visitors.

Figure 4.20: *Liserberg Theme Park Children Carousel*

Source: httpswww.mostphotos.comen-us4308972karusel

Oresund Bridge, Malmo: Oresund bridge is a combined railway and motorway bridge across Oresund Sweeden and Dernmark as shown in Figure 4.21. It is the longest combined road and bridge in Europe; running nearly 8 kilometres (5miles) from the sweedish coast to the artificial island Peberhorm in the middle of the strait.

Figure 4.21:*Oresund Bridge*

Source: https://www.bing.com/images/search?q=oresund+bridge+image&id= D2148E590E0F4440D65F46D637AD75B81066E6B0&form= IQFRBA&first=1&disoverlay=1

Lund Cathedral: This is Sweden's most visited cathedral and one of the most visited sites in the southern province of Skane. It was founded around 1 080s by the Danish King Canute IV and it is the oldest and finest Romanesque church in Sweden. The present building dates from the 12th C. Over the altar, is a magnificent 14th Century carved reredos, the work of a north German master. The crypt is the oldest part of the cathedral. Its roof is borne on a carved stone pillars, with figures that are traditionally believed to represent a mythical giant, Finn, who is said to have built the cathedral. On the aisle, is the famous 14th C astronomical clock with figures of the three Kings, which emerge daily at noon and 3pm on weekdays and 1 pm and 3 pm on Sundays.

Other tourist attractions include Sweden's art, literature, modernism, and music. Generally, Swedish society art and culture range from prehistoric rock carvings and Iron age man-made landscapes to a small group of timer buildings, known as a "church town", in the north, a gigantic copper mine, the oldest joint stock company in the world, a complete manufacturing community and a woodland cemetery with 20th century building of outstanding architectural merit. The cultural heritage and the natural environment, combined with activities, are the cornerstone of the Swedish tourism. Apart from the attractions explained above, other factors that contribute to successful tourism sector in Sweden are well-connected transport and communication network by roads, waterways, railways, and airways. All the cultural towns are linked and it takes a short time to reach the desired

destination. Swedish passport is the second most powerful, just after the Germany because the process of accessing it is less restricted. Swedish people have good language skills and English has been a compulsory subject throughout primary and secondary schools. Almost everyone from the age of 11 speaks English enough to understand you. Swedish are creative. They build ice hotel during winter and there are winter sports. It is also easy to do business in Sweden.

Contribution of tourism to socio-economic development in Sweden: Tourism generates big revenue in Sweden. Since 2000, total tourism consumption in Sweden has increased by a total of SEK 131.6 billion; equivalent to an average annual increase of 4.4% over the past 16 years. The export value proportion of total tourism has increased from 27 to 40%. Added value and the number of people employed in the tourism sector have also increased since 2000. The GDP share from tourism increased fairly from 2.6 to 2.8%. The total tourism consumption in Sweden increased by 18.5 billion or 7.0% Swedish Krona (SEK) in 2015. Visitors from abroad spent SEK 112.6 billion and Swedish leisure and business travellers spent SEK 169.1 billion. Goods purchases, involving shopping and food purchases account for SEK 77.8 billion or 27.6%.

Exercise 4.6

1. Using a library search or web resource, examine the usefulness of the Göta Canal in Sweden.
2. Account for the constrains of the tourism sector in Sweden.
3. Suggest ways of resolving the constrains of tourist sector in Sweden.

Activity 4.9

1. Form a group and use the library sources and the internet to identify tourist attractions that are found in Sweden and Tanzania. After accessing the right information;
   (a) Compare and contrast the tourist attractions in the two countries
   (b) Assess the performance of the Swedish tourism industry
   (c) Draw specific lessons that Tanzania can learn in order to improve its tourism sector
2. By using the extract map of Sweden, indicate clearly the following tourist attractions;
   (a) Visty Gotland
   (b) Abisko National Park Lapland
   (c) The Gota canal
   (d) Oresund bridge

Revision questions

1. 'Tourism activities in Tanzania are unevenly distributed'. Discuss.

2. To what extent has infrastructure development boosted tourism industry in Tanzania?

3. Tourism industry in Tanzania has made considerable development since 1990s. Discuss.

4. Explain technological changes that have impacted the tourism sector in Tanzania.

5. Discuss the strategies for risk management in the Tanzanian tourism sector.

6. What are the factors that determine choice of a tourist destination?

7. What lessons can Tanzania learn from South Africa and Sweden in the industry?

8. How have challenges of seasonality and COVID-19 affected the tourism and hospitality sector in Tanzania?

9. With reference to Tanzania, explain how the growth of tourism has brought both benefits and problems to the local communities in destination sites.

10. Describe the attractions that make Tanzania to be an equitable tourist destination.

11. Describe different management strategies which could be developed to allow environmentally friendly tourism.

12. Ecotourism has brought benefits to the people and the environment. Justify

13. Account for the distribution of tourist attractions in Sweden.

14. With reference to South Africa, explain how tourism can affect socio–economic development.

15. Describe the benefits of international tourism.

16. Analyse the impact of COVID-19 on tourism industry in Tanzania.

Chapter

Five

Manufacturing industries

Introduction

We use various items to satisfy our needs such as flour which is processed from maize, cassava, and wheat. We also require machines, clothes, building materials, and medicines which are manufactured in various industries. In this chapter, you will learn about the concepts of manufacturing industries, spatial distribution of manufacturing industries, different types of manufacturing industries, factors that are essential for industrial location and the contribution of manufacturing industries to socio-economic and technological development. You will also learn about the challenges that face industrial development and measures that are necessary for alleviating them. Moreover, you will learn about environmental problems that are caused by manufacturing industries and how these can be addressed. Through case studies, you will make a comparative analysis of the world manufacturing industries and factors that affect them. The competencies developed will enable you to use the opportunities available in manufacturing industries for economic development of the country.

The concept of manufacturing industry

Manufacturing is the act of producing something from raw materials. It includes processing raw materials into finished goods. The word manufacture is derived from two Latin words *manus* (hand) and *factura* (make); a combination of the two words means *made by hand*. However, most modern manufacturing operations are accomplished by mechanised and automated equipment that are supervised by human personnel. Manufacturing can be defined technically or economically. Technically; manufacturing refers to application of physical and chemical processes in making parts or products. Economically, manufacturing refers to addition of value to the material by changing its shape or properties, or by combining it with other materials. This is done by means of one or more processing and/or assembly operations. In a manufacturing industry, sheet rubber is transformed to form hoses, footwear upholsters, and tyres; timbers are made into furniture, construction materials, pulp, and paper. Copper ores are concentrated, smelted, and alloyed to produce household equipment and ornaments.

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Manufacturing is a value-adding procedure that converts raw materials, components, or parts into pre-designed goods or products that satisfy customer's expectations or specifications. In earlier times, the processes were mainly carried out by human power. Currently, much of manufacturing is being completed with the use of tools and machines in large scales and high accuracy. Manufactured goods or products can be sold to other manufacturers for further processing or sold to customers in market places, including wholesalers or retailers, then eventually to end users. In that case, the prices of the products have to be higher than those of the raw materials since the raw materials have already been processed.

World distribution of manufacturing industries

The manufacturing of goods began long time before the industrial revolution in the nineteenth century. Historically, people made household tools and agricultural equipment in their own homes or local villages known as cottage industries. Development of manufacturing industries started in the second half of the eighteenth century in Northern England and Southern Scotland. Thereafter, it diffused to Europe and North America in the nineteenth century. Then, it spread to other regions in the twentieth century. The distribution of manufacturing industries in the world is not uniform. Manufacturing industries in the world are mainly concentrated in three regions among the nine. These regions include Europe, North America, and East Asia. Statistics of the world industrial output in 2017, indicates that one-half of the industrial output comes from China, United States, Japan and German (Figure 5.1:).

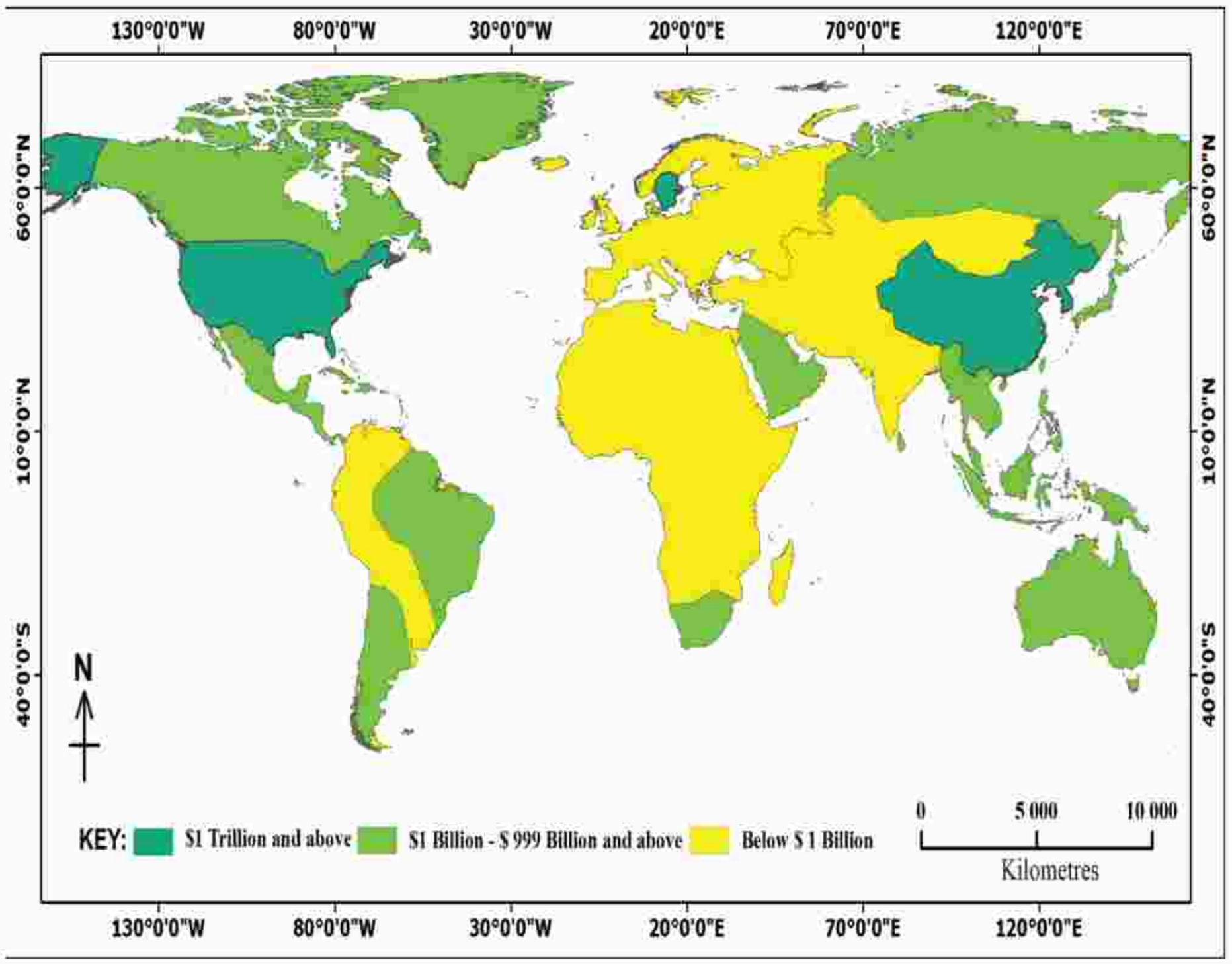


Figure 5.1: *World distribution of manufacturing industries*

Source: Rubenstein (2020)

Manufacturing of goods in these regions is very competitive. Their values are judged and validated in open markets. The following factors determine the competitiveness and the value of manufactured goods; product quality, production cost, delivery time, safety, and moral (collectively presented as QCDSM approach). These factors work collectively and simultaneously. Various technologies and management tools have been developed over years to support the control and optimisation of QCDSM. Manufacturing technology and management has evolved from the use of mechanical power, electrical power, automation system, and digital communications to the use of artificially intelligent systems (Figure 5.2). Manufacturing activities can be viewed from different perspectives such as enterprise, system, processes, and engineering.

Figure 5.2: *Evolution of manufacturing technology*

Source: Huang et al., 2019

Distribution of Manufacturing Industry in Tanzania

According to the Census of Industrial Production (CIP) of 2013 published in 2016, Tanzania mainland had 49 243 industries. About 98.4% are manufacturing industries. Other industries include mining and quarrying (0.8 %), water supply, sewerage, waste management, and remediation activities (0.5 %), and electricity, gas, steam and air conditioning supply (0.3 %). Most of the industries are for food products, clothes, wood products, and fabricated metal products. About 99.6% are under private ownership. Only 0.4% are under the ownership of the government.

Industrial distribution in Tanzania is uneven due to historical, resource-based reasons, and regional planning strategies. The records of 2013 industrial census show that Dar es Salaam is the dominant industrial Centre with about 7 443 industries which is equivalent to 15.1% followed by Mara with 3 549 industries (7.2 %), Ruvuma with 3 477 industries (7.1 %), and Morogoro with 3 077 industries (6.2 %). Katavi region has the smallest number of industries (221 industries, equivalent to 0.4 %). However, most of the industries in Mara and Ruvuma regions are of small scale that employs between 1 to 9 people. Arusha and Tanga regions rank in the second and third positions respectively by having industries that employ more than 100 people after Dar es Salaam region. Industrial sector growth in Pwani region is emerging due to its close proximity to Dar es Salaam region.

Exercises 5.1

1. Explain the importance of manufacturing industries?
2. What are the three dominant regions in the world that lead in the manufacturing industries?
3. Explain why the major or heavy manufacturing industries are mainly concentrated in three regions of the world.
4. What lessons can Tanzania draw from the major three regions of manufacturing industries?
5. Describe the evolution of manufacturing industries in the world.
6. Describe the distribution of manufacturing industries in Tanzania.

Activity 5.1

1. In a group, do the following;
   (a) Identify industries in your nearby town and describe the nature of technology used
   (b) Identify the major manufacturing industries in Tanzania and present your results in the classroom

Types of manufacturing industries

Industries are classified in a number of ways. They can be classified on the basis of size, capital investment, and labour force employed. They are also classified as large, medium, and small scale industries. On the basis of ownership, industries are categorised as public sector, private sector, and joint cooperative sector. Public sector enterprises are government/state controlled companies or corporations funded by governments. Private sector industries are owned by individual or group of individuals. Joint sector industries are owned and operated by civil society association including cooperative society, state and community based institution or organisation or in joint venture arrangement. Industries are also classified on the basis of the use of their products such as basic goods industries, capital goods industries, intermediate goods industries, and consumer goods industries. Another method of classifying industries is on the basis of raw materials used by them. Accordingly, these can be agriculture based industries, forest-based industries, and mineral-based industries.

Another common classification of industries is based on the nature of the manufactured products such as Metallurgical Industries, Mechanical Engineering Industries, Chemical and Allied Industries, Textile Industries, Food Processing Industries, Electricity Generation, and Electronics and Communication Industries. These diverse industries may generally be divided into major four types such as primary, secondary, tertiary, and quaternary.

Primary industries

A primary industry is a simple form of machinery (industrial) production which involves processing of raw materials for making (producing) goods. The industrial process involves fabrication of raw materials into finished goods. Raw materials are collected from farm/agricultural sites, fishing, mining, and forest areas. Primary industries normally produce unprocessed or semi processed materials which are later used by secondary industries in the production of finished goods. Raw materials that are produced by the primary industries include metal from mineral ores, coal, crude oil, and agricultural products such as cotton, rubber, fibre, and food.

Secondary industries

Secondary industries involve a wide range of production and operation, varying with complexity. Secondary industry uses raw materials from primary industry to produce finished or semi-finished goods. It can be divided into

two categories; namely heavy industries which deal with engineering, metal goods, heavy chemicals, cars manufacturing, shipbuilding, and light industries which involves electrical equipment, plastics, textile, and cosmetics. Secondary industries involve the production and reprocessing of partially manufactured goods into more complex products. For example, the use of cotton to manufacture clothes, use of iron parts to produce machinery, use of copper wire for electronics, and the use of paper to make books or the use of pulp obtained from timber to make papers. It also involves manufacturing and construction. For example, production of machines or turbines which are also used in industries and construction areas.

Tertiary industries

Tertiary industries involve provision of back-up services such as administration, retailing, transport, and communication. These are not falling under manufacturing but they provide services that assist in manufacturing industries such as trade, transportation, commerce, entertainment, tourism and administration.

Quaternary industries

Quaternary industries are an extension of the tertiary industry. They basically focusing on knowledge-oriented products and services. Such industries provide information services such as computing infrastructure and communication technology activities. Quaternary industries therefore, involve Information and Communication Technology (ICTs), research and development including technological development, scientific research, financial and strategic analysis, and consulting. They also accommodate media communication technologies including teaching, educational technologies, and services.

However, it should be noted that the classification of manufacturing industries into four major types; primary, secondary, tertiary, and quaternary is determined by the types of raw material used and the goods produced. The classification is normally guided by the International Standard for Industrial Classification.

Exercise 5.2

1. Describe the four types of manufacturing industries.
2. Distinguish primary industries from secondary industries.
3. Explain three ways in which primary industry is interrelated with secondary industry.
4. Describe the five roles of tertiary industry in the development of primary and secondary industries.
5. The classification of manufacturing industries is based on size, capital investment, and labour force employed. Discuss.

Activity 5.2

In a group do the following;

(a) Visit several industries in your locality and classify them on the

basis of raw materials used then, present your answer in the class

(b) Identify and classify manufacturing industries in your neighbourhood or in your area into primary, secondary, tertiary, and quaternary industries

Factors influencing the location of manufacturing industries

Manufacturing industries are developed in response to human needs of manufactured goods of great utility. The goods production needs to conform to local and international standards. So, in locating an industry, certain factors must be taken into consideration. Geographers try to explain why one location may be more profitable for a factory than others. Location of an industry depends on site and situation factors. Site factors are industrial location factors related to the costs of production inside a plant. These include labour, capital, and land while situational factors are related to transportation of materials to and from a factory to the markets. Other factors can be political or government policies. The factors are discussed as follow;

Availability of raw materials: Raw materials in all varieties are basic to the initiation of any industry. They are the ones transformed into semi-finished or finished goods. Raw materials may come from farms; such as cotton, coffee, or wheat, and from mines in a form of different minerals or from materials such as forest resources and water. Without raw materials, regardless of how modern machines are, nothing can be produced. For example, paper industry in Mufindi-Tanzania depends on raw materials from Sao Hill forest. The location of a cement industry, depends on nearby raw materials and finished products from limestone rocks. It may also depend on the availability of coal or any other sources of energy. The question of transport costs for raw materials from one place to another should be examined before determining the location of an industry. The optimal plant location should be as close as possible to the inputs to reduce the cost of transporting raw materials to the factory. For example, in a food processing industry, the perishability of food/raw materials should be considered. So the location of industries is also determined by the nature of raw materials, distance and bulkiness or availability of such raw materials.

Fuel and power: Availability of fuel and power is another factor to be considered when locating manufacturing industries. These are very important energy sources for running the engines/machines in the industry. For example, in the past years, coalfield in German and in South Africa served the purpose of establishing manufacturing industries in these countries. Nowadays, power can be derived from other forms which are also easy to move to the industry. For instance, electricity can be transmitted from a distant location using wires, and gas, while petroleum are transferred by using pipelines and other means. The use of solar energy and Liquefied Natural Gas (LNG) have high level of flexibility for industry location than coal. What must be maintained is to ensure reliable flow of power and fuel supply to the industry.

There are various sources of energy such as human power, wood, charcoal, coal, electricity, petroleum, and solar energy. Currently, the use of human power, wood, and charcoal is limited but was very significant before the industrial revolution in running small and cottage industries. Such energy sources are still significant for small scale industries.

Transport: Transport is useful for moving raw materials to the industrial sites as well as in transporting produced goods to the market. Transport network expands with the development of industries. As industries grow, there is an increase in the volume of freight and passengers, including workers. The location of an industry should consider what types of transport are available as certain means of transport are suitable and cheap than others. For instance, the use of water way or land surface transport is likely to be cheaper than air transport. In general, as one moves from water and land to air transport, the speed and transportation costs increase. Transport by way of rivers, lakes, canals or sea is the cheapest for bulky goods like coal, iron ore, and timber. Good and cheap transport allows great intervention and innovation even in remote areas. Moreover, it reduces the burden of costs to be incurred and so increase or maximise profit.

Availability of market: Industrialists must consider the availability of market and economic base since production depends on the demand of goods. Market is a place where finished or semi-finished products of an industry are normally sold at economically profitable margin. The power of industries to produce depends on the profit margin. Industries are located near the markets which consume their finished goods. If the demand of products is low, it discourages the establishment of the industries even if other conditions are met. Market assessment should base on the ability of people to pay and buy the products. For perishable goods, location must be market oriented.

Availability of human resources: Labour is an important site factor in the global industrial development. Industry need both people who are highly skilled such as scientists and technicians to run them and unskilled labour to do a lot of manual works. To be successful, inventions must be developed rather than depending on foreign experts. Semi-skilled people and unskilled ones are essential for less technical and mechanical activities. Other workers like industrial and managerial staff are necessary. Minimising labour costs is important for some industries, and the variation of labour costs around the world is large. So industries which are labour intensive should be located in areas with labour availability. This is why some of industrialised countries would locate in a foreign country an industry which is labour intensive to cut down the labour costs. For example, the USA located its watch industries in Brazil in Southern America.

Availability of capital: Capital is needed to run the industry; especially for site construction, purchasing machines,

industrial inputs, and payment of wages. Industrial capital can include working capital, physical or fixed capital, and social capital. Banks, insurance companies, and other financial institutions play a useful role in channelling the capital to industries. The ability to secure loans vary between the developed countries and developing countries. Availability of financial loans is a critical factor in the distribution of industry in the developing countries. Financial institutions in many developing countries are short of funds, so new industries have to seek loans from banks in the developed countries. However, enterprises may not get loans if they are located in unstable political system and if their capacity to recover the secured loans is low.

Government policies: The role of the government in industrial development is to create conducive environment for industrial investments and issuing guidelines, and policies such as fiscal policies, and legal framework. Government policies may encourage or discourage the development of industries in certain areas. For example, by 2016, the government of Tanzania planned to establish three corridors for industrial development. Sometimes the government encourages the establishment of industries to provide employment to people or formulate policies that promote economic development in areas where the standard of living is relatively low, or where there is serious underemployment. The government may put in place policies which are favourable to investors. For example, tax holidays for the first few years of starting an industry, something which attracts investors to locate their industries in such a country.

Industrial inertia: Industrial inertia is a tendency for an industry to maintain its activity in a place where the reasons for its introduction no longer existing. It is therefore, the resistance exerted by an established industry to move to the new location. This can be even when its earlier locational advantages change to disadvantages. Such circumstance may happen if the established industry has attracted development in the area like transport; highly skilled, semi-skilled and unskilled labour force; ready market; adequate source of power; financial institutions; and industrial agglomeration with supportive industries. The industry may not move to newer location if in the meantime it has acquired other advantages which have the capacity to outweigh its disadvantages. The cost of establishing a new industry in the new location may also be very high.

Nature of landscape/site: The nature of landscape or site affects the location of an industry. Sufficient land is required for installation of machines, office buildings, and waste disposal.

Availability of water: Water supply may affect the location of an industry since it is a very important ingredient required for cooling engines and other machines, especially in steel, iron, and aluminium industries. In some of industries such as textiles, water is used as a basic raw material which is mixed with dyes, and in beverage industries water is used to produce drinks such as soda and juice.

Exercises 5.3

1. With examples, examine six factors that need to be considered in the location of manufacturing industries.
2. Why should a location of manufacturing industries consider availability of inputs?
3. Analyse five factors that limit development of manufacturing industries in developing countries.
4. Discuss five ways through which industrial policy can influence development of manufacturing industries.
5. 'Capital is the most important input for industrial prosperity'. Discuss the statement with reference to the Least Developed Countries (LDCs).

Activity 5.3

Go to different markets in your locality then identify some goods sold and study where they were manufactured. Present the report in a class.

Focal studies

Aircraft (Aerospace) industry in USA

Development of the aircraft manufacturing industry in America and the world in general is not a smooth one. It has passed through a series of changes and reformations since the period of exploration and experimentation until the current period of space deal and missile development (Figure 5.3). The development of aircraft industry in USA evolved through the following phases:

Phase I: Post industrial revolution to pre-world war I (1750 – 1914): This was the period of intensive exploration, investigations, and testing of flight development by Aeronautical researchers

Phase II: Between WW I and WW II (1914 – 1939)

During this period the United States, did not invest in aeronautics. She built less than 100 aircrafts and fell badly behind Europe. This period witnessed massive aircraft constructions in Europe, especially war planes.

Phase III: Between WW II and the cold war (1939 – 1947): This marked the period of high aircraft manufacturing, especially those based on military defence. Aircrafts like Boeing 247D, the Douglas DC – 3 and the Sikorsky, Martin and Boeing and flying boats marked the United States return to a leading position of world aeronautical industry spheres.

Phase IV: During and post-cold war 1947 to 1980's: Cold war between USA and Soviet Union led to increased defence spending and continued to drive for supremacy in aerospace technology. The steady flow of military funding for flight research and development resulted in a string of technological victory. The outbreak of the Korean War 1950s had an impact on the American aircraft manufacturing industry since USA had to

revitalise and expand its tactical air power. By the time the Korean War had ended in 1953, the American Aerospace industry had undergone a massive expansion and was restored to its WW II status as the largest American Industry (Figure 5.3).

Figure 5.3: *An airbus assembly industry in USA*
Source: https://hpmleadership.com/wp-content/uploads/2018/12/Airbus-FAL-USA-3.jpg

Factors for the development of aircraft (aerospace) industry in USA

Research and technology: Since 1899, America had invested much on aircraft technology, especially the establishment of research and development institutions such as the Smithsonian Institution in 1896, the National Advisory Committee on Aeronautic (NACA) in 1915, Aircraft Manufacturers Association (AMA) in 1917, the National Aeronautics and space Administration (NASA) in 1957, the Aerospace Industries Association of America (AIAA) in 1957, and other individual private companies such as Lockheed, Boeing, Douglas, Chanute, Glenn Hammond, Wright brothers, Sikarsky, Hiller Bell, and Martins. Since 1899, new technologies had prompted a massive restructuring of the Aircraft industry from ordinary airplanes to Navy, War aircraft, satellites, missiles, and space vehicles.

Capital investment: The Government of USA had since 1900 invested highly in aircraft development including sponsoring Research and Development (R & D), providing loans to private companies and institution dealing with aircraft, ballistic missiles, and space vehicles manufacturing. For example, after the Korean War 1950 – 1953 the American government increased the budget for its investment in Aircraft for defence from USD 15 billion to USD 40 billion and by the end of the war in 1953, America had built 10 000 jet engines, 3 500 airforce for the Navy and 2 000 for export.

Availability of market: Since the World War I (WWI), America had been the leader in aircraft manufacturing in both military and civilian aircrafts. The main customers being Europe, Asia, and other countries and the American government itself. There had been adequate market for American aircrafts. The American aerospace products comprise between 6% and 10% of all American merchandise exports. The USA Export Import Bank was nicknamed the "Boeing Bank" after the aircraft company "Boeing" because of its willingness to lend other countries money to buy American airliners.

The influence of WWI, WWII, Korean war, and Vietnam war: The development of American Aircraft Industry had been largely influenced by the outbreak of Great Wars like the First World War 1914 –

1918 which influenced massive American investment in aircraft manufacturing.

The influence of cold war 1947 – 1980s: The development and evolution of American aircraft industry is highly also ascribed to the outbreak of the cold war between USA and the soviet Union in 1947 whereby America did not fight physically with the USSR but demonstrated its military power in space exploration. New technologies prompted a massive restructuring of the American industry during the cold war. The former established companies shifted from manufacturing to research, while the military channelled funds to technology specific start-up companies.

Development of outer space technology: Aircraft manufacturing industry development in the USA was also ascribed to the development of outer space exploration in 1950s. Evidence for this was the change in aircraft manufacturing and capital investment by USA after the launch of sputnik satellite by the Soviet Union (Russia) in 1957. With this rivalry surprise, USA government poured massive amount of money into the Aircraft industry and the USA Aircraft Industries Association changed its name to the Aerospace Industries Association of America (AIAA) as an indication to the public that those companies that were building aircrafts could also build outer space vehicles. The National Aeronautics and Space Administration (NASA) bent the efforts of academic aeronautics towards hypersonic and space travel whereby, in 1961, NASA was given a task to send a person to the moon and return him to the earth safely before 1970. By 1970s, NASA had succeeded to send a person to the moon and return him safely. After this achievement, NASA invested ahead of demand to create the space shuttle for regular access to space and advanced in finding the way to industrialise the space.

Good policy and governmental support: American aircraft manufacturing industry had since 1890s received enormous government support from both good aircraft policy reforms and financial support. The government had supported the industry in research development, financial aid, and provision of market for the manufactured aircrafts. Moreover, the US government had developed a well stipulated policy to protect the internal aircraft market and secure external market for her manufactured aircrafts. The government had provided a room for advancement of the technology and administration of the industry. For example, the government spent billions of funds to establish research and experiment centres for aircraft industrial development, including that of NASA in the1980s.

Commercialisation of American aircraft industry: The USA did not only produce aircrafts and space vehicles for internal use but also for commercial purposes. Sales are from both military aircrafts, passenger aircrafts, missiles, and outer space vehicles. The major market for the USA products is international customers. The development of aircraft industry in USA has greatly been contributed by external markets with high demand of modern aircrafts and space vehicles.

Commercialisation of this sector has enormous sales of aircrafts. Foreign companies are attracted to USA aerospace market because it is the largest in the world with multiple choices hence the availability of markets influences the development of aircraft industries.

Trust and honesty in the business: Any customer in a business needs a trusted and honest seller or producer. Investors in the USA aircraft industry are trustworthy and honest to their customers. This has greatly promoted the development of the industry. Investors in this industry are supported by the Federal Aviation Administration (FAA) and are attracted by good standard of aviation safety and their confidence on American aviation products. The FAA has a Bilateral Aviation Safety Agreement (BASAs) which facilitates the airworthiness approval of US aerospace products in more than 47 countries outside the United States, leading to the development of aircraft in the USA.

Challenges facing aircraft manufacturing industry in USA

The aircraft manufacturing faces several challenges including capital, labour, risk and technology composition as it is explained further in the following subsections.

Market fluctuation and failure: The aircraft market in the USA is not a smooth one. It is affected by the change in technology and competition from other aircraft manufacturing countries. There are more than 37 countries that make aircrafts within the same market. American aircrafts face market fluctuations due to competition from those aircrafts manufactured by Britain, Germany, France, Russia, and Brazil. The fluctuation of aircraft market in the world causes loss to USA aircraft industry.

Capital intensive: Investing in the aircraft industry requires huge capital as compared to other sectors such as textile industry, banking sector, and insurances. The aerospace business requires an enormous assortment of cash, technology, sophisticated equipment, and facilities. In other words, the airline industry requires a bulk sum of money to operate successfully.

Labour intensive: Aircraft industry needs a highly specialized and skilled labour. Aircraft manufacturing is a labour intensive business. Each aircraft firm employs a variety of professionals like pilots, mechanical engineers and security personnel. However, with the advancement in science and technology, most works in the manufacturing industry is done by machines. A number of labours are required in programming and operating machines.

Risk factors: The common risk factors in aircraft manufacturing include price fluctuation due to the fluctuation of currency, capital investment, and availability of raw materials. USA had frequently faced economic depression and recession which had affected the wellbeing of its aircraft industry.

Technology competition: USA aircraft industry had been facing stiff competition from the Soviet Union technology since

the eve of WWI. The Soviet Union had been most of the time ahead of the USA aircraft technology, making it hampered in the market.

Contribution of aircraft to the socio-economic development of the USA.

Employment, GDP growth, transportation improvement, and defence and outer space exploration are some of the air craft manufacturing contributions to the socio-economic development in the USA.

Employment: The aerospace industry employs about 500 000 workers in scientific and technical jobs across the nation and supports more than 700 000 jobs in the related fields. The investment in the USA aerospace industry is facilitated by a large pool of well-trained mechanics, aerospace engineers, and other highly skilled workers with experience in the aerospace industry.

Contribution in the GDP: The aircraft industry contributes about 4.6% to 6.5% of the national income. For example, in 2016 the industry contributed about 147 billion USD in export sales of the USA economy. The industry had a positive trade balance of 90.5 billion USD as a surplus; supporting high wage jobs of hundreds of thousands workers.

Improved transport of both goods and passengers: Aviation in the United States of America is one of the dominant mode of transport of goods and passengers. All activities implicated in the provision and exercise of aviation are imperative to the nation's economy. For example, since 1950's, aircraft transport had replaced the rail and road transport as a primary means of long distance travel.

Improved defence: The aircraft industry in USA has been the major sector on national defence since WWI, whereby military aircrafts have been the first priority of the government. In 2016 alone, the military aircraft sector was given more than 161 billion USD to advance its technology. Air craft industry had led to the development of Intercontinental Ballistic Missiles (ICBMs) and Intermediate Range Ballistic Missile (IRBMs), making the USA as the greatest superpower nation on Earth.

Exploration on outer space: The aircraft industry has contributed to development of the outer space vehicles. To date, the space craft has been the common technology to America. As alluded earlier, 1970's NASA succeeded to send a man to the moon and returned him to the Earth safely. By the end of the cold war, the high cost was mainly on space technology.

Limitations facing aircraft industry in USA

The limitations facing aircraft industry in USA involves; limited freedom on air space, financial difficulties, following global economic crunch and limited market especially in the third world. Other limitations include stiff challenges from other aircraft producing countries such as Russia,France, China and Korea and terrorism which creates worries among the user/passengers and deteriorates the aircraft markets.

Problems caused by the aircraft industry

Emerging problems as the result of aircraft operations include air pollution

due to emission of carbon gases into the atmosphere, increased accidents which lead to loss of life and property, spread of diseases such as HIV/AIDS, COVID-19, and Bird Flu, drug trafficking from country to country, acceleration of terrorism, and war in many parts of the world.

Ship building in Japan

The history and development of shipbuilding in Japan has dominated he global industry since 1970's. There are currently over 1 000 shipyards in Japan, main areas being Chugoku and Shikoku regions in the south-west part of the country. Other areas iclude Kinki, Hokkaido, South Kanto, Tohoku, and Touki. Some of these shipyards are privately owned by individual enterprises, while others are owned by larger private or public registered companies.

The largest shipbuilding enterprises in Japan are the Imabari shipbuilding, Tsuneishi Holdings, and Oshima Shipbuilding Company. Other companies include the Universal Shipbuilding, Mitsubishi Heavy Industries (MHI), and Namura Zosensho Company, which all together hold the top 30 shipyard groups worldwide. For example, the Oshima shipbuilding has been the Japan's largest shipbuilder with their main business being handymax and panamax bulk carriers. Tsuneishi is one of the oldest Japanese shipyard which has established local subsidiaries on Cebu Island and Zhoushan in China since 1994.

Tsuneishi has gone beyond domestic companies by developing a global strategy while Imabari shipbuilding is the third largest company in Japan with the main focus on bulk carriers and container vessels. The company has a total of 8 shipyards in the group and has been ranked number 6th worldwide.

The majority of Japan's 1 000 plus shipyards are focused on building smaller vessels and these enterprises undertake a variety of activities alongside their construction activities, including ship design, conversion, and repair or maintenance as shown in Figure 5.4. Small shipyards tend to construct coastal ships such as general cargo ships, oil product tankers, chemical tankers, coastal ferries, and fishing vessels. Large shipyards are used in building and repairing large ocean-going ships such as bulk carriers, crude oil tankers, container ships, and large passenger ships.

Figure 5.4: *A Ship yard in Japan*

Source: https://www.maritime- executive.com/media/images/article/Photos/Shipbuilding/ shipyard-japan.857ab6.jpg

Factors for the development of shipbuilding industry in Japan

Factors that contribute to the development of the shipping industry in Japan include;

Availability of raw materials: Availability of steel, iron ore and marine equipment are very essential inputs in shipbuilding industry. Japan is the second largest producer of steel in the world after China. It produced about 107.6 million tons of steel in 2011, and in 2010, shipbuilding demanded 12% of Japan's steel with an estimate of about 5.7 million tons consumed by ordinary ship builders. The greatest demand of steel is for plates, shapes, and bars.

Availability of advanced and reliable power supply: Inspite of having a small amount of fuel sources, including oil and coal, Japan has developed high hydroelectric power from all its sources; including geothermal and nuclear energies to provide power for her industries. This has helped it to generate sufficient power supply for the shipping industry.

Nature of the coastline: The country has an indented coastline with many parts being navigable with deep waters. These make it easy for the country to import raw materials and finished goods, including ships. Moreover, the navigable deep coastlines make the building of ships easy and accessible to the market. Normally, shipyards are located along the coastlines.

Use of high technology: Keeping-up with changes in technology and advancement is very important for the development of the shipbuilding industry and in moving up the value chain and also meeting the international regulatory standards for vessels. Companies have been allocating more money for Research and Development (R & D) on shipbuilding technology, particularly by concentrating on energy saving and environmental technologies. For example, the Mitsubishi Heavy Industries in 2012 targeted mainly at developing eco-friendly cruise-ships and other vessels, in addition to developing offshore structures and energy-efficient devices and systems.

Availability of capital: Building of large and small ship industries requires heavy capital investment either by the government or individual syndicates. In Japan, small shipbuilding companies form large firms and syndicates in order to accumulate capital. For easy accumulation of capital most firms in Japan are registered in the Tokyo or Osaka stock exchanges. Through selling of shares or taking loans, it becomes possible for companies to import raw materials for the construction of cargo ships, oil tankers, chemical tankers, coastal ferries, fishing vessels, bulk carriers, and container ships. The government of Japan provides financial support to shipbuilding companies. Finance is also provided by the Development Bank of Japan (DBJ) in partnership with commercial banks.

Training and skills development programmes: Japan has some specialised training centres for shipbuilding. These were established in response to concerns about generational change in the industry. In the early 2000's, nearly half of the ship building workforce was ageing 50 years and above. To help enhance the transfer of skills and expertise, the government worked with shipbuilding companies to establish Shipbuilding Skills Development Centre (SSDC). This centre

was tasked to develop training materials and to support regional training efforts. As part of this training programme, centres have been developed in Hiroshima, Imabari, Nagasaki, Oita, and Yokohama. Various Universities in Japan also offer studies in maritime-related topics.

Availability of markets: There are both domestic and external markets for ships from Japan. Japanese shipbuilders have a strong domestic market. At the same time, many Japanese-built vessels are destined for other markets particularly large vessels. External buyers of Japan ships include China, Norway, Germany, Greece, India, Canada, and Denmark.

The contribution of shipbuilding to the economy and technology in Japan

Shipping industry has contributed to the economy of Japan in various ways including;

Contribution on Japan's GDP: Shipbuilding sector has for years contributed to both Gross Domestic Products (GDP) and value added in the country from vast sale of ships and marine instruments. However, this contribution has been fluctuating overtime due to frequent economic crisis. Currently, the shipbuilding industry represents a fairly low percentage of the total Japanese value added. For example, by 2008, the activity of building and repairing ships and boats accounted for only 0.8% of Japanese value added. With some technological improvement and invention, the Kawasaki Heavy Industries presented the sales of ships and offshore structures on March 2012 to be JPY 113.5 billion with operating profit of JPY 3.9 billion (approximately USD 48 million). Mitsubishi Heavy Industries presented the sales of the shipbuilding and ocean development division of about JPY 311 billion, and Sasebo Heavy Industries presented the shipbuilding segment report of JPY 59 billion in the same financial year 2012.

Employment opportunities: The shipbuilding industry has contributed to the availability of employment opportunities in the shipbuilding especially in marine-related activities or in other improved and established industries. Currently, due to the advanced technology in the shipbuilding industry which mostly uses machines, the workforce is about 0.13% of the whole Japanese and about 84 000 people engage directly in the shipbuilding industry (including subcontractors, but not those in the marine equipment).

Improved social welfare: The shipbuilding sector has promoted the improvement of the social welfare of the country such as medication, schools, water and energy supply with promoted and simplified transportation sector. There is diversification of the economies which allows the benefits obtained from the shipbuilding sector to be invested in other economic sectors such as cars-manufacturers, electronics, textile industry, agriculture, tourism, and trade. Shipbuilding industry has also promoted the development of the education sector, including the universities related to marine specialities. For example, the Maritime Faculty of Japanese University has been established and is the major

source of new knowledge, with staff and students producing research on a wide range of technical and practical issues that are relevant to the ship design and construction.

Challenges on ship building industry in Japan

The development of shipbuilding industry in Japan is threatened by massive emerging countries which engage in shipbuilding industry. Different statistical data show that Japanese shipbuilders have been facing market competitions and difficult conditions both internally and worldwide. Moreover, the impact of long-term and prolonged economic deflation squeezes corporate profits. There are also various governmental structural impediments that restrict labour productivity and firm's dynamism.

Japanese shipbuilders have been losing overall market share in both volume and value terms due to market competition. Shipbuilder companies in Japan have lost their share of global competition in the construction of bulk carrier, oil tankers and ore carriers which accounts for a large proportion of their vessels output. The average value of vessels delivered has also dropped and now is below that of many competitor countries. For example, currently, Japanese shipbuilders account for 16% of the current order book, behind China and Korea, with orders that are still focused on bulk carriers. Moreover, natural hazards like frequent earthquakes has affected Japanese shipbuilding because the country lies within the zone of tectonic plates convergence. The economic depression that has frequently affected the world between 2000s and 2010s has also affected the stability of the shipbuilding industry in Japan.

Solutions and initiatives taken to solve the experienced challenges

Recently, Japanese shipbuilders attempted to adjust their technologies and approaches in shipbuilding in order to tackle competition and financial challenges. Several approaches are opted for, aiming at diversification of activities and improvement of efficiency through modernisation, advancement of the scale of production, and internationalisation of production process. These efforts are mostly being made by larger public companies with greater resources at their disposal.

Diversification of constructed vessels and types of products: To improve the trends of the declining shipbuilding industry in Japan, some industrial companies are currently changing their business focus by diversifying the types of vessels constructed. For example, the Mitsubishi Heavy Industry in Kobe shipyard launched its last merchant vessel in 2010 and focused on offshore units such as research vessels and other specialised orders. It also placed more emphasis on cruise ships construction than other types of vessels. The Kawasaki Heavy Industry has also attempted to strengthen its domestic facilities such as manufacturing bases for high value added products in order to meet the demand of marine associated development and gas transport than constructing vessels.

Boosting and providing shipbuilding business services: In reaction to the change in ship-market trends, some companies are boosting their businesses by focusing on the provision of shipbuilding services such as ship design and related technological support. For example, the Mitsubishi Heavy Industries (MHI) has been developing its engineering business services to boost its shipbuilding industry. To attain its goal the MHI made an agreement with an Indian shipbuilder company to provide technology, ship design, and related marine support. The MHI has agreed to training Indian engineers and other marine workforce. Furthermore, the MHI made agreement with the Chinese shipbuilding group to provide conceptual design and related technologies for the new bulk carrier ships. The Imabari Heavy Industries (IHI) Marine United has a contract for technical assistance with a Brazilian shipbuilding company.

Investment on research and development: In order to develop new products and rebuild new competence on the ship industry, the Japanese government in collaboration with shipbuilding firms decided to establish various centres for research and development in order to provide new skills, knowledge, and innovation on marine industry. The focus was on energy efficiency as a key goal to shipbuilding. Various companies have developed new vessel designs and new technologies that seek to reduce Carbon dioxide (CO_2) emissions, increase fuel efficiency, and cut off pollution.

Modernisation of shipbuilding facilities: Besides the new business lines, a further strategy to improve the shipbuilding industry in Japan has been to modernise the shipbuilding facilities by upgrading and expanding them. For example, recently, the Mitsubishi made capital investment to upgrade and expand its shipbuilding facilities in one of its shipyards in the Yamaguchi Prefecture. The company acquired new equipment and re-organised the physical production site to improve work efficiency and productivity.

Strengthening co-operation and leverage: Most companies, especially the smaller ones, have been engaging in merger partnership forms of cooperation to strengthen their production and capital stability. In one high-profile for example, Universal Shipbuilding and Imabari Heavy Industries Marine United merged their operations into a new company called Japan Marine United. This merger aimed at leveraging the combined engineering resources and production facilities of the two companies to boost design and development capabilities and raise productivity. At a looser level, Mitsubishi Heavy Industries (MHI) has signed a technological collaboration agreement with Imabari, related to container vessels. The intent of the agreement is to improve competition in the international market and to actively explore the possibilities for demand in the market.

Expansion of international trade: In order to improve competition and internal markets for vessels, shipbuilders in Japan have decided to expand their foreign investments to the international level. Acquisition of yards abroad has been

strongly driven by the search for lower production costs, particularly, in light of the strength of the Japanese Yen against the US dollar and the South Korean Won. For example, the Kawasaki Heavy Industries (KHI) has risen its stake in the Dalian Cosco Shipbuilding Industry Company by 49% so as to mitigate against the strong Yen by exporting directly its products from China. Namura Shipbuilding also made a move to acquire a yard in South Korea to take advantage of lower production costs. Therefore, overseas investment has been seen as a means for shipbuilders to shift their business focus, by acquiring yards with different production capabilities and clients at lower production costs.

Governmental policy support: Policies for the shipbuilding industry in Japan have been of great help to the improvement of the ship industry in the country. The policy has focused on export credit, insurance home credits, and research and development support funds. With export credit, the improvement had been high including sales profits to the companies. The total amount committed under the policy rose from JPY 41 billion (USD 378 million) in the 2004 to JPY 130 billion (USD 1 622 million) by 2011. Direct spending on research and development has increased and is now focusing on high level technologies for carbondioxide emission reduction, although the sums remain relatively small of about JPY 80 million or USD 0.7 million. For example, in 2010 through research, the Mitsubishi developed the so called Mitsubishi Air Lubrication System (MALS) which uses air to reduce friction resistance between ship hulls and seawater, to increase vessels energy efficiency and reduce CO_2 emissions. The first trials in 2010 confirmed that the system reduces carbodioxide emission by approximately 13% percent. These systems are planned to be installed in various types of ships such as passengers ships and bulk carrier ships.

Germany automotive industry

Germany is the country where the automobile industry was invented. Karl Benz, the German mechanical engineer, designed and built the world's first automobile powered by an internal combustion engine in the year 1885. Germany is recognised in the world for its outstanding automotive industry and excellence in engineering. German cars are appreciated worldwide for their innovation, reliability, safety, and design. Audi, BMW, Mercedes Benz, MAN, Porsche, and Volkswagen are the major German automobile brands. Germany has 41 automobile assembly and engine production plants with a total capacity of over one third of total automobile production in the European market. The leading automotive States in Germany are Bavaria, Baden - Württemberg and North Rhine – Westphalia, which together account for more than 60% of its manufacturing industries. Other states are Lower Saxony, Hessen, Niedersachsen and Berlin. The Germany automotive industries manufactures both passenger cars and commercial vehicles as shown in Figure 5.5 (a) and (b)

Figure 5.5 (a): *Automotive industry in Germany*

Source: httpswww.accenture.comus-enblogsindustry-digitizationindustry-x0-in-germany-time-to-get-ambitious

Figure 5.5 (b): *Automotive industry in Germany*

Source: httpswww.iwkoeln.deenstudiesthomas-puls-manuel-fritsch-the-importance-of-the-automotive-industry-for-german

Factors for successful automotive development in Germany

Several factors have contributed to the success in automotive industry in Germany. These include;

Huge capital investment: Gross capital investment in German automotive industry in 2015 was a total sum of Euro 13.2 billion. Automobile companies source capital from the German Private Equity and Venture Capital Association. They also obtain loans from commercial banks whereby investors can participate in government subsidised loan programs. They are usually offered loans that have attractive interest rates and free recovery start-up years, particularly for small and medium sized companies. Due to huge capital, some automobile companies have been able to invest in car manufacturing abroad such as in India.

Presence of other engineering industries: The presence of other engineering industries responsible for the manufacturing of car component parts such as iron and steel industries, engine, car body, innumerable machine parts, internal fittings, and the wheels have promoted the development of automotive industry in Germany. These industries provide raw materials for the car assembly plants and stimulate their operations.

Presence of high skilled labour force: The Germany labour force is innovative, productive and produces high quality, reliable, safe, and best designed cars. Dual education system in Germany provides direct access to a highly qualified and flexible labour pool. The country's dual education system is specifically geared to meet industry needs. Over 30% of Germany university graduates have a natural sciences or engineering degree background.

Research and Development: There is huge capital investment in research and development. In 2015, a total sum of 20.6 billion Euro equivalent to 40% of Germany's total research and development expenditure was spent in advancing the automotive industry.

Reliable power supply availability: Germany has reliable power supply for her car manufacturing industry. This include hydroelectric power from river Rhine and coal which is very crucial in iron and steel industries which in turn produce car component parts for car assembly plants.

The application of advanced technology: Due to research and development, science has rendered advanced technology which is used in design, invention, and assembly of automobile. Advanced technology has increased effectiveness and efficiency in car and vehicle production processes hence meeting the market demands accordingly.

Market availability: Both domestic and international markets are available for Germany's cars and vehicles. Germany is Europe's number one automotive market, accounting for over 30% of all passenger cars manufactured and about 20% of all new car registrations.There is a total of 45 million passenger cars and 2.3 million commercial vehicles on the Germany roads. About 77% of the cars produced in Germany in 2015, were exported to other European countries. There is high demand for German cars in Asian countries including Taiwan, South Korea, USA, China, and India.

Geographic location of Germany: Germany is located at the market crossroads of Europe. It is easy to reach Germany from all places in Europe and to reach other market places from Germany to all over European countries through well-established transport systems such as roads, railways, waterways, and airways.

The contribution of automotive industry to Germany's socio-economic development

Automotive industry plays a significant role in the prosperity and competitiveness in Germany. It accounts for about 20% of the total industrial revenues in Germany. Through export, Germany passenger car and light commercial vehicle manufacturers recorded a foreign market generated revenue of more than EUR 423 billion in 2017 and contributed about 5% to Germany GDP. Automotive industry has promoted trade and commerce at both domestic and international levels. The automotive manufacturers produced over 5.5 million vehicles in 2021. Germany is the European car production leader; in 2015, a total of 5.7 million passenger cars and 325 200 trucks and buses were manufactured in the country.

The automotive industry is one of the largest employers in Germany, with a workforce of 792 618 persons in 2015. The Germany automotive secures jobs, drives Germany's export, and invests in research and development. This helps to improve the country's social welfare. Diversification of economy from the automobile sector assists the country to invest in other sectors such as engineering, metallurgical, mining, and agriculture. The industry has also stimulated advancement in the road transport sector. Given a population of 82.1 million people, the average level of motorisation was 508 vehicles per 1 000 inhabitants in 2010. The car is the most important means of transport in Germany. About 58% of all trips and 79% of all passenger kilometres are made by car, hence the automotive

industry enhance mobility of people and goods transportation services.

Internationally, Germany products enjoy high reputation and the 'made in Germany' label is associated with positive attributes such as quality, efficiency, durability, reliability, and safety. Germany is the most innovative automotive hub on international comparison. This gives Germany a competitive advantage.

Challenges facing the automotive industry in Germany

Several challenges face the Germany's automotive industry. These include changing demands for car mobility whereas the possession of driver's licence in Germany has fallen slightly in the lowest age group of 18 to 29 years and risen among older people. This indicates that the ownership or use among young people is declining. This may potentially influence both interest in owning a car and the choice of a specific car. Motorised transport as a source of greenhouse gases is another challenge. It is estimated that 89% of carbon dioxide (CO_2) emissions are produced by cars or trucks.

Inspite of the specified challenges, there are pending issues that need to be addressed in the automobile industry. These include development of efficient vehicles, retaining the position of the Germany automotive industry as a technology leader and manufacturer of premium products on the global market and complementing the product portfolio with new micro and city car concepts. Germany also plans to penetrate its automobile markets in the BRICS (Brazil, Russia, India, China, and South Africa) countries and manage vehicle crisis in Europe by reducing the number of vehicle platforms.

Measures to contain the challenges

In order to address the challenges that face the automotive industry in Germany, the government has implemented the following measures;

Efficient vehicles: The German automobile industry has developed highly efficient combustion engines. The priority has been to improve diesel engines and efficiency potentials of petrol engines. The automobile industry has also introduced other technologies to complement the existing ones. Conventional Hybrid cars have been manufactured. These combine both gasoline engine and an electric motor. Their batteries are charged by using regenerative braking that converts kinetic energy into electricity. This energy is normally wasted in conventional vehicles.

Use of alternative drive: German manufacturers are generally pursuing a second-mover strategy in manufacturing alternative drives such as PHEVS, BEVs and FCEVs. PHEVs refer to Plug in Hybrid Electric Vehicles. These vehicles have both an electric and internal combustion engine. The batteries can be charged by plugging into an outlet. BEVs refer to Battery Electric Vehicles. These vehicles have no gasoline engine. They run on electricity via on-board batteries that are charged by plugging into an outlet or a charging station. They have longer driving ranges compared to PHEVs and never produce tail pipe emissions.

FCEVs refers to Fuel Cell Electric Vehicles. These cars use an electric motor like a BEV, but store energy in a different manner. Instead of recharging a battery, FCEVs store hydrogen gas in tank. The fuel cell in FCEVs combines hydrogen with oxygen from the air to produce electricity. The electricity from the fuel cell powers an electric motor, which powers the vehicle just like a BEV. Like BEVs, FCEVs have no smog-forming or climate changing pollution from FCEVs tail pipe. The only by product is water. There is no plugging in since full cells are recharged by refilling with hydrogen. The German automobile industry aims at producing high performance batteries. Among the pioneers of this technology is Daimler Group.

Positioning of the German industry: For years, the German automobile industry has profited from its position as a leader and manufacturer of premium vehicles, firmly anchored in the image of Audi, BMW, Daimler, Porsche and Volkswagen (VW).The leading position is maintained through innovation strengthening, investing on research and development and investing in high income population countries, especially in the newly industrialising countries. Such measures made the automotive industry more stable and reliable and the leading premium producer.

New city and micro car concepts: The German automotive industry is involved in the production of new city and micro-car (one or two seater cars). This is due to the fact that expanding of cities and urban centres requires the presence of effective means of transport. Establishment of small, lightweight and manoeuvrable city and regional vehicles may guarantee city-friendly mobility alongside local public transport services and reduce transport challenges. In newly industrialising countries, there is a relevant market share for new entrants into motorised mobility. This may be possible to people with low purchasing power. Electric mobility (e-mobility) offers the possibility to establish small and light e-cars (electro cars) powered by batteries in urban areas.

Tapping new growth market: The Germany automobile industry is currently extending its market to the BRICS countries. BRICS is the acronym for an association of five major emerging national economies namely Brazil, Russia, India, China and South Africa. The German Original Equipment Manufacturer (OEM) manufactures high quality equipment and reliable products or brands. Some Germany made vehicle brands such as Volkswagen are leading in China and Brazil based on market shares, as well as with the traditional manufacturers of premium vehicles, who export large parts of their production from Germany to China. China has become the largest and most important single market for Porsche as well. The Germany's Daimler Group have produced Bharat Benz, the commercial vehicle exclusively made in India following the "Made in India Programme" launched by the Prime Minister Narendra Modi, in September 2014. Under this bilateral programme, all the major Germany and most of the other leading international automobile companies are produced in India. India is

thus expected to be a major manufacturing hub.

Modular and platform strategies: Modular and platform strategies involve plans to reduce the number of vehicle systems and engine orientation or mounting in order to reduce engineering costs and weight. It also involves the production of new car models to meet customer demands and reduce engineering costs and bulkiness of weight of products. Developing a focused system strategy enables large batch production and diversified products, equipments, and components. The international pioneer in this field are Volkswagen, Audi, and Porsche with longitudinal and transverse engine orientation, front-engine, and front wheel drive.

New mobility concepts: New mobility concepts are based on the idea of "using instead of owning", which include different variants of car- sharing, bike sharing, dynamic car-pooling and integrating these mobility services with each other or with public transport. This concept is likely to transform the OEM from purely product suppliers to mixed providers of products and services. Within a few years, large bike sharing schemes have been established in other European countries with up to 20 000 bicycles per town or city. Cities like Paris, Barcelona or Milan bike-sharing have introduced bike sharing programms to significant and growing shares of cyclists. Dynamic car-pooling has reached a new level of quality supported by the use of internet and smart phone apps in making ad-hoc offers and ad-hoc booking possible when sharing a ride.

Earth-moving and loading machines in Germany

Earth moving machines involve equipment used for moving large amount of earth, digging to lay foundation, and landscaping. Broadly, earthmoving equipment can be classified into three segments; construction of tractors, loaders, and excavators. The earth-moving machines comprise a large set of industrial machines used in construction, mining, forestry, agriculture, cleaning, and many other industries. Such machines include a vehicle (main body) and a robotic mechanism mounted on the vehicle. Many types of earth-moving machines are available with different combinations of vehicle and robotic mechanisms. The robotic mechanisms typically consists of a robotic arm (a combination of links and joints) powered by a hydraulic system and a tool designed for tasks such as loading or excavation of materials.

Wheel loaders are extremely versatile and often used as multi-purpose machines at production sites. They are used every day, especially in the transportation of soil, ore, snow, wood-chips, and construction materials. Wheel loaders have extensive use in the mining industry. They are used in transporting ore in both open-pit mines and underground mines. In underground mines, special types of wheel loaders called Load-Haul-Dump (LHD) machine are used. Fundamentally, the LHD machines are the same as wheel loaders called load head dump, except that they are adapted for the low ceilings of underground mines.

Germany occupies the third top world position (just behind USA and Japan) in manufacturing of construction machinery . Other top countries include China, Sweden, South Korea, and the Netherlands. The major companies involved in the manufacturing of construction machinery in Germany include the Liebherr Group of Industries and Caterpillar.

Earthmoving and loading machinery industries in Germany fall under the Machinery and Equipment Industry (M & E). The machinery and equipment industries are concentrated in Bonn Dusseldorf, North Rhine, and Westphalia. They are also found in Frankfurt Main, Herse Leipzig, Saxony, Munich, Nuremberg, Bavaria, Weimar and Thuringia. The Machinery and Equipment industry is the second largest and most innovative industry sector in Germany. It is one of the technological motors that drive the country as a high-tech nation, and one which combines all of the key future technologies, including electronics robotics, materials, and software.

The major earthmoving and loading equipment produced in Germany include bulldozers, loaders, backhoes, power cranes, excavators, graders, and rollers, crashers, mixers, pavers, concrete pumps, various types of off-road trucks trailers and a wide variety of specialised machinery. Such equipment are used for three major activities: earthmoving, paving, and lifting (loading). Figure 5.6 is a picture of earth moving equipment (Bulldozer). The major market for the construction equipment and machinery made in Germany is the USA, Europe, and the Germany itself.

Figure 5.6: *Earth moving equipment (Bulldozer)*

Source: https://www.thebalancesmb.com/thmb/lNsgH9eKhYvS4KOBXEY2W5O3LfI =/800x0/filters:no_upscale ():max_bytes(150000): strip_icc():format(webp)/bulldozer-163796_960_720-57a271685f9b589aa95363f3.jpg

Factors for successful manufacturing of earth-loading machines in Germany

The strength of the Germany's machinery and equipment industry is driven by a combination of its proven engineering tradition, its position as a leader in technological development, and its highly diversified industrial base. Germany was a champion of the industrial revolution and has for many years worked to advance its industrial base and use it for the economic development. The earthmoving and loading equipment industry has developed due to factors such as heavy capital investment, good national policies on industrialisation and self-determination of the country. However, the use of high technology in the manufacturing industries and efficient energy supplies ensure effective production of equipment. Germany has also invested widely in the development and use of robotics and automation.

The machinery and equipment industry utilises high skilled and innovative human resource. Engineering excellence and dual education system promote industrial development in Germany. Germany's share of university students in the sciences, mathematics, computer sciences, and engineering is the second highest in the EU, with 29% of students in all subjects. One in five Germany companies takes part in the dual vocational training system, thereby turning apprentices into specialists who fit each company's needs. Most apprentices receive an employment contract after training. Moreover, Germany has large market share for its machinery equipment in the European Union (EU) and United States of America (USA). There is sufficient market in mining, agriculture, forestry, manufacturing, and construction sectors within and outside the country.

The contribution of machinery and equipment industry to Germany's social and economic development

The machinery and equipment industry has played a significant role in socio-economic development in Germany. The equipment are used in construction and mining. This has, in turn, promoted industrial development such as locomotives, aircrafts, and shipbuilding sectors. It has also advanced the construction of transport routes to international standards.

Germany machinery and plant manufacturers are world market leaders in 18 out of 31 machinery and equipment sectors. This contributes to national income, foreign currency, and Gross Domestic Product (GDP).

The machinery and equipment sector is the largest in Germany and in Europe; attracting 23% of all international Monitoring and Evaluation (M & E) projects. The M & E projects offer a large share of employment opportunities in Research and Development (R&D), manufacturing, and marketing. The machinery and equipment industry provide good and attractive wages to employees and improve livelihood. The industry contributes to the improvement of social services in the country through its direct contribution to other sectors such as transportation, engineering, and manufacturing infrastructure.

Textile manufacturing industry in China

China is located in South Asia along the coast of the Pacific Ocean. It has always been an agricultural country with little industrial development. It has vast reserve of coal, oil, natural gas, iron, and other metals. China attempted to industrialise when communists came into power in 1949. Great progress has been made whereby the great labour force has enabled China to manage resources and improve roads and railways. Rapid development has made China a leading producer of iron, steel, and textiles.

The history of cotton textile in China can be traced back to 5000 years ago. The status of China being the major producer of both raw cotton and cotton textile products is of most recent. China is among the leading country in cotton production and textile, preceded by USSR (Russia). Technological development has also made synthetic, polyester, and fibres to become more pronounced; making

China the leading country in replacing the use of cotton with sythetic fibres in the textile industries.

Distribution of textile industries

Textiles industries are located in most of industrialised towns (in all parts of the country) and the industries are supported by the availability of both internal and external markets. Shanghai is the major textile industry centre. Other producing areas include Chongqing, Nanjing, Xian, Zhengzhou, and Beijing. Figure 5.7 shows the distribution of textile industries in China. The most important cotton growing areas in China include Great Plains of Northern China along the Huang He and Wei He Valley, Sichuan (Szechwan), and the Chang Jiang (Yangtze) Valley. The production of cotton is cheap, hence the cotton produced is cheap in China compared to the other countries.

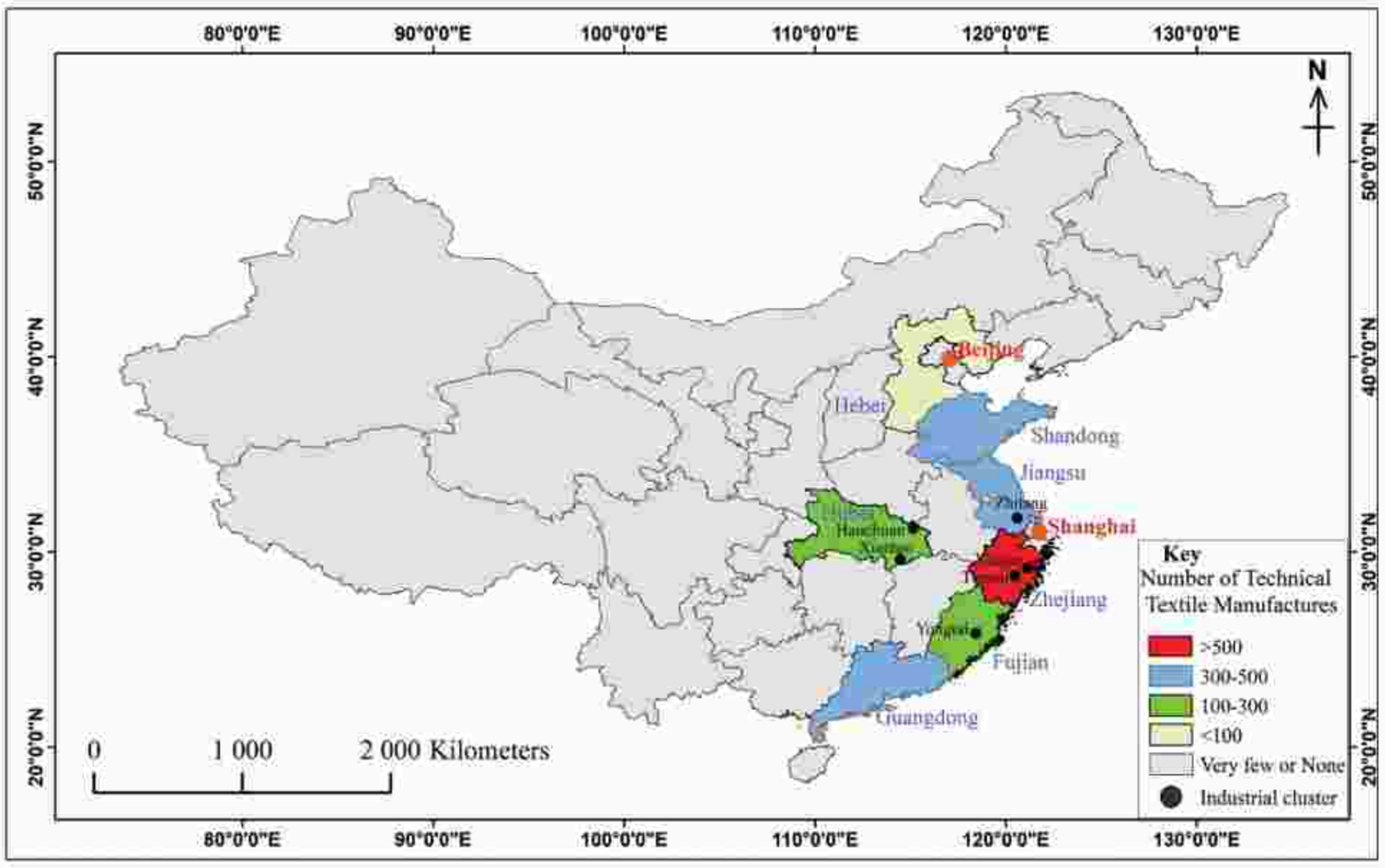


Figure 5.7: *Distribution of textile industry China*

Source: https://images.fibre2fashion.com/articleresources/images/68/6757/2_files/image001.jpg

Factors influencing the development of the textile industry in China

The development of textile industry in China is influenced by several factors, which are discussed as follows;

The availability of raw materials: Being an agricultural country for a long time, China produces sufficient cotton for its textile industry. Moreover, about 65% of all sythetic fibres in the world is produced in China, and the majority is used in the textile industries.

The availability of cheap labour: Cheap labour has contributed to textile industry

advancement due to the fact that China is a highly populated country in the world with 1.4 billion people. This offers opportunity for availability of both skilled and unskilled labour. Human resource is an essential factor to the development and advancement of any industry. This is necessary since the sufficient number of people is required to perform different managerial tasks and monitor the production in industry.

The presence of iron and steel: Iron and steel stimulate the development of textile industry. This is because they serve as raw materials for manufacturing equipment which are supplied to the textile industry. These equipment include machinery and spare parts.

Reliable and sufficient power supply: China has established various power supplies from different sources. Hydro electricity supply from different dams and other sources of energy such as coal has great deal in industry since they generate power for running of the machines. For example, there are power centres on great rivers such as Yangtze kiang and other centres which supply power to the industries.

Introduction of textile technology: China has developed modern textile technology to ensure sufficient supply of goods/products and quality of textile products.

Availability of transport and communication networks: China has cheap transport and the most effective communication networks in the world. It has been enable to construct sufficient roads, water based infrastructure, and railways. Some underground railways which remove congestion over the land cause easy movement of raw materials to the industries and the finished goods to the markets.

Availability of markets: Availability of markets for the Chinese textile products is supported by high population. China has well established domestic market and has access to external market in European countries such as Britain, USA, and other Asian countries together with African countries, particularly the United Republic of Tanzania.

Advanced application of science and technology: China uses the modern technology in industrial production and advanced local skills to facilitate the development of the textile industry. Moreover, the government influences industrial development through formulating the policies that encourage the development of industries in the country.

Challenges facing textile industries in China

Stiff competition from other countries like India and Pakistan threatens the textile industries in China. Emergence of new textile industries with the new styles of production can lead to the decline of the industry. Sometimes the country's weather, especially frequent floods also affect industrial production by damaging crops that generate cotton, fibre, and other forms of raw materials. Floods also affect transport and communication systems. Price fluctuation of textile products in

the world market and environmental pollution including air pollution and waste dumping, lower the performance of textile industries.

Evolution of manufacturing industry in Tanzania

Industrial production has been one of the key activities in Tanzania since independence. During the colonial period, industries produced simple consumer goods. After independence, Tanzania inherited a very small industrial sector. It had only 220 manufacturing industries. Foreigners owned most of the factories that existed at the time. Some of these include Coca-Cola, East African Breweries, Tanganyika Packers, British American Tobacco, Metal Box, and Bata shoes.

Development phases of the industrial sector in Tanzania started with the mixed economy (1961-1966). The second phase shifted to state-led import substitution industrialisation (1967-1985). The period of de-industrialisation under structural adjustment programmes (SAPs) policy reforms was from 1986 to 1995. The current period is a return to the development agenda with industrialisation occupying a central role in enhancing economic transformation. Currently, the manufacturing sector consists mainly of food processing (24%), textiles and clothing (10%), chemicals (8.5%), and others, including beverages, leather and leather products, paper and paper products, publishing and printing, and plastics.

Food and beverage industry

The history of food and beverage industry in Tanzania stems from government-owned enterprises to private investors after privatisation. Privatisation not only improved the efficiency of these companies, but also led to significant new investments in the industry by the private sector, changing the face of the food manufacturing sector significantly. Two giant companies the Bakhresa Group and Mohamed Enterprises Group emerged after privatisation reform. The country's largest and most diversified food industry operators cover the milling, beverages, bakery and other sectors. Privatisation also opened up the industrial sector to other local, regional, and multinational companies including the beverage giants like Coca Cola Kwanza Ltd, SBC Tanzania Ltd. (Pepsi), Tanzania Breweries Ltd, and Serengeti Breweries Ltd. Most of the consumer-oriented food processing industries use local ingredients. However, because of the increasing demand, some rely on imported food ingredients and supplements such as soy, rice, wheat, and industrially processed products. The food processing sector is characterised by micro and small-scale processors, with a number of medium and large size processors, most of which are in Dar es Salaam, Tanga, Kilimanjaro, and Arusha.

Sugar industry

In Tanzania, sugar production is the largest agro-processing industry. This industry started early in 1924 with the Tanganyika Planting Company Limited in Moshi. Between 1961 and 1962 two other

sugar companies situated in Kilombero and Mtibwa were established. Currently, the industry had grown to four sugar companies namely Kilombero Sugar Company Ltd, Tanganyika Planting Company Ltd (TPC), Mtibwa Sugar Estates Ltd, and Kagera Sugar Ltd. Based on existing data, sugar production in the country has increased from the initial 2 000 to more than 300 000 metric tonnes per year with the country importing the deficit of about 100 000 tonnes. The Government has called out for investors to meet the deficit through new investments in sugar plantations and new plants across the country.

The government is seeking joint ventures for the Ruipa Sugar project in Kilombero District to grow sugarcane on 13 950 hectares of land with the potential of producing 100 000 tonnes to meet the current sugar deficit. Sugar Board of Tanzania (SBT) has proposed several small-scale to large scale sugar projects including Mkulazi Holding Ltd (Mkulazi & Morogoro), Purandare Industries (T) Ltd (Dodoma), and Suba Agro Co. Ltd (Manyara). Others include Bagamoyo Sugar Ltd (Bagamoyo), and Nile Agro Industries Ltd (Tarime). The new developments are potential to yield over 200 000 tonnes per annum. Other potential sites for large scale sugar plants are Kisaki and Mvuha (Morogoro), Rufiji Basin, Kibondo (Malagarasi Basin), and Songwe Basin.

Wood industry

Wood and furniture production is one of Tanzania's oldest industries. The first sawmills in the country were established in the late 1950s and early 1960s. The main products of wood industry in the country include metal household furniture, office furniture, and garden furniture. Except for some relatively large firms importing and manufacturing furniture for the domestic market, the majority of wood products and furniture producers are small and medium-sized enterprises (SMEs) located in clusters. Wood processors that supply timber to the construction sector and to wood and furniture manufacturing firms are, for the most part, small entrepreneurs employing mobile sawmills. In terms of employment, since 2008, the wood industry has grown 2.5 times. In 2016, the wood and furniture industry employed roughly 8 000 workers, representing 6% of total manufacturing employment.

Cement industry

Locating a cement industry needs access to limestone. Tanzania has enough limestone resources to support the cement industry. After food, beverages, and agro-processing sectors, cement manufacturing is the largest. Tanzania's largest cement producers are Tanga Cement (Simba), Portland (Twiga), Mbeya Cement Company Limited, and Dangote Cement. The country's cement capacity has expanded rapidly in recent years, most significantly after the entry of Nigeria's Dangote Cement in Mtwara region in 2015. The sector has created employment opportunities for Tanzanians, hence contributing to the improvement of their livelihood.

Coffee and tea industry

Tanzania is an important producer of coffee and tea, mainly in the southern and northern highlands. Some of the major tea companies in Tanzania include Chai Bora, Rift Valley, and Tea Blenders. Although the bulk of the crops is destined for the export markets, the demand for coffee and tea continues to thrive in the country, which has seen the setting up of local tea and coffee processing plants. Before 1988 there were only two union-owned coffee processing facilities, one in Moshi (Kilimanjaro region) processing arabica, and another in Bukoba (Kagera region) processing robusta. Since 1994, the processing capacity for coffee has increased enormously.

Textile industry

Tanzania's textile sector has passed through various stages since independence to date, from a period where the government owned most of the textile industries to the period where private companies are the main owners. According to the Ministry of Industry and Trade 2004 report on Status of Textile Industries in Tanzania, the government and private companies established 50 textile industries. About 23 (46%) of the established industries are operating. The industries are involved in dyeing, spinning, wearing, printing khanga and Kitenge, bed sheets, garments, and knitting woven blankets and socks.

Steel rolling

Steel rolling is a metal forming process in which metal is passed through a pair of rotating rolls for plastic deformation of the metal. It is classified according to the temperature of the metal rolled. If the temperature of the metal is above its recrystallisation temperature, the process is termed as hot rolling. If the temperature of the metal is below its recrystallisation temperature, the process is termed as cold rolling. On the other hand, rolling mill is a machine for plastic deformation of metal between rotating rolls. In a broader term, a rolling mill is an automatic system or line of machines that perform both rolling and auxiliary operations. These operations involve transport of the original billet from the stock to the heating furnaces and the mill rolls, transfer of the rolled material from one groove to another, transport of the metal after rolling, cutting into sections, marking or stamping, trimming, packing, and conveying finished products into the stuck.

Different types of rolling processes include; continuous rolling, transverse rolling, shaped rolling or section rolling, ring rolling, powder rolling, continuous casting, hot rolling, and thread rolling. Rolling mills produce products such as slabs, bars, sheets, plates, strips, tubes, pipes, rods, and rails. The metal rolled to specific shapes has applications such as construction materials, partition beam, ceiling panel, and roofing panels. Other applications include steel pipe, automotive parts, household appliances, metal furniture, door and window frames, and other metal products. In Tanzania, rolled steel producers include Simba steel, MM steel Co Ltd, SITA Rollings Ltd, ALAF, and Jeje Industries Ltd. These companies have their industrial bases in Dar es Salaam and Mwanza. They are also expanding their investments to

the other regions. The manufacturers import semi manufactured and finished steel products. Iron from Itewe deposit in Chunya and scraps from various places are used as raw materials in steel rolling industries. Figure 5.8 show steel industry in Tanzania.

Figure.5.8: *Steel industry in Tanzania*
Source: httpswww.lakeoilgroup.comlakesteelindex.phpcountry=TA&cmp_id=11

Factors influencing the growth of steel sector in Tanzania

Tanzania's steel sector has gone through a period of significant growth over the past 20 years, with expansion at all stages of the value chain – from scrap collection to fabrication, distribution and wholesale of local and imported steel products. Its growth trajectory mirrors the wider experiences of industrialisation and de-industrialisation over time. Structural changes as well as rapid growth of the construction sector and building projects related to increased investment in mining, urban housing, and large and small infrastructure projects are driving the steel sector expansion. Basic raw materials are iron ores deposits readily available in the southern highland.

The country's steel sector consists of a few large industries involved in steel roofing and reinforced bars, and many smaller producers that make a range of steel materials for the construction sector. Traders and wholesalers also play a key role in the value chain along with construction companies that depend on steel. Despite the increase in the number of steel firms, and a significant increase in domestic capacity, the sector remains remarkably concentrated with a few firms that dominate both long and flat steel products. The largest firms in Tanzania include domestic and foreign firms that are involved in trade and manufacturing activities across the region. Ownership, capital, technology, raw materials, and expertise are factors behind the observed trend of steel sector growth in the country.

Contribution of the steel rolling industry to the national income

The steel rolling industries have played a significant role in the construction sector through provision of employment and contribution to the national income. Hence, it has contributed in raising the living standards of the people.

Challenges of steel rolling industries in Tanzania

The challenges encountered by the steel rolling industries in Tanzania include insufficient raw materials, poor technology, and insufficient industries/ factories. Lack of reliable market for

the final processed goods, unreliable and high cost of power and small number of skilled labour in the iron ore industry also pose significant challenges to the sector. Despite the challenges encountered, there has been progress in terms of production as shown in Table 5.1.

Table 5.1: *Production of selected manufactured products in Tanzania 2016 - 2020*

S/N	Product	Unit	2016	2017	2018	2019	2020
1	Rolled steel	000tonnes	220	232	275	273	278
2	Iron steel	000tonnes	91	85	84	101	108

Source: URT (2020)

Opportunities in the manufacturing industry in Tanzania

Tanzania offers huge opportunities for investors in the agriculture, agro-processing, manufacturing, retail, and hospitality industry. The country's agricultural powerhouse potential is due to its abundant land, fertile soils, and good rainfall. Unique opportunities for the growth of the food, beverage, and milling industry are enormous in East Africa. Opportunities also exist in the chemical industries sub-sector, as there is a local demand for fertilisers, pesticides, pharmaceuticals, and petrochemicals, met through imports. Other opportunities exist in the production of building materials, metalworking, and local assembly. Export Processing Zones (EPZ) Act of 2002 also offers a conducive environment for investment in the manufacturing sector in Tanzania. The Act offers a ten-year exemption from corporate taxes, remission from customs duty, VAT, and other taxes on raw materials and goods of a capital nature which are related to production in EPZs, allowances to sell 20% of goods in domestic markets, access to an export guarantee scheme, and unconditional transferability of profits, dividends, and loyalties.

Contribution of the manufacturing industry in Tanzania

The manufacturing sector has been making a significant contribution to the GDP. The contribution of the manufacturing sector to the overall GDP of the country has averaged 8% over the last decade. In 2014, the sector generated USD 3 billion while in 2018 it generated USD 4.1 billion representing an increase of 39%. In addition, the contribution of the sector to foreign currency earning cannot be underestimated. Tanzania's manufactured goods export reached USD 795 million in 2018, accounting for 18% of the total value of goods export. The exported goods include cotton yarn, processed coffee and tobacco, sisal products (yarn and twine), wheat flour, plastic items, textile apparel, and cement.

The manufacturing industry is of considerable importance to the Tanzanian economy and it is still one of the most reliable sources of government revenue. In terms of employment opportunities, the manufacturing industry is one of the sectors that have the potential for private employment and entrepreneurship. According to the industrial census of 2013, about 49 243 investments are in the

manufacturing sector hence contributing to the economic growth and livelihood. The number is expected to rise due to the recent expansion of industrial activities in the country following the government's slogan *"Tanzania ya viwanda"* whith an intention to promote industrialisation in Tanzania. Tanzania adopted the Development Vision 2025 in 1999 with an emphasis on the role of the industrial sector for development to enable the nation semi-industrialised by 2025. The Vision 2025 recognises the leading role of the industrial sector in transforming Tanzania's economy.

Challenges of manufacturing industries in Tanzania

Relatively, Tanzania has a small and underdeveloped manufacturing sector. Most of the initiated manufacturing investments have not survived for long, mainly because of insufficient infrastructure and inefficient macroeconomic policies. Innovation, participation of wider population in deriving industrialisation along with financial constraints and mismanaged parastatal ventures have been contributing to the poor performance of the sector. Furthermore, the span of Tanzania's manufacturing industry is relatively narrow. It comprises processing and packaging, textiles and garments, steel and steel products, petroleum and chemicals, and non-metallic products. The shortage of skilled labour force also contributes to the declining development of the industrial sector in Tanzania. For example, about 75% of the total labour force in the textiles industry are unskilled making this sector the least skilled industry. Other challenges include technological constraints, market challenges, and administrative and policy issues.

Experts or skilled labour: The manufacturing industry has few local experts and relies on foreigners. This increases the industrial production cost. Fewer skilled labourers lead to mismanagement, embezzlement, and over expenditure. This results to production costs being high and products being expensive than the imported goods. The long term dependency on experts from foreign countries also leads to the decline of industries.

Technology: Technology is another challenge in producing some types of clothes such as suiting materials. For example, Urafiki textile in Tanzania which relied on the Chinese technical and financial support failed to attain its intended objectives. This resulted to the decline of the country economy in the 1980s and liberalisation policy in 1994/1995.

Capital: Industries needs sufficient capital to establish, purchase machinery, construct offices and workshops, and purchase raw materials. Capital may be provided by private investors, large companies, banks or the government. Insufficient capital to support manufacturing industries in Tanzania affects the overall performance of industries. For example, "Bora" industry in Tanzania is no longer operating in the manufacturing of footwear due to poor financial base. Mis-management of financial resources allocated for

development and modernisation of manufacturing industries also hinder development of the industrial sector in Tanzania.

Competition from external industries: Some countries have liberalised their trade to allow the importation of foreign goods. This weakens the internal market for local goods and cause external competition in various sector and sub sectors including textile and foot-ware. It jeopardises the demand for local goods and appraise imported foreign goods. Similarly, heavy competition in the tyre industry, is one of the factors that led to the collapse of the General Tyre factory in Arusha. Competition from synthetic raw materials contributed to the decline of manufacturing industries in the country, especially those that are based on agricultural raw materials. The Moshi sisal bags industry declined due to lack of synthetic fibres.

Raw materials: Shortage of raw materials for textile industries in Tanzania, particularly, agricultural raw materials such as cotton affects industrial operation and performance. Several textile industries that were active in the 1980s, such as MWATEX, MUTEX, Sungura textile, Polytex, and Urafiki textile are no longer operating due to insufficient production of cotton in the country.

Importation of industrial equipments: East African countries lack heavy industries which can manufacture industrial equipment, for other industries. Due to this factor, most of the spare parts are imported from abroad. The imported equipment, are very expensive and it takes a long time for them to be locally available. Importation of spare parts increases industrial production costs and cause shortage of industrial output to the market. It also encourages, irregularity in servicing the machines.

Foreign exchange: Foreign exchange affects the performance of manufacturing industries in Tanzania since there are restrictions on the allocation of foreign exchange for exporting raw material and importing equipments. This contributes to the decline of manufacturing industries in the country and increases dependency to the developed countries.

Competition with imported goods: Products from the Tanzania manufacturing industries strongly compete with the imported goods. Most of the customers believe that imported goods are better than the local goods. Due to this belief, local buyers prefers to buy the imported goods than the local goods. Therefore, industrial manufactures are urged to build trust to local and international markets by increasing the quality of their products.

Investment environment: High taxation for local goods and few foreign investors in Tanzania also affects the performance of manufacturing industries in the country. Investment costs for manufacturing industries are partly escalated by the presenc e of many regulatory institutions such as the Tanzania Bureau of Standards (TBS), Tanzania Investment Centre (TIC), Tanzania Medicine and Medical Devices Authority (TMDA), Occupational Safety and Healthy Authority (OSHA), and the National Environmental Management Council (NEMC).

Transportation network: Transportation of raw materials from producing areas to the manufacturing industries is a challenge, leading to losses and high prices of the goods produced. Improved transportation networks is needed to link the manufacturing industries with sources of raw materials.

Markets for manufactured goods: Manufactured goods may face challenges due to demand and supply forces operating in the market. In most cases, low quality goods attracts few buyers than high quality goods. In addition, mass production of some manufactured goods causes saturation, leading to inadequate markets.

Exercise 5.4

1. Explain favourable conditions for the expansion of textile industry in China.
2. With examples, describe the lessons that Tanzania may learn from China's textile industry.
3. Examine five factors that have contributed to the expansion of shipbuilding in Japan.
4. Explain the contribution of aircraft industry to the socio-economic development in the United States of America.
5. Investigate factors for the growth of steel rolling industry in Tanzania.
6. Discuss five factors that determine the location of steel rolling industries in Tanzania.
7. Describe six challenges that face Tanzania in its attempt to modernise the manufacturing industry.
8. Explain why Germany is more advanced in the manufacturing industry.

Activity 5.4

1. (a) In a group, conduct online research and ground observation to identify the available raw materials in Tanzania for;
   (i) Aircraft manufacturing
   (ii) Ship building
   (iii) Steel rolling
   (iv) Automobile manufacturing
   (v) Earth Moving equipment building
   (vi) Textile Industry
   (b) Summarise your results and present them in the class or group for discussion
2. (a) Conduct a research to identify industrial raw materials in your neighbourhood
   (b) Use results from your research to innovate industry of your dream and plan how you will establish it

Contribution of manufacturing industries to the economy

Manufacturing industries serve as a key element to the economic development in any country. These have advantages such as capital accumulation, economies of scale, and technological progress. Manufacturing industry can produce greater spillover effects on other industries and ultimately increase job opportunities and income to individuals and society as a whole. They help in modernising agriculture by manufacturing tractors, tools, and machines used in cultivations. They also bring foreign currencies and help in the expansion of trade and commerce through the export of manufactured goods. Moreover, their presence attracts social services such as roads, water, and power. The contribution can further be expanded as follows;

Employment opportunities: The manufacturing sector is a source of employment. Many people work in different sections and departments of the manufacturing industries, which enable them to earn income for their living. Skilled, semi-skilled and even unskilled people play different roles in the manufacturing industries to ensure that they operate effectively.

Expansion of social services: When an industry is established in a certain area, it contributes to the expansion of social services such as availability of power, water, health services, financial institutions such as banks, roads, and other various human needs including shops, schools post offices, and security services (police posts/center).

Growth of cities: Manufacturing industries stimulate the growth of towns and cities. In China for example, some cities grew after the establishment of the textile industries in those areas. These include Shanghai, Guangzhou, and Sichuan.

Improvement of transport infrastructure network: Manufacturing industries stimulate the development of transport infrastructure where by main and feeder roads are connected to the industrial area to faciliate movement of goods and raw materials. Some industries are connected to railway lines and some influence the construction of harbours and airports for cheap and easy transport of goods and raw materials.

Manufacturing industries also facilitate the diversification of the economy, generates a state self-sufficiency, reduces the cost of importation, and improves social services provision in the country.

Effects of manufacturing industries to the environment

Manufacturing industries can cause direct or indirect impacts on the environment. Large number of industries may potentially cause high levels of environmental effects such as pollution (water, air, and soil), loss of biodiversity, depletion at the ozone layer, global warming, and climate change.

Air pollution: Industrial activities are great sources of greenhouse gases emitted to the atmosphere. The main greenhouse gases are carbon dioxide (CO_2), nitrous oxide (N_2O), Methane (CH_4), and Chlorofluorocarbons (CFCs).Burning fossil fuel such as coal, petroleum, and charcoal contributes to the rise

of atmospheric carbondioxide which increases temperatures hence global warming. Smoke from industries and vehicle is very common in large cities that experience heavy traffic like Tokyo, Sydney, and Mexico. Fossil fuel burning is the main source of energy/power in most of industries. For example, industrialised countries contribute to over 75% of carbon dioxide generation to the atmosphere through fossil fuel burning. Burning of fossil fuel is estimated to contribute to 80% of all greenhouse gases in the atmosphere. The remaining percentage is contributed by deforestation and land degradation. Therefore, emission of these greenhouse gases in the atmosphere harm the life on the planet Earth. Air pollution can cause lung diseases such as Tuberculosis (TB), lung cancer and skin cancer. Figure 5.9 is an example of industrial air pollution.

Figure 5.9: *Air pollution from burning of fossil fuel*

Source: httpswww.2eyezmedia.comhabariviwanda-vipya-8477-vimeanzishwa-tanzania

Water pollution: Industrial activity is among the major cause of water pollution. Improper handling of industrial wastes and dumping of various industrial waste products into water sources, often result in polluting water. Many factories use water for cooling then the same water is discharged back into river and lakes. Water pollution is also caused by chemicals in a form of liquid waste discharge from the industries, such as textile industries, engineering industries, iron and steel industries, paper industries, food processing industries, and steel industries. Polluted water can harm various plants and animal species. Water pollution disturbs the balance of the ecosystem in water, resulting in the death of various animal and plant species present in the water. Pollution also reduces the potential of water as a resource for the various uses such as drinking. It is difficult and costly to treat polluted water to the acceptable quality for reuse. Discharging polluted water to the environment, especially rivers and lakes can lead to water borne diseases like cholera and typhoid as well as dysentery as a result of drinking untreated water. Figure 5.10 shows an example of industrial water pollution.

Figure 5.10: *Industrial Water pollution*

Source: https://assets.nrdc.org/sites/default/files/styles/full_content/public/media-uploads/guide_waterpollution_66615937_2400.jpg?itok=sFkjJE59

Loss of biodiversity: Inspite of their benefits to the economy and livelihood, manufacturing industries may contribute to the loss of biological diversity. Most of the loss is experienced where raw materials for the specified industries are obtained, especially the agriculture sites, where trees are cleared in order to expand the crop lands and other forms of farming. It is also evident that the loss of biodiversity is caused by discharge of industrial chemicals to the environment such as chemicals that kills fish, insects, and a wide range of species. Industries also generate wastes in solid, gaseous, and liquid forms which pollute water and attract airborne and land related diseases.

Depletion of ozone layer (O_3): The ozone layer (O_3) absorbs ultraviolet radiations and shields the earth's surface from its potential negative impacts. The layer filters harmful rays (ultraviolet-radiations) which can cause skin cancer if they can directly reach the earth's surface. The penetration of ultraviolet radiations may only be possible if the ozone layer is destroyed. This layer is depleted by a combination of gases which are commonly known as ozone depleting substances. This includes chlorofluorocarbons (CFCs), hydrofluorocarbons (H CFCs), and halogens. Most of which are produced by industries.

Measures to improve management of environment in industries

Measures to reduce environmental problems in the manufacturing industries are guided by policies, strategies and international agreements. For example, the management of air pollution is guided by the Kyoto Protocol principles which came into force in 2005. This is because air pollution has no boundary; it can occur at global, regional and local scales. The Kyoto Protocol operationalises the United Nations Framework of the Convention on Climate Change (UNFCCC)by committing industrialised countries and growing economies to limit and reduce greenhouse gases (GHG) emissions levels in accordance with agreed targets. This can be achieved through the use of clean energy technology. For example, the use of clean burning fuels which emit none or less greenhouse gases. Tanzania is among the signatories of the Kyoto Protocol. It is also supposed to ensure that clean energy technologies are promoted in order to reduce the emission of greenhouse gases in the country by promoting alternative sources of energy. Alternative clean energy sources include hydroelectric power, solar, wind, nuclear, and geothermal. Figure 5.11 presents an example of wind power as an alternative energy source. Emphasis should also be placed on the need to plant trees that have high capacity to absorb carbondioxide. Trees or forest in general are considered among the carbonic sinks which reduce the amount of carbondioxide from the atmosphere.

Figure 5.11: *Mwenga wind farm in Iringa, Tanzania*

Source: https://cceonlinenews.com/2020/06/22/tanzanias-mwenga-wind-farm-begins-operation-2/

Industrial planning and decision making should take into account the management of resources and environment in order to attract sustainable industrial development. Sustainable industrial development is supposed to consider social equity, economic needs and environment. Industrial development should not interfere with the environment and ecosystem. To achieve this target, existing laws and associated regulations should be enforced. For example, in Tanzania EMA Act No. 20 of 2004 assigns the National Environmental Management Council (NEMC), the responsibility to make regular checking or inspections of the operations of different industries and to ensure that the Environmental Impact Assessment (EIA) is conducted before project implimenatation to avoid potential risks that may affect the health of people and the environment. NEMC is also responsible in directing and enforcing waste management and disposal including the use of sanitary landfills. Other recommended measures include the need for proper emissions of industrial gases, proper discharge of industrial effluent, and adoption of clean technologies. Figure 5.12 and Figure 5.13 show an example of a factory with a waste water recycling plant, whereby waste water is treated for reuse.

Figure 5.12: *Waste water recycling factory*

Source: https://constructionreviewonline.com/wp-content/uploads/2017/05/Installatie.jpg

Figure.5.13: *Wastewater treatment for pollution control*

Source:https://www.britannica.com/explore/savingearth/wp-content/uploads/sites/4/2019/03/water-treatment-hero.jpg

Exercise 5.5

1. List down four greenhouse gases emitted through industrial activities.

2. Explain why carbon dioxide is more problematic than other greenhouse gases.
3. Examine five impacts of water pollution on living organisms.
4. Explain how manufacturing industries cause loss of biodiversity.
5. Develop a strategy that Tanzania can adopt to reduce industrial related environmental pollution.

Activity 5.5

In a group do the following;

1. Read different e-books from online sources to help you identify the areas that experience high pollution due to the manufacturing industry in the world.
2. Identify the existing international agreements that deal with industrial pollution.
3. Draw a map of Tanzania illustrating areas prone to air pollution due to the concentration of manufacturing industries.

Revision questions

1. Describe seven factors that determine industrial location.
2. Assess the environmental problems caused by manufacturing industries and suggest measures that need to be taken.
3. Outline and comment on the location of steel rolling industries in Tanzania.
4. 'In the developing countries, expansion of industries is often limited by the small size of the market compared to the lack of natural resources'. Substantiate.
5. 'Third world countries experience difficulties in deciding whether priority should be given to industrialisation or to improvement of agricultural production'. Discuss.
6. 'Industrial development contributes to the environmental degradation'. Justify.
7. With examples, elaborate the factors that affect development of aircraft industry in the USA.
8. Tanzania is currently involved in a major campaign for industrialisation, what are the confronting challenges?
9. As a senior advisor to the Ministry of Industry in Tanzania, What measures would you recommend for improving performance of the industries in the country?
10. Explain the contribution of the industrial sector to the economy of Tanzania.
11. What are the effects of greenhouse gases to the environment?
12. Write short notes on the following;
    (a) Industrial inertia

(b) Greenhouse gases

(c) Labour intensive industries

(d) Capital intensive industries

13. Tanzania has revamped its aviation industry, what lessons can it learn from the success achieved by the USA in its aircraft industry?

14. Explain the factors for the development of steel rolling industries in Tanzania.

15. Pin point the bottlenecks to the development of steel rolling industries in Tanzania.

16. Germany automobile industry is among the leading industry in the world. Examine the factors for its success.

17. What do you understand by Kyoto Protocol? Assess its resolutions for controlling environmental problems in the world.

18. Explain at least eight factors which have influenced the development of textile industries in China.

19. Specify the lessons that Tanzania can learn from China textile industries.

20. Critically, examine the contribution of machinery and equipment to the Germany's social and economic development.

21. Explain the problems that manufacturing industry face in Tanzania.

22. Analyse the problems which can be caused by the aircraft industry in the world.

23. Tanzania has all it can take to modernise its manufacturing sector. Suggest the possible path ways to that end.

Chapter

Six

Transport and communication

Introduction

Transport and communication play a great role in ensuring that information on goods and services is exchanged and conveyed appropriately from one level to another. The two serve as a link to all sectors of the economy and are thus relevant and useful in different development contexts. In this chapter you will learn the concept of transport and communication, and the modes and forms of transport. You will also learn the transport and communication systems in focal countries and Tanzania in particular. The competencies developed from this chapter will enable you to engage in transport and communication activities and contribute to the socio-economic development of the country.

Concepts of transport and communication

The concepts of transport and communication are concerned with the mobility of people, freight and information on the attributes, and constrains that prevail in places of origin and destination.

Transport

Transport refers to the activity that facilitates physical movement of goods and people from one place to another. It is considered as an auxiliary to the other sectors of the economy. This sector supports trade and industry in carrying raw materials to the place of production and in distributing finished products for consumption. Individuals or business firms that engage themselves in such activities are called transporters.

Communication

Communication refers to the process of transferring information between individuals, groups, and places. It is a very vital aspect which facilitates spatial interactions. If the information is not clearly communicated, it can omit the delivery of goods and services to the public.

Importance of transport and communication

Transport and communication are important since they facilitate transportation of raw materials to manufacturers or producers. Transport makes it possible to carry raw materials from production sites to places where they can be processed into finished goods. For example, a flour mill purchases grains as raw materials which are processed, packed and sold as finished goods.

Make goods available to customers: Transport aids the movement of goods and industrial products from one place to another easily and timely. Thus, consumers who are located in different parts of a country have the benefit of consuming goods produced in distant places. For example, Dar es Salaam consumes coffee transported from the northern and southern highlands of the country.

Enhance the standard of living: Easy means of transport facilitates large-scale production at low costs. It gives consumers the choice to make use of different quantities of goods at different prices. So it improves the standard of living of the people.

Help during emergencies and calamities: In times of national crisis such as war or internal disturbances, availability of transport facilitates the movement of troops and the supplies needed in the operation. For example, a Bailey bridge was used by Tanzania troops to move heavy equipment across the river during the Kagera war in 1978.

Help in creation of employment: The transport sector provides employment opportunities to individuals such as drivers, conductors, pilots, and cabin crew who are directly engaged in the transport business. It also provides employment to people who are involved in the manufacturing of transport equipment. People can also benefit from repairing and maintenance services by opening service centres in convenient locations.

Help in labour mobility: Transport helps a lot in facilitating labour mobility. People move from one place to another in search of work. Workers move from their places of residence to working places and back to their homes. Foreigners can easily move from their home countries to work in other countries.

Helps to strengthen international relationship: Transport facilitates the movement of people from one country to another. It enables people to interact through travelling, moving commodities and spreading information. This helps in exchange of cultures, experience and practices between the people of different countries. It also improves interactions and raises awareness among people of different countries. Transport also helps to establish relationship among people of different parts in the world and promotes a feeling of international connectivity.

Income generation: Transportation business helps to generate revenue hence it contributes to the country's Gross Domestic Product (GDP). Both transport and communication play great roles in the socio- economic growth of a country and promote internal and external trade. Transport links the logistic system and thus increases production and plays a major role in the economy. For example, in 2018, the Tanzania transport sector contributed 8.1% to the country's GDP, 3.8 billion USD compared to 2.8 billion USD billions in 2014.

Accessibility and utilisation of resources: Transport and communication promote accessibility and utilisation of natural

resources such as minerals, water, and forest resources such as timber.

Saves time and costs: Well-developed means of transport and communication reduce time, distance, and costs to be used in the delivery of goods, services and information from one individual to another.

Industrial development: The development of transport system also leads to advancement of industries because transport system utilises the products of industries and they both complement each other in different ways.

Growth of tourism: Transport and communication enhance the growth of tourism industry and create affordable traveling in long or short distance. Places which have developed transport systems have good and improved tourism sector.

Accessibility to different places: Transportation revolution improves accessibility to places, bringing development and growth. This is because transportation is the main vein through which development facilities and services are channeled. The level of transport development in many areas has positive correlation to the level of economic growth and development.

The common modes of transport

The manner in which goods, services or people move from one place to another depends on the common modes of transport namely land, water and air. Land transport has several forms such as road, railway, portage, animal, cable, and pipeline transport. For instance, on land, the trucks, tractors, and trains are used in carrying goods while train, bus, and cars carry passengers. Water transport includes inland and sea waterways. Ships, ferries, and boats are used to transport goods and passengers in water bodies. Aeroplanes and helicopters facilitate air transport. Generally land, water, and air are the important means of transport for the development of any country.

Land transport

Land transport involves physical movement of goods and passengers on land. This movement takes place on road, rail, pipe or rope way. Hence, land transport may further be divided into road transport, rail transport, pipeline transport, and cable or ropeway transport.

Road transport: Road transport is the of transport that connects one place to another on land through roads. It is a line of communication which use a stabilised base other than airstrip or railway. Road transport is the most common of transport. Vehicles, bicycles, and motorcycles are used on road transport. They range from pathways to motorways as shown in Figure 6.1.

Figure 6.1: *Motorways transport*
Source: httpswww.thecitizen.co.tztanzanianewstanzania-secures-sh570-billion-wb-loan-for-phase-3-of-dar-bus-rapid-transit-3325672

Important features of road transport: Road transport can quickly be established whenever a demand exists for a route from one place to another. They are flexible in nature. Roads can be used by a very wide range of transport agents. Both human and animal driven transport can use roads, as well as vehicles, bicycles and other locomotives. Very few roads, generally the largest and most modern restrict the use of motor vehicles, especially in cities and town centres where the roads are characterised by traffic jams. Moreover, pedestrians are part of users of this mode of transport. Unlike the early days of civilisation when animal driven transportation was dominant, motor driven transport is assuming the dominant role.

Technologically; roads are paved with soil, gravels, or tarmac to allow smooth movement of people and goods. Intermodal utilisation is very high in this mode of transport. This means that road transport can be used and connected easily with other modes of transport. It can be linked to railway, air, and water transport. The means of road transport may be divided into three types, namely human, animal, and motor driven.

Human driven transport: Human driven transport dates back to ancient times, when member of the family moved their possession by carrying them in their hands or on backs or heads. People carried their goods to near or distant markets on foot through narrow paths. This type of transport is common even today in forested areas, rugged mountains, and sparsely populated areas, where roads are difficult to build. For example, hunters carried home the animals they killed. People also ride bicycles or use rickshaw to travel short distances.

Animal driven transport: After animals had been domesticated, a wide range of beasts of burden were employed in carrying loads, including cows, dogs, horses, elephants, cattle, yaks, camels, llamas, and donkeys among others as shown in Figure 6.2. Animals were used for the first time, for riding and as pack animals, having loads tied on their backs. While a man can carry only 32 – 36 kg over a distance of about 16-24 km per day, most animals can carry large loads over long distances. The camel, for instance, can carry about 360 kg of baggage in addition to a man for over 24 – 32 km per day. The invention of the wheel was another major step forward in the development of transport. The use of carts and wagons drawn by animals

created a space for larger loads to be carried.

The type of animals used for transport varies from region to another, depending on the climate or the terrain (relief or topography). For example, the use of yaks in Tibetal highlands, llama in Andes, camels in the desert, buffaloes, oxen and elephants in the tropics, and horse in temperate grasslands of the Eurasian steppes and tropical. Horses are the most efficient animals for riding, carrying loads or drawing carts and carriages as shown in Figure 6.2.

Figure 6.2: *Animal driven transport*
Source: httpstwitter.comvitusnkunastatus 1096563737513943041

Motor driven transport: The use of motor driven transport suggests that there has been advancement in the transport sector. Animal and human driven transport are mainly used where motor transport is not available. Motor vehicles such as vans, buses, motorcycles and trucks are used in carrying passengers and goods from one place to another. They have high speed and great capacity of carrying goods and people. Increased construction of roads and their connectivity have also enhanced the use of motor driven transport.

The major modern forms of road transport

Road transport is the most dominant mode of transport in terms of its use and availability in space. Roads were first constructed by Romans during the time of Roman Empire. These were of low quality and low technology which encouraged low speed. They were mostly used for military purposes. Road can be classified into seasonal roads which are rough and dusty and all weather roads which are paved (covered with tarmac). Others are classified on the basis of administration and construction. They include municipal roads, under agencies such as the Tanzania National Road Agency (TANROADS) and the Tanzania Rural and Urban Roads Agency (TARURA) in Tanzania. Others are classified on the basis of where they are located, these are termed as rural or urban roads. Modern roads are characterised by advanced technology used in traffic lights, tools, software, and materials. Some paved roads in cities are connected with modern bridges as shown in Figure 6.3.

Figure 6.3: *Tanzanite Bridge in Dar es Salaam*
Source: *https://www.mwananchi.co.tz/mw/habari/kitaifa/daraja-tanzanite-rasmi-leo-bila-malipo-3701176*

Advantages of road transport

The costs are cheaper as compared to other modes: Road transport is relatively cheaper as compared to other modes of transport. The costs of establishing infrastructure and transport facilities are lower as compared to air and railway transport. Prices for transport fares are also relatively cheap. The majority of the people are able to afford costs of road transport than other modes. For example, it would cost TZS. 50 000 - 65 000 TZS to cover 1 126 km (Dar es Salaam to Mwanza) which is cheaper than airplane which cost more than TZS 200 000.

Flexibility in terms of loading and offloading: It allows flexibility in loading and offloading in different terminals and stations. There are different points and stations where people can load and offload their goods or board and alight.

It is quick and appropriate for perishable goods: It is a quick mode of transport and appropriate for perishable goods. It can be used for perishable goods that move in shorter distances. For example, tomatoes that are being transported over shorter distances can be quickly transported by cars.

It is appropriate for places that are not connected by other modes of transport: It helps people to travel and carry goods from one place to another, especially in sites that are not connected to other modes of transport such as railways, air, and water transport. Rural areas are mostly connected to the road transport. This suggests that road transport has higher connectivity and accessibility advantages.

It can be connected to other modes of transport: Roads facilitate international linkage as they can be connected to other modes of transport. This is called intermodal linkage. This advantage occurs because of high infrastructural connection and accessibility. Infrastructure for roads are not very much affected by the environment as compared to those from railways. They can be established in different landscapes. This makes the road to be an easier mode of transport that can be connected to other modes. For example, it can be used to support railway, air, and water transports.

The mode is useful in linking different countries: Road transport helps to link one country and its neighbouring countries. For example, the Trans-African Highway (TAH) built in 1970s aimed to link African countries to major capital cities. Through TAH4, Tanzania is linked to Egypt, Sudan, Ethiopia, Kenya, Zambia, Zimbabwe,

Botswana, Cairo – Gaborone and Cape town. Transport is also used to increase interactions and transportation of goods, people, and information from one area to another.

Provision of employment opportunities: It provides different employment opportunities in the private sector. Youths and other people can employ themselves in the sector. There are different private employment opportunities in this sector. Youths may be employed as drivers in commuter transport popularly known as daladala in Tanzania and matatu in Kenya. Other employment opportunities in this sector are in the areas of motorcycle transport. There is a growing number of youths serving as operators in motorcycles both two-wheels and three-wheels. Others are specialised in selling spare parts, repair, servicing, and maintenance of motorcycles. Some are specialised in washing and cleanliness of the transport vessels by opening car wash and selling car wash sanitation facilities. Women on the other side, employ themselves in selling different food products as food vendors around garages, motorcycle stations, construction sites, and bus stops. This suggests that transport and communication provide diverse opportunities for self-employment.

Disadvantages of road transport

It has limited carrying capacity: In terms of types of road facilities, there are limitations on types of cars using some roads. Trucks and lorries are restricted to use some roads especially in towns or city centres. Private cars are also restricted to use some roads such as DART roads in Dar es Salaam. Moreover, there are limitations in terms of goods transported and therefore, this mode of transport is not economical for long distance transportation of goods.

It is costly to transport heavy or bulky goods by road: Some goods that are transported over long distances face higher costs in terms of fuels and prices. It is costly to transport goods such as coal through road than transporting through railways.

It is affected by adverse weather conditions: Road transport is affected by adverse weather conditions such as floods, rain, and landslides. During these events, some roads cannot be used because of flooding which may destroy bridges. A good example is the Dumila bridge between Morogoro and Dodoma which was swept away in January 2020 by floods as shown in Figure 6.4. This caused delays in the transportation of goods, including international deliveries which were on transit. This problem is highly experienced in rural areas than in urban areas because of poor infrastructure.

Figure 6. 4: *Collapsed Bridge in Dumila Tanzania*

It is vulnerable to traffics jam problems in towns and cities especially during the peak hours: Traffic jams occur mostly in developing countries. They are caused by factors such as poor regulations in the use of cars and poor infrastructure. This problem occurs mostly in urban areas; leading to air pollution and causing delays that may potentially affect the working environment.

It is mostly vulnerable to accidents and deaths: High speed and heavy traffic increase the rate of accidents and deaths in road transport. Because of the increasing number of users of road transport and incompetence of some drivers, accidents have been widespread.

These disadvantages and challenges require various mitigation measures to reduce their prevalence. Possible measures include the use of speed limits, effective enforcement of laws and regulations and regular inspections. Other suggestions include promotion of use of non-motorised transport and improvement of public transport services in cities and towns.

Trans-African Highway

The Trans African Highway (TAH) is a network of road transport that was established in 1970s to facilitate connectivity of capital cities of all African countries. It aimed at making contribution to political, social and economic integration of African countries. In its design, it has 10 routes with a total of 60 000 kms. Since its establishment, some countries have managed to connect their capital cities with nodes of other countries while others have not. The TAH traverses through different countries in Africa. Figure 6.5 provides a map of Trans –African Highways Routes. These routes or networks are summarised in Table 6.1.

Table 6.1: Trans-African High ways (TAH) network routes

Route	Length (kms)	Countries
TAH 1 (Cairo-Dakar)	8 636	Egypt, Libya, Tunisia, Algeria, Morocco, Mauritania and Senegal
TAH 2 (Algiers-Lagos)	4 504	Algeria, Niger and Nigeria
TAH 3 (Tripoli-Windhoek-Cape Town)	9 610	Libya, Chad, Cameroon, Central African Republic (CAR), Congo, DRC, Angola, Namibia and South Africa
TAH 4 (Cairo-Gaborone-Capetown)	8 860	Egypt, Sudan, Ethiopia, Kenya, Tanzania, Zambia, Zimbabwe and Botswana
TAH 5 (Dakar-N'Djamena)	4500	Senegal, Mali, Burkina Faso, Niger, Nigeria, Cameroon and Chad
TAH 6 (N'Djamena-Djiboute)	4 220	Chad, Sudan, Ethiopia and Djibouti
TAH 7 (Dakar- Lagos)	4 760	Nigeria, Benin, Togo, Ghana, Cote d'lvoire, Liberia, Siera Leone, Guinea, Guinea Bissau and Senegal
TAH 8 (Lagos-Mombasa)	6 260	Nigeria, Cameroon, Central African Republic (CAR), DRC, Uganda and Kenya
TAH 9 (Beira-lobito)	3 523	Mozambique, Zimbabwe, Zambia, DRC and Angola
TAH 10 Djibouti-Libreville-Bata)	7 000	Djibouti, Ethiopia, Kenya, Uganda, Rwanda, Burundi, DRC, Congo, Gabon and Equatorial Guinea

Source: ADB, 2003

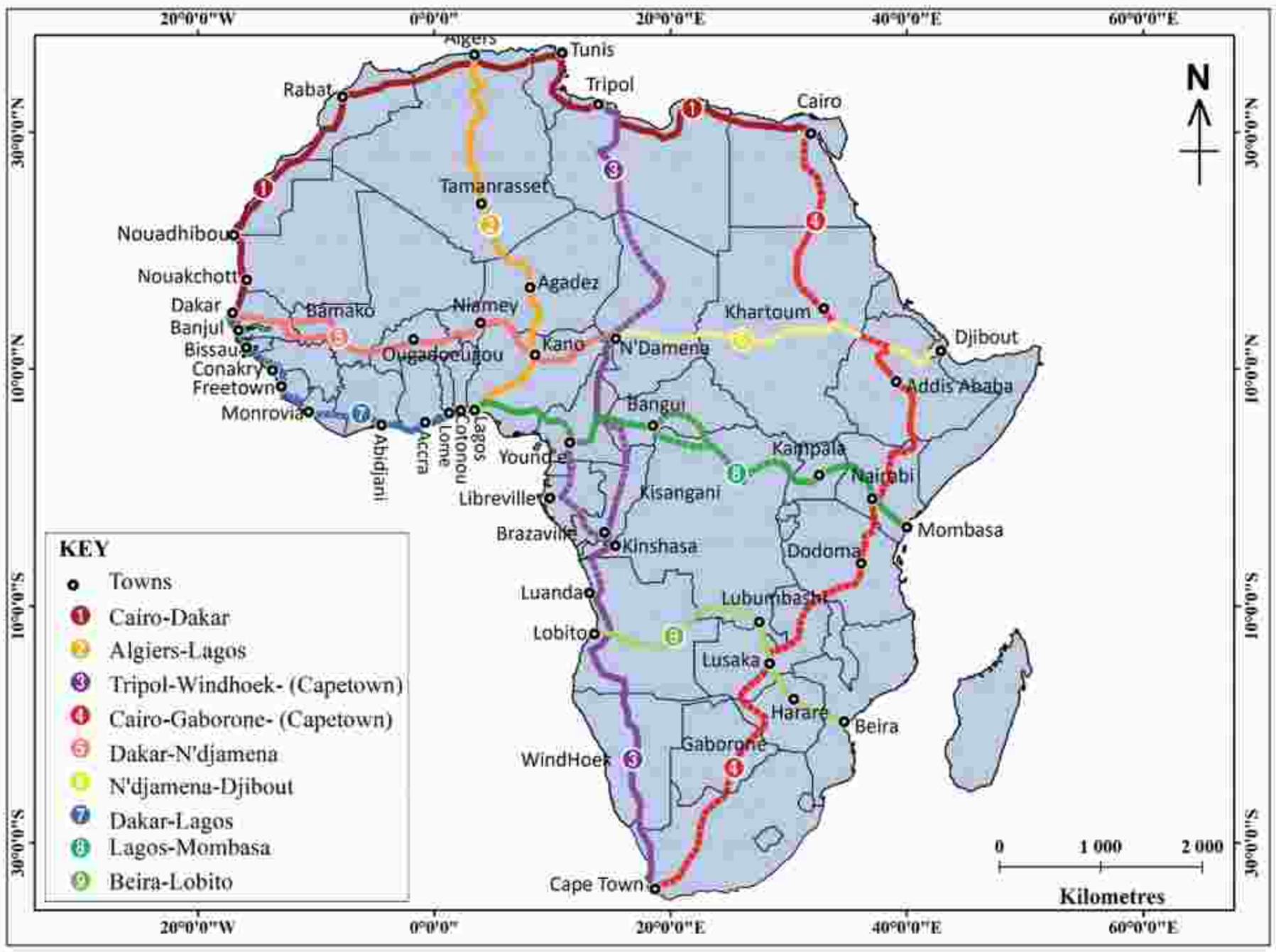


Figure 6.5: *Trans-African Highway routes*

Source: https://commons.wikimedia.org/wiki/File:Map_of_Trans-African_Highways.PNG

Railway transport

Railway transport refers to the transportation of goods and passengers on rail lines through trains. It occupies an important place in the land transport system and it is the most reliable mode of transport which carry goods and passengers over long distances as shown in Figure 6.6. There are both cargo and passenger trains. Cargo trains are very useful for carrying bulky loads over long distances. Train wagons are moves by rail engines (locomotives) which use steam, diesel or electric power.

The development of railway transport in the 19th Century revolutionised transportation. The first public railway was opened between Stockton and Darlington in Northern England in 1825. In Africa, the first railway line was built from Cape Town to Inland, then extended with the discovery of diamond at Kimberly and later extended to the Copper belt. In Tanzania, a very important railway line was financed by the Chinese government in 1975, extending between Kapiri-Mposhi (Zambia) and Dar es Salaam (Tanzania), commonly abbreviated as TAZARA, which stands for Tanzania Zambia Railway Authority. Another railway line is called Central Railway ,formally known as Tanganyika Railway which runs west from Dar es Salaam to Kigoma via Tabora with a branch to

Mwanza. Furthermore, in 2017 Tanzania started to implement a Standard Gauge Railway project from Dar es Salaam to Mwanza with a new route branching northwest at Isaka to Kigali in Rwanda.

Figure 6.6: *Railway transport*

Source: httpswww.globalrailwayreview.comarticle33994revolutionising-rail-south-africa 2

Advantages of railway transport

Appropriate for long distance travels: It is a convenient mode of transport for travelling long distance. Although the old locomotives are slow in terms of speed, it can facilitate individuals to travel long distances. For example, it is appropriate to transport heavy goods from Dar es Salaam to Kigoma. Therefore, this means of transport connects users from different areas in the country.

It is faster than road transport when it uses modern technology: When it is made up of modern technology such as standard gauge, this transport is faster. It is common in the developed countries where most electric trains uses standard gauge. In Tanzania, a standard gauge Railway (SGR) project, is an example of this technology which will have a speed of 160 km per hour.

Cheaper compared to road transport and carries large quantities of goods: This mode of transport is suitable for carrying heavy goods in large quantities over long distances than those transported through road, air and water transport. In terms of fares, it is cheaper as compared to air transport fare. This has been the main means of transport that links Kigoma and Dar es Salaam.

It is least affected by weather conditions: Railway transport is not affected very much by rainfall. The infrastructure for railway transport are resistant to rainfall as compared to road transport. This makes this transport friendly to different weather conditions. Goods and people can be transported at different times. This offers an advantage over air transport which is affected by rainfall and cloud cover.

Trains are environmentally friendly: Trains are environmentally friendly than trucks because they burn less fuel per ton compared to other modes of transport. This occurs mostly with the modern technology such as electric trains. Pollution from railway transport is also reduced. Furthermore, facilities that move on the railway are not as many as those that use the road such as cars and motorcycles. This reduces likelihood of accidents.

Disadvantages of railway transport

Not user friendly for door to door services delivery: Railway transport is not flexible in terms of offering door to door services

which form a large portion of transport market. Because of limited infrastructure, railway transport cannot offer door to door services. This makes the mode of transport appropriate for limited services.

Infrastructure is not easily improved to accommodate traffic: Because of the nature of infrastructure, it is not easy to accommodate changes to suct traffic demands. Any change in uprooting and re-laying of a whole network, require huge investment.

Very sensitive to gradient: The infrastructure for railway transport is easily established in areas with lowland. Steep slopes are not convenient for laying railways. Therefore, its establishment increases costs and the distance covered.

Transport between countries is difficult: Railway transport is difficult in transshipment between countries because different countries have different railway technology and infrastructure. Technologies and infrastructure used vary between countries. For example, using railways to transfer goods from Tanzania to Rwanda, Uganda, and Kenya is difficult. Users of this mode of transport are forced to use other modes of transport.

Old locomotive have low speed: The speed of trains is also affected by the nature of the railway gauge. There are three major categories of railway gauge. These are Broad Gauge (1.5 -1.7 m) as used in trans-Siberian Railway, Standard Gauge (1.4 m) for example, Canadian Railways, and Narrow Gauge (1 m), for example, most of railway networks in Kenya and Tanzania are 1m gauge with the exception of the new standard gauge wider construction in Tanzania.

Railways are unevenly distributed globally: Railways are unevenly distributed over the world. Well-developed railway infrastructure are found in highest economically active and populated areas such as North America and Western Europe. Currently, USA has the widest coverage of railway network followed by Europe and Canada. This makes intercontinental connection through railways difficult.

Has higher risks of death of people and destruction of properties: Railway transport can lead to heavy loss of lives and goods in case of serious accidents. This mode of transport has huge negative impacts when accidents occur. It causes widespread deaths of people and destruction of properties. These accidents are sometimes caused by decay or old infrastructure or sabotage made by some people through stealing railway facilities and equipment.

Pipeline transport

Pipelines are sections of pipes which are welded together to form one long continuous pipeline and are laid on the surface of the ground, commonly in shallow trenches as shown in Figure 6.7. In some parts of the world, they are laid on the sea bed as submarine pipelines. In modern times, pipelines are used for various purposes such as water supply, transporting petroleum crude oil or natural gas. In some advanced countries, they are used to transport milk from production areas to the processing industries. The

good example of pipeline transport is the Mtwara gas pipeline which extends from Mtwara to Dar es Salaam.

Figure 6.7: *Pipeline transport*

Source: https://www.google.com/search?q=tazama+pipeline&client=firefox-b-d&hl

The longest pipeline network is the Trans-siberian pipeline, linking Russia to the Arctic fields in Eastern and Western Europe, with 9 344 kms. Pipelines are also mostly developed in USA, Middle East, Russia, and Canada. In Tanzania, a good example is TAZAMA (Tanzania Zambia Mafuta Pipeline) with about 1 710 km from Dar es Salaam, Tanzania to Indemi petroleum refinery in Ndola, Zambia. The pipeline was meant to serve the refinery in the Copper belt where consumption of petroleum is highly demanded. Another good example is the Mtwara - Dar es Salaam gas pipeline that transports natural gas from Mnazi Bay in Mtwara to Kinyerezi power generation plant in Dar es Salaam. The proposed Hoima –Tanga pipeline is meant to transport crude oil from Uganda to Tanga Port, Tanzania.

Advantages of pipeline transport

This mode of transport has various advantages. First, pipeline is the cheapest mode of transport which enables continuous flow and constant supply. It is used by both low and high-income people, in transporting water from one area to another. Second, pipelines are used for large scale supply. Large quantity of gas can be transported through this mode of transport. For example, gas from Mtwara region, is transported and supplied to other regions through this mode of transport. Third, it is the safest mode of transport which is suitable for transporting highly inflammable resources such as petroleum and gas. As compared to railway and road transport, pipelines produce less pollutants and thus protect the environment. Fourth, pipelines can be laid both on land and sea. This is a flexible advantage. It is better in terms of flexibility as compared to railway transport which cannot be constructed on the sea or in high mountain areas. Fifth, pipelines tend to link isolated areas of production to major refining and manufacturing centres. It is useful in linking some industrial areas which are not connected well with other infrastructure and has low operating costs as compared to air and road transport. .

Disadvantages of pipeline transport

Pipelines are expensive to install and maintain. They, may also lead to pollution when damaged. Pipelines cannot serve on an intermediate location and can only be justified when demand and supply are constant and high. Once they are built, they cannot be adjusted to meet

the demand. Solid goods such as coal cannot be transported with pipelines. Pipelines are also highly and easily targeted during wars or be under sabotage. They are only used for transporting one commodity. They require more financial and infrastructure investments and may explode leading to deaths or loss of properties. In 1998, a gasoline pipeline exploded in Nigeria, killing 250 people. Another accident occurred in 2019 wher 50 people were killed. The blast was caused by a massive oil spill in Nigeria.

Cable transport

Cable transport refers to a mode of transport, which connects two places on hills, or across a valley or river. In the hilly areas, trolleys move on wheels connected to a rope and are used for carrying passengers or goods such as building material and food as shown in Figure 6.8. Items may be moved by pulling, sliding or by driving within the object being moved on cables. An examples of the cable transport are cable cars. Traditionally, cable transport has been used in rural areas to move people or goods from one side of the river to another. In order to install it, one pole is placed on one side of the river and tied to a pole and others are placed on the other side.

Figure: 6.8: *Ropeway/cable transport*

Source: httpsafrica.cgtn.com20190507tanzania-plans-cable-car-for-mount-kilimanjaro

Advantages of cable transport

This mode of transport has several advantages. First, it promotes tourism industry. This is more useful in countries where tourism industry is well developed. In African countries like South Africa, this mode of transport is found in different places where cable cars are used for tourism purposes. In the effort to boost tourism in Tanzania, cable transport has been proposed to be used in Mount Kilimanjaro. Second, the infrastructure for cable ways are not expensive. For example, in rural areas, ropes and poles are key facilities for installing cable transport to allow people cross from one side of the river to another. Materials used for the establishment of this mode of transport are relatively cheaper because they are readily available in the target areas. Third, it has low operating costs in terms of energy. People use local knowledge and skills such as slope to establish the direction of movement. Fourth, it makes less use

of land resources. A very small portion of land can be used for installation or erecting poles and some instruments. This minimises the use of land.

Disadvantages of cable transport

Despite these advantages, this means of transport is affected by various disadvantages. The service may be destructed during bad weather such as wind. Locally made cable cars and ropes may not be reliable. People cannot travel or transport goods using ropes that are open during rainy seasons. It is also appropriate for shorter distances. It cannot be used for longer distances. Ropes cannot be extended to cover several kilometres or miles. Moreover, it is characterised by some risks or accidents in case of electricity blackout. This occurs mostly for cable cars. Moreover, when the ropes are cut, people may die and properties may be destroyed.

Water transport

Water transport refers to the movement of goods and passengers on waterways by using various means like boats, steamers, ships and ferries. Rivers and canals may facilitate the movement of boats and ferries. This type of transport is called inland water transport since the movement of goods and passengers takes place inside the country. When the different means of transport are used to carry goods and passengers on the sea route, it is termed as ocean transport.

Types of water transport

There two major types of water transport. This include, inland water and ocean transport.

Inland water transport

Inland water transport is a means of transport occurring in water bodies such as rivers, canals, and lakes. This type of water transport varies depending on their natural forms and type or means of transport that can be operated on them. These modes of transport are mostly man made. They are highly developed in USA and Canada such as in the Great lakes and St. Lawrence Sea way connecting the region with the Atlantic Ocean. In the developing countries such as Africa, most of inland transport occurs in natural rivers, lakes, and oceans.

River transport

River transport is well developed in the Mississippi (USA), Amazon (South America), Yangtze Kiang (China), Niger river (Africa), and Rufiji river (Tanzania). In Tropics, rivers often play a vital role in the transport of local products and people, where other means of communications such as railways and roads are not available. For example, in countries such as China, India and Egypt river basins have been the nuclei of civilisation and empire building. Besides, rivers have various importance such as; water carriage (Navigation), water supply for agriculture (irrigation) and water supply for daily domestic needs. Rivers offer food in the form of fish, generating Hydro-Electric Power (HEP) and supplying water for domestic and industrial activities such as in paper and pulp industry, most of the rivers face several limitations especially in navigation.

Challenges of river transport

Despite the historical importance of rivers for both trade and economic development, many rivers in their natural conditions are not navigable or cannot be easily used for transportation due to the following reasons;

They flow across empty and inhospitable lands: Many rivers such as the Yenisei (Russia), the fifth largest river in the world with a length of about 5 539 km; Lena (Siberia) which has 1 415km and Mackenzie; the largest river in Canada (4 472 km), flow across empty and inhospitable lands into the frozen Arctic Ocean. Therefore, they are of little economic significance despite their great length and volume. This makes these rivers not useful for transportation purposes.

Flow through sparsely populated areas: Many large rivers which would be capable of promoting trade, flow through sparsely populated areas and in areas that have hostile environment where dangerous wild animals are found. For example, river that traverse in the Amazon forests are not frequently used for transportation. In Tanzania, Ruhuhu and Kilombero rivers are examples of rivers traversing in sparse population.

Dominance of river meanders: Rivers tend to meander over their flood plains, making the distance covered by them much longer than a similar journey by land. Meandering also affects the flow of vessels in water. This makes it difficult to use these rivers for transportation purposes. In Tanzania, river Ruaha is one of the rivers with meandering.

The presence of waterfalls and rapids: Few rivers are navigable throughout their length. Most of them are interrupted by waterfalls, rapids or cataracts. For example, the Nile river has five major cataracts and the Zambezi river, the Orange river, and the Limpopo river fall over the edge of the plateaus. These waterfalls flowing over distance, obstruct the use of rivers for transportation.

Too shallow water and too short: Many rivers are too short in lengths, too shallow or too swift to be useful for navigation, especially those in Japan, Korea, Indonesia, the Philippines, New Zealand, and various rivers in Africa.

The fluctuation of water: Most of rivers are temporal in nature, they have more water during the rainy season and less water in the dry season. Rivers, also fluctuate in volume seasonally, during flood navigation may be too dangerous. This also affects transportation in these rivers.

Silting problems: The largest rivers are usually subjected to silting, especially near their mouths. This leads to swallowing of their channels or constant change in the position of the channels, making navigation difficult.

Canals

Canals are man made waterways that allow boats and ships to pass. The waterways are built primarily for navigation or transportation. These rivers have been modified to improve navigability. Waterfalls and rapids can be removed to improve the use of canals, such as the; Iron Gate Gorge on Danude

rivers (Romania) and the Yangtze kiang Gorge Canals (Asia). Figure 6.9 is a good example of canals.

Figure 6.9: *A Canalised River in China*
Source: httpscommons.wikimedia.orgwikiFileCanalized_River_in_China.jpg

Types of canals

Canals can be grouped into two types. First, canals which connect large water bodies like Suez Canal (160 km) and Panama (65 km), whereby large ship pass through. Second, small canals that are designed to handle light traffic. For example, Dotmund Canal, Ems Canal (Germany), and Albert canal (Belgium) which link Antwerp with the industrial areas in the country. Africa has two water ways; Suez Canal (Egypt) and Jonglei Canal (Southern Sudan), while in North America, the most important waterway is the Great Lakes-St. Lawrence sea way shared by Canada and USA which covers 3 760 km long; connecting Lake Superior and Atlantic Seaboard constructed in 1954. Towns such as Venice, Amsterdam, and Manchester in Europe have many canals.

Advantages of canals transport

The use of canals as a mode of transport offers various advantages. They provide connection and accessibility to different places. For example, Dortmund Ems canal was built in 1889 to move war material and reduce demand on railway network. They are man made and are constructed to meet certain specific needs. Lastly, they contribute to beautification of towns. In this case, they can be used in promoting tourism. In terms of regional distribution, canals are very much distributed to the northern hemisphere and developed countries. These countries because of their economic power and technology, are able to develop and maintain the canals.

Disadvantages of canal transport

Canal use may also have disadvantages. First, canoeing can only be connected in particular constructed canals. They are thus expensive to construct. Second, they are appropriate for shorter distances. This is because longer distances require more extension of the infrastructure. Third, they have less inter modal connectivity. This implies that they cannot be easily connected with other modes of transport such as railways and airways.

Marine transport

Marine transport refers to the movement of goods and passengers with the help of ships through sea or ocean waterways as shown in Figure 6.10. It plays an important role in the development of international trade. Ocean transport has its fixed routes which link almost all the countries of the world. Ocean transport represents the cheapest means of haulage

across barriers that separate producers from consumers some kilometres apart. Oceans and seas form a broad natural waterway which is used by over 50 000 vessels. Major sea routes form an East-West direction while minor sea routes form the North-South direction.

Figure 6.10: *Marine transport*

Types of marine transport

Ocean or Sea transport may be of the following two types;

Coastal shipping: In this type of transport, ships operate between the main coastal cities of a country. This is important in home trade and in carrying passengers within the country.

Overseas shipping: In this transport, ships operate between different countries separated by a sea or ocean. It is mainly used for promotion and development of international trade. It is an economical means of transport for carrying heavy machines and bulky goods. Under marine transport, different types of ships are used in carrying passengers and goods.

Types of ocean or sea vessels

The ships that sail in the high seas (deep seas) vary in their structure and capacity. They usually fall into three groups.

Passenger ships (passenger liners): These liners usually are characterized by floating hotels, comfortable cabins, luxurious dining halls ballrooms, shops, banks, cinemas and swimming pools. These ships may carry up to 2 000 passengers and crew members.

Cargo ships: Cargo ships normally carry between 2 000 - 20 000 tons. They include oil tankers and containers, truck ship, collier ship for coal shipping, grain ship for wheat, banana, ship for banana and refrigerator ship for fruits, meat and dairy products.

Other ships for special tasks: Dredgers ship are useful for deepening the coastal; lighters ship are for loading and offloading; ice breakers for breaking and opening up frozen water; and life boat ships are for recovering wrecked vessels or rescuing sea men. Other ships include research ships, fishing vessels, marine boats, and military vessels.

Advantages of Marine Transport

Marine transport is relatively an economical mode of transport for bulky and heavy goods. The cost of maintaining and constructing routes is very low as most of them uses natural routes. It is a safe mode of transport with relatively few potential accidents, hence it is suitable for transporting fragile goods. Marine transport has a critical role in the promotion and development of international trade. It is not restricted to traffic congestion.

Disadvantages of Marine transport

It is a slow moving mode of transport and therefore, not suitable for transporting perishable goods like tomatoes. Marine transport requires large investment on ships and maintenance. Widespread deaths and loss of properties occur in case of accidents, especially when certain vessels sink in the sea or ocean.

Exercise 6.1

1. Examine the three modes of transport.
2. Justify four factors that hinder transportation on African rivers.
3. Analyse six roles of transport to socio-economic development of Tanzania.
4. Discuss five problems that face transport in Tanzania.
5. Suggest five efforts that need to be made by the government of Tanzania to improve transportation.
6. Identify the advantages and disadvantages of marine transport in Tanzania.

Activity 6.1

Study the Trans African High way map (Figure 6.5) and identify the following;

(a) Capital cities that are located in route 4.

(b) The importance of each capital city listed in part (a)

(c) The longest TAH route.

Activity 6.2

Make a mini tour and observation of the major means of transport used in your street or village and identify the following;

(a) Challenges facing the major means of transport

(b) Four strategies to address the identified challenges

Air transport

Air transport is the movement of goods and people through airplanes and other facilities such as balloons, airship, gliders, and helicopters. For several years, man has attempted to fly in vain. The first successful flight by aeroplane was by the American Wright brothers in 1903. The earliest countries to operate airlines were Britain, France, and the USA. Depending on the region or destination areas, air transport may be classified as domestic or international, carrying passengers and goods between different destinations. Domestic air transport mainly facilitates movement within a country while international transport refers to the movement beyond the country's boarder. Air transport is conducted in fixed air routes, which connect almost all countries or regions. Airlines are also classified on the basis of purpose where there are three types of airlines. These are passenger airline, freight airlines, and military airlines.

Advantages of air transport

It is the fastest mode of transport: Air transport has higher speed than other modes of transport. This makes it the fastest mode of transport. Because of this advantage, travelling to longer distances is possible, crossing borders and continents. Because of its speed, it can reach places of destination in relatively shorter or time. This makes air transport appropriate for perishable goods.

It is useful in rescue and relief during disasters: Air transport is very crucial in the relief of disasters; when land transport is unable to reach the areas affected by disasters such as earthquakes or floods. Emergency relief supply and rescue are necessary for dispatching urgently required services like medical supplies, rescue personnel, clothes, food, express mails, machines and perishable goods

It is not affected by physical barriers: Air transport is not affected by physical barriers such as forests, oceans and seas, high mountains, jungles (dense forest) polar, and desert regions. This mode of transport is able to bypass different obstacles.

It can load many people and goods: Modern aircraft can carry several hundreds of passengers. For example; Jumbo Jet can take between 300-500 passengers. This enables air transport to be capable of transporting many people at a time. As compared to the road transport which takes a limited number of people and freight, air transport can load many people and goods.

It is a symbol of national prestige: Air transport is considered as a symbol of national prestige. Most of the countries prefer to have at least one airline for this reason. The use of air transport advertises the country in foreign destinations. National airplines, therefore, make a country known to the world. For example, Tanzania's airplanes are marked with a symbol of Kilimanjaro mountain which advertises the country's famous and largest mountain in Africa and an image of a giraffe symbolising its rich wildlife resources.

Connects areas that are not accessible by other modes of transport: Air transport facilitates the transportation of goods and passengers to areas which are not accessible by any other means of transportation. Some areas are not connected to other modes of transport such as water because they are land locked, others have no railway infrastructures. These can easily be connected by the air transport.

It provides vital support to the national security and defense: Air transport is appropriate for defense and security during occurrence of wars and other security emergences. It can be used to transport fighter weapons and food to the fighting grounds.

Disadvantages of air transport

Prone to be affected by weather conditions: Air transport is affected by weather conditions such as cloud, rainfall, and snowfall. During these weather conditions, transportation through air is

affected. Passengers are forced to wait until weather conditions come to normal or use other modes of transport. In this case, goods that were to be transported and the passengers are delayed. Services that were to be provided at destinations are also affected.

Expensive in terms of operation and use

Air transport is very expensive in terms of running costs. However, they may vary depending on density of the routes, frequency of services, and potential demand for air services. If there are sufficient passengers to fill regular flights to the required capacity, the operations will be possible. Air transport is also not affordable to low income individuals because flight costs are normally very high. The costs of fuel and service of air terminal facilities, flying and landing charges and fees or salaries for pilots, ground clerks, booking personnel and air hostesses are also high. Due to such costs, only wealthy businessmen, government official, and tourists can afford the expenses. Due to high operation costs, some people and nations also fail to operate air transport.

Limited in carrying capacity: Air transport has limited carrying capacity as compared to other modes of transport. Only passengers, mail, and highly valued goods are flown. It is not suitable for transporting heavy and bulky goods. Moreover, the number of passengers and goods carried on board depends on the size of the craft; smaller crafts usually carry few people and limited amount of goods.

Restrictions in some destinations affect the use of air transportation: The territorial air jurisdiction has seasonal restrictions. International flights are not allowed to cross national jurisdictions unless special permits are given in advance for security purposes. For example, at some point, American planes, were not allowed to fly over Russia, North Korea, and Cuba due to political reasons.

It is not suitable for short distance transport: Air transport is not suitable for short distances. For profitability and efficient use, shorter distances such as less than five kilometres or a few miles are not good for air transport. Flying in short distances may cause airlines to operate at low profit and higher costs.

Accidents: The severity of the impact of accidents in the transport sector depends on the type or mode of transport. The impact of accidents in air transport is huge as compared to road and railways. Survival rates are higher in road transport than air transport. This is a reason for establishing higher safety standards in air transport than other transport modes.

Factors affecting air transport

There are several factors which affect air transport from becoming a common form of transport. First, limited carrying capacity, many goods are either too bulky or of too low value to merit air transport. This limits the types of goods to be transported. Second, international restrictions; there has been too many instances in history where planes were shot down for trespassing over the space of other countries. Some of these events

led to war. For example, America - Russia (Soviet skies) and Pakistan - India 1971 in Bangladesh. Third, inadequate air terminals affect the use of air transport in respect of its size and capacity. Many terminals find themselves inadequately equipped to accommodate some planes. The shortage of runways, fuel supplies, ground staff, ground maintenance and meteorological services also affect the productivity of air transport. Fourth, because air terminals demand a large space, they are usually situated outside the centrers of major towns where access to them is affected by traffic jams. This occurs in most of the developing countries, including Tanzania. Fifth, the cost of air transport is extremely high and it is influenced by fluctuation of fuel prices, regular maintenance costs, provision of air terminal facilities, the cost of flying and landing rights, and staff remuneration. This affects the air fare rates, causing some people to opt for other means of transport.

Transport systems in focal countries

Transport and communication are important sectors of development. Some countries perform very well and have developed their transport sectors. Such countries may provide important lessons and learning context. The knowledge, skills, and policies they used could be useful in designing our own strategies, policies, and plans for improving the transport sector in Tanzania.

Air transport in the USA

Air transport is one of the highly developed means of transport in the USA, assuming a leading position in the world. The USA has three major international airlines which are Delta Air-lines, American Airlines, and United Airlines. There are also eight additional large carriers that mainly operate domestic flights but have some international destinations such as Alaska Airlines, Allegiant Air, Frontier Airlines, Hawaiian Airlines, JetBlue, Southwest Airlines, Spirit Airlines, and Sun Country Airlines. Figure 6.11 shows an example of a USA airline.

The federal government regulates aviation and has exclusive sovereignty over USA airlines. The primary agencies are the Federal Aviation Administration (FAA), the Department of Transportation (DOT), and the Department of Homeland Security (DHS). The USA is served by many large airline corporations but the top (4) include; American airline, Southwest airline, Delta airline and United airlines.

The busiest airports are those of New York, Chicago, Washington D.C, Los Angeles San Fransisco, Atlanta, and Boston. The main Trans-American air routes move from New York, then Westwards to Pittsburgh, Chicago, Denver, and San Fransisco with branch routes to St. Louis, Kansas City, Daltas, Houston, Phoenix and Los Angeles. Southward, the route goes to Washington DC, Atlanta, Miami, and New Orleans. Northwards, the route goes to Canada cities, such as Montreal, Quebec, Toronto, Ottawa, Winnipeg, Edmonton, and Vancouver.

Figure 6.11: *Passenger aircraft in USA*
Source: American_Airlines_Boeing_737-800_N930NN_15637455769-Small

By far, more incidents of air traffic are found in the USA,where both international and internal flights are very common. The USA alone is served by about 9 000 air terminals, over 150 000 registered civil aircrafts and the country accounts for almost half of the world's air passenger traffic, over one-third being air freight. Apart from passenger transport, the main goods moved by air include printed matters, mail, small machinery, electrical parts, films, optical instruments, personal baggage, drugs, liquor, fresh fruits, and vegetables or in other words, goods of small size or high value, which require speedy transport.

Factors for the development of air transport in the USA: There are different factors that have contributed to the development of air transport in the USA. First, advancement of science and technology. The USA has invested heavily in science and technology. Second, the country has invested in space education. Space and aviation studies are widespread in the USA. There are different colleges and Universities offering space education. Third, the presence of aircraft industry in Los Angeles at Seattle. This contributes to manufacturing and maintenance of airplane facilities. Availability of this industry is an opportunity for development of the aircraft sector.

Fourth, investment in research and development in the air transport, the USA has invested highly in research, innovations and development for air transport. Studies on fuel, engines, laws, policies, and market are frequently conducted to inform the industry. Fifth, the presence of scientists with amazing scientific and space technology provides an opportunity for advancement of the sector, the USA invests in science and involves qualified innovators who contribute to the development of the sector. There are also great investments in terms of financial capital. The budget for the air transport in the USA keeps on increasing annually. The USA has set a sufficient budget for the aircraft industry development.

Implementation of different policies and strategies such as open skies policies has also contributed greatly to the growth of the air transport sector. This is a policy which allows the USA to enter into an agreement with different nations and aviation companies to have unlimited fly and trade with the USA in aviation industry. This is also called globalisation or liberalisation of aviations. The USA has also invested in marketing and promotion of its air transport industry. There are competitions in this sector. To perform better, the industry needs to be well advertised. Lastly, the country

facilitates its air cargo through customs and borders. These services are fast and of quality standards. The U.S ranks the 1st out of 124 countries in terms of the air trade facilitation index (ATFI) and 10th out of 135 countries in terms of the e-freight friendliness index (e-FFI) globally. The use of software is advanced in facilitation of cargoes. No delays and obstacles in inspections are experienced. Therefore, these strategies, and investments in the industry offer lessons to the developing countries that can help them improve and mechanise their transport sectors.

Challenges of American air transport

Capital intensive: The airline industry, unlike other sectors like service industries, banking and insurance, requires an enormous assortment of extremely expensive and technological equipment and facilities. Airline industry requires bulk sums of money to operate successfully and generate profit.

Frequent maintenance: The air transportation industry requires frequent maintenance and sufficient capital to restore or maintain the system components and structures of airplanes. Direct maintenance counts for 11% of the total operating cost of an aircraft. As an aircraft gets older, its maintenance cost increases since aging systems and structures require extra maintenance. When profits are not sufficiently realised, companies fail to pay their debts and fail to acquire new aircraft.

Market competition: There are more than 37 countries manufacturing aircraft for market. This has paused a challenge to the American aircraft industry and transport in general. The industry competes for passengers with other transport service providers.

Labour intensive: Air transport demands highly skilled and specialised professionals. Each major airline needs to employ a variety of professionals such as pilots, mechanics, security personnel, cooks, cleaners, accountants, and lawyers. All these need to be highly paid. However, with the advancement in science and technology, machines have started to replace human labour because most of the systems are currently automated.

Risk factors: The common risk factors faced by the companies in the aviation industry include fluctuating fuel prices, the use of foreign currency, and risks associated with interest rates in banks and investments. The company's earnings may be affected by changes in price and availability of aircraft fuel or oil in general. Aircraft operations are also affected by the fluctuation on foreign exchange rates against the US dollar.

Small profit margin: The profitability of air transport has relatively been low due to high operation costs. In low seasons, the profit margin declines. The low profit margin is also caused by seasonality of the industry since the business becomes high during summer months and low during winter months. This causes the revenues generated to escalate and decline significantly over the course of the year.

Contribution of air transport to the USA economy

Aviation in the United States of America is the dominant mode of transporting goods and services. The Americans aviation industry contributes to about 4.7% to 6.5% of the Gross Domestic Product (GDP) on average. Aviation and associated economic activities accumulate about 975.7 billion USD annually and for each dollar delivered to final demand by the aviation industry, an addition of 1.87 billion USD in output is generated. The American aviation industry employs thousands of people and thousand more work in the aviation industries. For example, in 2016, the US aerospace industry directly employed 500 000 workers in scientific and technical jobs across the nation and 700 000 jobs in related fields. The aviation also contributes to the promotion of tourism in USA in terms of trade, hence it facilitates international trade.

Exercise 6.2

1. Analyse five factors that have contributed to the development of Air transport in the USA.
2. Examine the contribution of air transport to the USA Economy.
3. Discuss four factors that affect the development of airways among African countries.
4. Examine the challenges that face air transport in the USA.

Activity 6.3

Visit your school library or use internet sources to read about airspace technology and industry in USA, then;

(a) Summarise six strategies used by the USA in developing its air transport sector

(b) With the assistance of your subject teacher, present your work in class and allow your fellow students to comment on your presentation

Marine transport in Norway

Norway has an internationally leading maritime sector with competitive companies. The Marine sector is of major importance in stimulating creation of employment in the country. The Norwegian maritime industry has its roots in a unique combination of talented seamen, risk taking ship owners, technologically advanced ships and ship's gear, world-leading research, and a tremendous capacity for innovation.

Together with seafood production and offshore energy, Norway's maritime industries form a complete industrial cluster. Norway's population accounted for only one thousand of the global, by 2017, where it had about 5 258 317 people and an area of about 385 252 sq. km. The country has an extensive coast line facing the North Atlantic Ocean and the Baltic Sea, with the highest per capital income in the world. The CIA-GDP list in 2015, estimated that Norway, including

its territories and some regions had the world's largest sovereign wealth fund of about USD 1 trillion, ranking number 7 in the world. Norwegian control, led shipping companies to own about 5% of the global fleet due to the international focus of the maritime sector; a large share of revenues comes from abroad. Figure 6.12 provides an example of cargo ships in Norway.

Figure 6.12: **A cargo ship in Norway**

Source: httpswww.balticshipping.comvesselimo9403621#gallery-2 - Copy

Factors leading to the development of marine transport in Norway

Capital investment: As the country with the highest GDP per capital income, Norway has highly invested in marine activities. The government controls all maritime activities including ship building and fisheries. Norway is the fifth largest ship owning country with about 5% of the world's fleet. It has invested an enormous amount of money on maritime technology with about 15 million tonnes of ships under its flag. Financial strategies are in place to capacitate investors loans with affordable interests and the necessary conditions have already been established.

Insurance strategies and companies: To protect the sector from various negative impacts like accidents, the insurance sector has been launched in the marine transport industry. All vessels and ships are protected by insurance, in case of any accidents, companies are compensated. The guaranteed safety has encouraged investment in the sector.

High levels of science and technology: Norway has invested much on Research and Development (R&D) on maritime technology. New materials have been discovered for building, operating, and using ships, and a shift from wood to iron and from steam to diesel has been enabled. This has been done through promoting research institutes on marine technology and development of the maritime sector. It has also fostered innovation activities that promote sustainable growth and value creation and competitiveness of the maritime industry. Research and Development helps in realising the potential of the maritime industry through synergies with the other marine industries.

Development of ship manufacturing industries: Norway has a substantial marine manufacturing industry consisting of numerous ship yards, ship equipment manufacturers, and ship consultants. It has a surplus of other companies and institutions with maritime oriented activities. It is specialised in production, designing, and manufacturing of marine vessels and equipment. The maritime sector in Norway is probably the best known globally due to the country's large merchant marine fleet.

Stakeholders' involvement in decision making: Norway has a good holistic and unified stakeholders including strategies for research and development and innovation in the maritime industry. The strategies have promoted intensive efforts in conducting basic and applied research, investing in education and competence development and prioritising testing and demonstration of solutions. The strategies ensure that, investment in research development and innovation is highly done in order to strengthen the maritime sector and maintain Norway's status as a leading maritime nation.

Presence of competitive market: Strong interdependencies between actors in various parts of the maritime sector and an emphasis on promotion strategies have contributed to the development of the sector. Its geographical position and interaction with various nations have increased market opportunities and appointments for income generation.

Foreign investment: The presence of major international companies in Norway has in turn made the Norwegian maritime sector better and more complete; creating a highly internationally oriented Norwegian maritime industry with a firm foothold in the global market. Norway has clearly identified its attractiveness in the maritime business internationally and implemented various measures to attract foreign investment on maritime technology and transport in the country. Foreign companies invest billions of dollars in the Norwegian maritime industry.

Innovation and ICT: Innovation and ICT in the maritime industry has a significant help to the sector. Information technology is very important in the maritime industry because the automation and control system enhance safety and efficiency by reducing the number of operations necessary for vessels management, maritime operations, and ship production. The demand for communication and navigation services has increased causing Norway to establish good ICT and decision support system on board, especially in connection with the use of remote controlled and autonomous vessels. The use of information systems such as Geographical Information Systems (GIS), satellites, Global Position Systems (GPS), and mobile phones have equipped fishermen with capacities to monitor wind, waves, and track the location of fish.

Long coastline with well-protected harbours: The long coastline with its many well-protected harbours, renders shipping a livelihood that can be adapted by other coastal countries like Tanzania. This is an opportunity for the performance of the sector. This physical feature has contributed to the development of the sector in Norway. The coastline provides places for storage of equipment and conducting of fishing activities.

Challenges facing marine transport in Norway

Despite the successes recorded in the Norwegian marine sector, various challenges are still existing. These include;

High operational costs: The cost of maritime operations is very high hence more efforts are devised to invest more in the sector. The country needs to explore the potential for developing solutions that are commercially suitable for the national and international markets. New companies must be nurtured to join the industry.

Capital intensive: Investment in the maritime port is very expensive. High capital investment by the government is needed to run the industry. Norway is a high cost country which requires proper operation procedures and efficiency monitoring of its maritime initiatives. The design and production of ships and other maritime vessels and equipment need to be well supervised. Ships and equipment must also be designed to operate in the most cost effective environment-friendly and safe manner.

Market competition: Shipping is one of the international business sectors in the world and competition continues to increase. Since 1975, East Asia has doubled its shares of the global trade fleet to 33% of the vessels. This increased competition in and outside Norway. Over the last 25 years, the volume of maritime transportation has increased rapidly. The world trade fleet vessels above 100gt, increased by 75% to more than 81 400 vessels. Freight capacity increased by 129% to 1 306 million dead weight tons. Due to investments made before and the recession, the fleet increased its freight capacity by 32% in 2017. All these changes kept the Norway's maritime industry at stake.

Environmental problems: Norway is one of the leading countries in marine transportation. It has been contributing to air and water pollution. Smoke from ships and oil tankers cause water pollution. The use of marine areas raises challenges relating to weather, climate, the environment and sustainable resource use. Monitoring and observation above and below the sea is very crucial for all maritime activities in order to secure safe environment and biodiversity. Given the current levels of global greenhouse gas emissions and projection for the future, Norway faces the challenge of high emission trends from maritime industry. Dramatic measures have been suggested by the international community for Norway to reduce energy needs and increase energy efficiency as well as developing new energy carriers and cleaning technology. Norway, however, has the potential for value creation in technologies and methods for reducing pollutant emissions to air and water.

Maritime piracy: Marine transport is very risky due to the emergence of plunders and looters who conquer cargo and carrier ships on board. Safety and security at the sea involves protection of the vessel against both internal and external threats. The new Norwegian technologies are faced with new challenges and risks. Wide spread digitalisation and remote control are accompanied by new types of safety risks like cyber attacks.

Contribution of Norway's maritime to the socio-economic development

Maritime activities in the Arctic and northern areas is on rise, and they

are connected to tourism, fisheries, exploration, and recovery of oil and gas and sea transport. Norwegian maritime actors are engaged in commercial activities in these areas, and the most highly trafficked waters are located within the Norway's jurisdiction. The Norwegian ship building and maritime cluster also benefits the international shipping companies, equipment manufacturers, classification societies, ship designers, brokers, insurances, and financial service providers.

In 2015, the maritime industry in Norway accounted for about 6.7%; with the shipping, maritime equipment supply and ship building sectors representing 1.2% and 0.3% respectively. Norway was the 19th largest ship building economy in the world, accounting for 0.25% of global ship completion in 2014. The maritime industry in Norway employs about 109 600 people (2%) of the Norwegian population, which represent 4% of the whole labour force in 2014. It has 10 400 people working in the ship building sector accounting for 0.4% of the labour force. However, due to the economic recession of 2014, the offshore market has dropped with the drop in oil prices, hence the number of employees in the maritime sector drastically dropped by 10% in 2015. Most of cuts occurred within shipping companies and equipment manufacturers.

Exercise 6.3

1. Explain five advantages of marine transport.
2. Explain the contribution of marine transport to socio-economic development in Norway.
3. Explain six lessons Tanzania can learn from the marine transport in Norway.
4. Describe five challenges that face marine transport in Norway.
5. Explain five efforts being made in solving the problems of marine transport in Norway.
6. Compare and contrast marine transport in Tanzania with that of Norway.

Activity 6.4

1. Visit nearby libraries and use online resources to provide the lessons that Tanzania need to learn from Norway in advancing its marine transport potentials.
2. Study the maritime map of Tanzania and Norway to show their differences and similarities

Railway transport in South Africa

South Africa has an extensive rail network, the 13th longest in the world. The country's rail infrastructure accounts for about 80% of Africa's total rail lines. Its railway connects to Sub-Saharan region networks and neighbouring countries of Namibia, Botswana, Mozambique, Zimbabwe and Swaziland. The rail network connects the ports and the rest of South Africa. Its total length is 23 000 km; of which

15 000 km are heavy lines and 8 200 km are electrified. The Gautrain is the Africa's second high speed trains after the Moroccan. The Gautrain as shown in Figure 6.13 connects Johannesburg, Pretoria and Oliver Tambo International Airport. It transports about 40 000 people every day.

Ownership and operations

The National freight rail network is owned by Transnet and managed, maintained and operated by its Transnet Freight Rail (TFR) division. The national passenger rail network is owned by the Passenger Rail Agency of South Africa (Ply) Ltd (PRASA), while the management and operations are carried by the Metrorail, a division of PRASA.

Numerous sidings (branch lines), connect industrial, commercial, and mining facilities to the national network; some of which are operated by private entities but owned by the Transnet. TFR operates freight trains on certain PRASA lines. Metrorail and Shosholoza Meyl operate in suburban and intercity trains on certain Transnet lines. These operations are regulated in terms of a mutual usage agreement between Transnet and PRASA.

Rail networks in South Africa

The suburban rail networks in the metropolitan areas of the Western Cape, Gauteng and KwaZulu-Natal are well developed and are maintained by regional Metrorail offices. Out of the 468 passenger rail service stations (across 3 180 km of rail lines), 374 are on property owned by PRASA. The suburban rail infrastructure belonging to PRASA includes 175 route kilometres in Western cape, 385 route kilometres in Gauteng and 138 route kilometres in Kwa Zulu-Natal. Metrorail also uses Transnet lines for the suburban rail services. The route kilometres span 235 in Western Cape; 119 in Gauteng; 136 in KwaZulu-Natal; 43 between the Port Elizabeth Station and Uitenhage in Nelson Mandela Bay; and 41 between East London Station and Berlin Buffalo city. The Metrorail operations between Kraaifontein and Malmesbury in the Western Cape and the services in the Eastern Cape include train authorisation by Centralised Traffic Control (CTC) and colour light signalling. PRASA is currently planning a four kilometres line to Cape Town International Airport. A new line from Duffs road has been completed and is already operational.

The Gautrain infrastructure belongs to the Gauteng Provincial Administration. The rail connection comprises two links, a link between Tshwane and Johannesburg and a link between OR Tambo International Airport and Sandston. Apart from the three terminal stations on these two links, seven other stations are linked by approximately 80 kilometres of rail along the route. The standard gauge lines allows for a maximum speed of 160 kilometres per hour. The following extensions are currently being considered under the Gautrain phase 2 developments, Extension 1: New line from Mamelodi in Tshwane to Naledi in South of Johannesburg, Extension 2: From Ortia to Boksburg, and Extension 3: New connection between Randburg and Sandston.

Figure 6.13: *Gautrain in South Africa*

Source: httpswww.engineeringnews.co.zaprint-versiongautrain-rapid-rail-link-south-frica-2015-07-31

The eastern cape provincial administration leases the 281 kilometre Kei Rail Line between Amabele and Mthatha from Transnet. The province upgraded the line and introduced a limited passenger service. Strategic planning includes the offering of freight services that will support development in the Northern province. Transnet's Freight Network (TFR) is well developed and it is connected to the strategic rail lines of landlocked neighbouring countries. The rail gauge (Cape) allows inter-connectivity and mutual usage of rolling stock and traction between neighbouring countries without any infrastructure complications. A record high of 857 000 TEUs for freight transported on rail was achieved in 2013. In 2013/2014, this network transported 83.1 million tons of coal, 18.5 million tons of minerals and chrome, 62.9 million tons of iron and manganese, 21.4 million tons of cement and steel, 11.1 million tons of agriculture products and bulk liquid, along with 13.4 million tons for the automotive and container industries. The Transnet freight network consists of 31 000 track kilometres and 22 500 route kilometres. The main objectives are to provide capacity ahead of demands, ensure sustainability of development plans, integrate port, rail and pipeline planning, align the network with national road and electricity supply planning, provide capacity through operational efficiencies, and ensure proper environmental and social integration.

Factors for the Development of railways in South Africa

Existence of developed mining sector: South Africa's railways are developed to support the growth of the mining

sector and other heavy cargo industries; the large-scale agriculture and forestry industries. The presence of mining plants particularly coal, iron, diamond and gold stimulate railway development in South Africa.

Existence of diverse tourism sites: The growth of tourism industry has fostered the development of the railway lines. The more recently railway, the Gautrain, links all the important cities in South Africa.

Good policy and government's commitment to the sector: Government commitment and good policies have contributed greatly in advancing South Africa's railway development. The railway sector secures financial support from the Government Treasury whereby it is required to only pay interest, with no requirements for redeeming the capital. In addition, some proportions of the capital debt are written off which altogether reduce their financial obligations. The infrastructure and services are supported by the tax payers and road users. The development of international trade has contributed to the development of the railway transport. The railways link the interior with the coast in all parts and with neighbouring countries.

Financial investments: The government has been investing in various ways; including allocation of the budget and resource mobilisation. These have contributed to the growth of railway transport. There is a big portion of investment dedicated to rail. In March 2014, Transnet announced a R50bn (USD4.26bn) contract with four manufacturers to build a 1 064-strong locomotive suite.

Separating the passengers' railways from the Transnet: The operation of passengers railways through the Transnet was done between 2008 and 2009. This contributed to the development of the sector, enhanced specialiSation and reduced the responsibilities.

Renovating and maintenance of the railway infrastructure: Renovating the infrastructure and upgrading of various stations contributed to the development of the railway sector. Users and freights increased.

Reducing transportation costs in railway transport: South Africa aims to reduce the transport of freight and people through road by increasing the performance of the railway sector through improvement of railway facilities and infrastructure. The use of railway transport is regarded to be relatively cheaper as compared to the other modes of transport. Using trains, it is cheaper than air transport (flights).

Contribution of railway transport to socio-economic development in South Africa

The existence of modern railways has improved modal competition. This implies that people do not depend mainly on road transport but also on diverse choices. Prices of other modes of transport are becoming low. Railway transport has facilitated development of mining, agriculture, forestry, and tourism sectors in the country. It has enabled the transportation of raw materials to industrial regions and the finished goods to the market at fairly low costs. Moreover, railway transport has

significantly promoted people is mobility. More than two million people travel by train everyday within South African cities. This is because the country's rail system is significantly more developed. The rail system also plays a great role in promoting international trade and relations. The South Africa's rail line connects to neighbouring countries such as Namibia, Botswana, Mozambique, Zimbabwe, and Swaziland. It also promotes employment creation where by various people are employed in the rail sector as workers and service providers such as food vendors and security guards. This is an important contribution to the economy.

Challenges of railway transport in South Africa

Although there has been significant investment in the railway sector and infrastructure, there are various challenges that affect the sector. The majority of South Africa's national network is older than 25 years which exceeds the design life, even if they are being maintained. Oldness of the network affects transportation of goods and freights occasionally. The network is already experiencing major operational, institutional, and technical constraints. Oldness of infrastructure increases operation and maintenance costs. Rolling stock failure, security, and power outages (including power outages as a result of cable theft) are major issues that need regular attention. South Africa is also facing a challenge of embezzlement of incomes earned from the railway transport. It encounters a challenge of lack of integrity for some employees.

Measures taken to address these challenges

The top priority of the government of South Africa is to improve the country's railway network by initiating projects that aim at increasing freight volumes and market shares of container traffic. Significant investment is being made in rolling stocks as in signalling equipment and infrastructure. Since the announcement of the Transnet's Market Demand Strategy (MDS) by the former South African president, Jacob Zuma in February 2012, the expansion of the country's railways, ports, and pipelines has been implemented by relevant institutions, including Transnet Railway Engineers (TRE). This is a division of Transnet that provides maintenance, repair, and upgrading of the railway infrastructure.

Exercise 6.4

1. Briefly, explain the history of railway transport in South Africa.
2. Explain five challenges of railway transport in South Africa.
3. Describe five measures taken by the government of South Africa to modernise her railway transport industry.
4. What lessons can Tanzania learn from the railway transport system of South Africa?
5. Explain the socio-economic contribution of the railway transport sector to the economy of South Africa.

Activity: 6.5

Draw a map of Tanzania and that of South Africa and on each map;

(a) Show the towns and cities that are linked with railway transport networks

(b) Illustrate the connection between the railway and other modes of transport in Tanzania and South Africa.

(c) Find Railway network map of South Africa and Tanzania.

(d) Study the network map found.

(e) Compare the railway network you have studied in the map of Tanzania and South Africa.

Road transport in Japan

Japan has the most advanced road network and well established infrastructure. Prior to 1950, Japan had enough road networks but these were still underdeveloped and of low quality. The demands for extending the road network was driven by population growth. In order to address the situation, two measures were taken. First, there was introduction of fuel tax in 1954 as a source of funds to improve roads using a 5-year rolling plan. Second, a toll system on motorways to build a national wide motorway network was introduced in 1952. The Japanese Road Act classifies "Roads" into several categories being; national highways, national express ways, prefectural roads, and municipal roads. There are also various roads such as private roads, farm roads, and forest roads.

Administration of roads

In terms of administration, some roads are administered by the government and the road bureau which work closely with the agencies such as Japan Highway Public Corporation (JHPC). There are privately administered roads where companies are responsible for construction, operation, and toll-collection. These include, Metropolitan Expressway Company Limited, Hanshin Expressway Company Limited, NEXCO East, NEXCO central, NEXCO west, Honshu-shikoku bridge, and Expressway Company Limited. These are companies that are allowed to construct, operate, and charge taxes on the use of some roads and bridges. This suggests that the road sector in Japan has been privatised.

Cost sharing system and business scheme in the road sector

In terms of cost sharing, Japan has established different strategies for cost sharing in the construction, improvement, and operation. There are some roads that are financially managed by the government and others by the local government authorities. To extend the network of road transport in Japan, the government collaborates with the private sector in the construction, repair, and maintenance of roads. It provides loans at a very low interest rate or non-interest at all. The loans are being paid for not more than 45 years using the income earned.

Laws and regulations related to road usage:

The country has established various regulations and standards that foster continued quality of roads. Such regulations include requesting for a permit to transport goods that are overweight and specialisation in the use of some roads; where some roads are used for specific purposes. Because of these development, Japan is highly developed in terms of road network and quality. These networks are also connected to trains. Railway is the main mode of transport, followed closely by the use of bicycles and lastly, automobiles as shown in Figure 6.14. According to the Japan statistical yearbook 2015, the country had approximately 1 215 000 km of paved roads. A single network of high speed with limited road toll connect the major cities of Honshu, Shikoku, and Kyushu. Hokkaido has a separate network and Okinawa Island has a highway of this type.

Figure 6.14: Road connectivity in Japan

Source: https___blogs-images.forbes.com_geoffreymorrison_files_2016_10_Gate-Tower-Building-8-of-11

Factors for the development of road transport in Japan

Establishment of toll companies: The toll system is the one of unique aspect of the motorways construction in Japan. Toll is a charge payable to use a bridge or road. Construction of motorways is financed through the government loans which is repaid in the pre-determined period of not more than 45 years (in principle), using the toll revenues. In Japan, the national subsidy only represents about 3% of the annual expenditure on motorways. The construction costs of the first motorways completed 30 years ago, has already been repaid through tolls.

The Role played by local government: In Japan, some large cities like Tokyo have their own network motorways. The users of these urban motorways must pay toll determined in the same way as that of the inter-city network. These toll payments are fairly high and sometimes they play a role as congestion tax.

Expansion of motorways users by 1980s: Road passengers and freight transport expanded considerably in the 1980s due to an increase in private ownership of motor vehicles along with the development of high quality and extent of the national roads. Automobile increase had contributed much to the development of road networks in Japan. Bus companies including the JR Bus Company which operates long distance bus services on the national expanding express way had greater contribution to this development. The cargo sector which has grown rapidly has also contributed to the growth of

road transport in Japan. The cargo sector grew rapidly in 1980's, recording 274.2 billion tonne-kilometres in 1990's. The freight being handled by motor vehicles, mainly trucks, in 1990, was about 6 billion tonnes, accounting for 90% of domestic freight tonnage and about 50% of tonne per kilometre.

Government intervention: The Ministry of Land, Infrastructure, Transport and Tourism with other government agencies are responsible for administering and developing the Japanese highways. Beginning in the 1950s, Japan had classified these highways into classes for easy management, financial investment, maintenance and development. They are classified into class 1 and class 2 highways, Route number 1to 58 were classified as class 1 highways while Route number 507 was classified as class 2 highway.

Capital investment: The introduction of fuel tax in 1954, as a source of funds to improve roads, using a 5-years plan and the establishment of a toll system had contributed much on the development of road transport in Japan. The revenue collected from the two sources, together with the government subsidies and loans in the transport sector had contributed to the enormous flow of capital into road transport networks.

Good transport policies: The Japanese road transport is governed by good road policies which guide and provide guidelines for the transport sector. The government through its agencies provides the ring-roads (tolls) in urban infrastructure. Plans have been made to reduce CO_2 emission as well as to provide a better environment for road users. Currently, about 70% of the major harbours and airports are accessible from express way interchanges and have been recently improved. The transportation modes and all station squares are being improved to ensure that there is smooth transit of pedestrians, vehicle, bicycles, and public transportation.

Investment in information and communication technology (ICT): Japan has invested highly in Information and Communication Technology (ICT) for road transport. Geographical Information Systems are developed in the management of traffic congestion and accidents. Software such as Intelligent Transport Systems (ITS), Electronic Toll Collection System (ETS), and Vehicle Information Communication System (VICS) have been useful in the collection and provision of real time information.

Challenges facing road transport in Japan

Road traffic congestion: Despite the advancement of road transport sector in Japan, congestion is still experienced, especially in large cities. This congestion contributes to air pollution and depletion of the ozone layer, global warming, and climate change. Although a lot of measures have been put in place to improve the Japanese roads, the overall quality of its roads is still low compared to those in the Western Europe. In the case of Tokyo, the largest drawback of its road system is the fact that loop motorways are not completed by 100%. This forces vehicles originating outside the city and going to

places outside Tokyo to pass through the city centre causing congestions due to the shortage of by-passes.

Road traffic accidents: Although road fatalities have been decreasing due to some strict laws and regulations such as introduction of regulations to prohibit driving while drunk, in 2004 alone, the country experienced more than 7 358 deaths on Japanese roads. In fact, the road traffic congestions and accidents are so high and they cause potential problems in the urban areas. However, new strategies have contributed to the current decline in fatalities over the past quarter of a century to about 4 113 in 2014, which implies 32 deaths per 1 000 000 inhabitants.

Declining interest by public to use road transport: Users of road transport have been declining year after year. The decline of road transport also is ascribed to the increased urbanisation and improved railway transport systems. This competition attracts more people to use the rail transport. However, motorisation in Japan is still high with at least 472 cars per 1 000 inhabitants in 2013 which remains one of the leading automotive industry worldwide.

Contribution of road transport to the national economy

Japan is the world's second largest automobile producer (behind China) and the automobile industry is one of the country's major industrial sector. In 2014, the domestic motor vehicle production reached 9.77 million units (an addition of 1.5% of that of 2013), of which, 8.28 million were cars. The country is also the largest exporter of motor vehicles, just ahead of Germany and France. This massive production is supported by well-developed express ways and highways. The sector has contributed to the economy of the country by creating employment opportunities. About 5.5 million people are working in road services and automobile industry. The sector also contributed to 22.4% of the national GDP in 2014. This suggests that it has great contribution to the Japan's economy.

Exercise: 6.5

1. Examine five factors that have contributed to the development of road transport in Japan.
2. Evaluate five contribution of the automobile industry to the economy of Japan.
3. Identify five challenges that face road transport in Japan.
4. Explain three strategies used by Japan to address road transport challenges.
5. Show how Japan has been able to manage and administer complex road networks.

Activity: 6.6

In a group, use the web or internet based resources to draw the road transport network in Japan. Present your work in the class and invite.

Road transport in Tanzania

Road transport is the dominant mode of transport in Tanzania, where the majority

of people use this means of transport. Tanzania has the road network length of about 85 517 km. This includes 28 892 kms of Trunk and Regional roads managed by TANROADS and the urban, district, and feeder roads with a total of 56 625 km, managed by the Local Government Authorities (LGAs). There are five types of roads in Tanzania. These are classified as trunk roads, regional roads, district roads, feeder roads, and urban roads. There are also some unclassified roads such as those managed by Tanzania National Parks Authority (TANAPA), Tanzania Forest service (TFS), mining companies, and village authorities with unknown total length. There are also several network corridors in Tanzania namely;

Northern corridor: The northern corridor starts from Segera (junction) towards Tanga and Mombasa on one direction and towards Moshi on the other. It passes major cities and towns such as Mombo, Same, Moshi, and Arusha and finally reaches Namanga (border to Kenya).The same road branches from Himo, Mwanga, Rombo to Tarakea.

Central corridor: The central corridor starts from Dar es Salaam, passing through towns such as Chalinze and Morogoro. It advances to the city of Dodoma, Manyoni, Singida, Nzega, Kahama, Nyakanazi, Rusumo and ends to the border between Tanzania and Rwanda. It covers a total length of about 1 190 km.

Dar es Salaam corridor (TAZARA Corridor): The TAZARA corridor starts from Dar es Salaam and ends at Tunduma border. Major cities and towns that this corridor passes are Chalinze, Morogoro, Mikumi, Iringa, Mafinga, Makambako, Mbeya, and finally reaching Tunduma, which is the border to Zambia. It covers about 1 100 km.

Mtwara corridor: The Mtwara Corridor starts from the port of Mtwara and passes several major towns such as Mingoyo, Masasi, Tunduru, and Songea and reaches Mbamba Bay, which is facing Lake Nyasa. The total length of the corridor is 825 km.

Coastal corridor: The coastal corridor starts from Mtwara and passes Mingoyo, Lindi and Dar es Salaam. It starts again from Chalinze and reaches Segera, which is the junction to Tanga. The distance from Mingoyo to Dar es Salaam is 479 km and includes the section from Chalinze to Segera which is about 174 km and the road is two-way, two-lane road with the carriage width of around 6 -7 m.

Namanga Corridor: The Namanga corridor handles the north-south traffic; starting from Arusha, Babati, Karema, Dodoma and reaches Iringa, to join the TAZARA corridor. This is an important north-south connection in the middle of the country between the Tanga corridor and TAZARA corridor via Dodoma, which is the capital city of the country. The total length of the corridor is 689 km.

Sumbawanga Corridor: The Sumbawanga corridor starts from Tunduma and connects to the TAZARA corridor. It passes Sumbawanga, Mpanda and Kasulu. The road continues to Kalebezo via Kibondo and Nyakanazi which is the junction to

the central corridor, and reaches Kibondo. The Sumbawanga Corridor branches off at Kasulu about 80 km from Kigoma port, towards the border of Burundi. As it enters Burundi, passes Mabando, Nyanza-Lac and finally reaches Bujunbura.

Out of these corridors, there are other corridors which include; Singida-Babati road, Kasulu-Nyakanazi road, Mbeya-Nzega road and New Bagamoyo port access.

Planning and management of road transport in Tanzania

The Ministry of Works, Transport, and Communication is responsible for establishing policies, laws, programmes and national projects. It is in custody with higher levels management and monitoring. The ministry also has established a Road Fund that provides a stable base for funding of road construction and maintenance. TANROADS was also established to manage regional and trunk roads. Today, Tanzania Rural and Urban Roads Agency (TARURA) has also been established to manage rural and urban roads. It obtains its funds from various sources. The government's general budget, fees raised from transit charges and overloading penalties, are among the main sources of income to these institutions. The regulation of the road transport sector is under the responsibility of the Land Transport Regulatory Authority (LATRA). The main role of LATRA is to regulate the land transport sector in the country.

Types of roads in Tanzania

In Tanzania, roads are classified according to the materials used in the construction such as gravel roads, murrum roads, concrete roads, tarmac roads, and earth roads. For many past decades, road transport was dominated by earth roads, and gravels in rural areas, and urban areas were dominated by gravels and tarmac. Today, infrastructure is improving whereby better roads are being constructed, and tarmac roads dominate a bigger segment of the country. Modern and tarmac roads have connected all regions in Tanzania and this development is scaled down to the §district and minor towns. An example of ongoing improvement in Tanzania is presented in Figure 6.15.

Figure 6.15: *Road transport in Dar es Salaam*

The connection of TAH to road networks in Tanzania

In terms of its connection to Trans-African Highway (TAH), Tanzania (Figure 6.16) is found in route 4 which traverses from Cairo-Egypt to Cape town-South Africa. The route in Tanzania traverses in Tunduma-Dodoma-Namanga along the main part of the central corridor that

links Dar es Salaam to Rwanda, Burundi, Uganda and the DRC. This is part of one of the four corridors that form the backborne of Tanzania's infrastructure. Other corridors start from Dar es Salaam west to Dodoma and northwest to Mwanza on Lake Victoria; from Dar es Salaam west and south west to Mbeya and Zambia; from Dar es Salaam North to the mountainous area around Kilimanjaro, Tanga and Arusha; and from Mwanza to Bukoba and Kigoma on lake Tanganyika. Another major route is from Dar es Salaam South to Lindi and Mtwara which has 6 route connectivity.

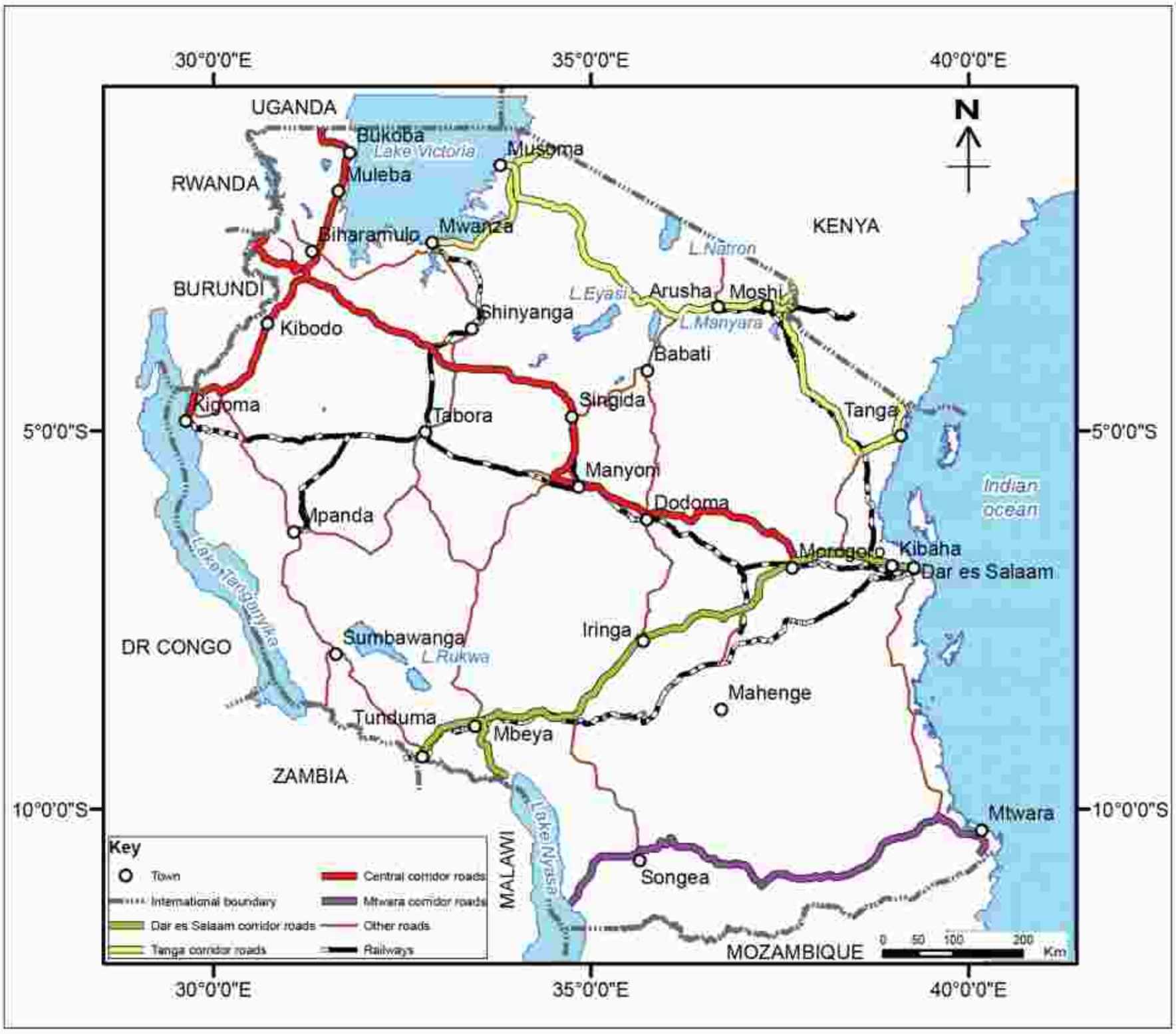


Figure 6.16: *Road network corridors in Tanzania*

Challenges facing road transport sector in Tanzania

Despite the improvements and successes, the following are some of challenges, facing the road transport sector in Tanzania:

Local construction companies are limited in managerial skills and financial capacity. They have also poor equipment, management skills and tendering skills. This makes the country depend on foreign companies. Weak institutional capacity of the implementing agencies for road maintanance such as TANROADS and

TARURA is another challenge that face the road sector in Tanzania. The agency has inadequate skilled staff to meet the demand.

Inadequate financial resources affect this sector. The Road Fund has been established to finance road projects in the country. This has been affecting the government efforts to expand the current network and reach rural areas. The shortage of financial and other resources is also aggravated by poor planning and design of trunk and regional roads. Plans are poorly designed, they have been contributing to the low quality of roads in the country. Roads constructed have been of poor standard and on routine maintenance.

Another challenge relates to the increasing number of vehicles which increases the possibility of accidents and traffic jams. Irresponsible behaviours among road users is also another challenge. Over speeding and overloading are common ill-driving behaviours, especially in towns and cities. For example, currently, about 25% of tracks are exceeding the axle load limit. Others commit road offences such as wrong parking, irresponsible crossing, and reckless driving. Growing traffic congestion, especially in urban areas, is a great challenge to the road transport in Tanzania. This is aggravated by poor infrastructure, shortage of alternative routes, and lack of clear management of traffic users. In Tanzania, these challenges occur mostly in cities of Dar es Salaam, Arusha, and Mbeya.

Measures to be taken to address the challenges

Various strategies may be adopted in addressing the challenges of road transport in Tanzania. Such strategies include, capacity building for employees, agencies, institutions, and staff in the sector, particularly, those who are involved in construction, repair, and maintenance of infrastructure. Strengthening institutions such as TANROADS, the Road Fund, and TARURA to be able to construct and maintain road networks may yield promising results. However there is also a need to take action against misuse and embezzlement of resources in this sector. Efforts should also be made to improve road safety strategies and create awareness to all stakeholders.

Investing on basic and applied research as a source of reliable data and feedback in the road development may be useful. Research data may also help in producing quality construction materials and effective network systems should be prioritized. Improvement of coordination in the sector is encouraged. Coordination between institutions under local government authorities and those in the central government is required. It is important for the central government to coordinate properly the activities of TANROADS and TARURA.

Strategies for road improvement and frequent maintenance of drainage systems that affect many roads should be emphasised. Rainfall causes road destruction, especially in rural areas. This has been resulting into frequent damage

of roads. There is a need to establish some strategies for routine maintenance of roads. The problem of traffic jams and congestion may be addressed by discouraging private cars, increasing parking fees, and raising awareness on car sharing for people living in the same households. This is very important for urban areas where the demand for transport is high. Encouraging people to walk and use cycling may reduce traffic congestions as well as greenhouse emissions. Other strategies include construction of fly overs, construction of new interchanges, and introducing Bus Rapid Transit (BRT) system or trans. Tanzania has already invested in some of the proposed measures especially in the city of Dar es Salaam which is the business capital.

Exercise 6.6

1. Use school library and internet sources to study the available information on the land transport in Tanzania. Then, do the following;
   (a) Document the contribution of road transport to the socio-economic development of Tanzania
   (b) Identify the challenges that face the road transport sector
2. Examine six challenges of road transport in Tanzania and propose measures which may be taken by the government in addressing them
3. Differentiate between features of Rapid Transit System and Bus Rapid Transit.

Activity 6.7

Draw a map of Tanzania to show its main corridors of road networks.

(a) From the map you have drawn, identify the two most connected corridors and two socio-economic advantages of this level of connection.

(b) Identify two least connected corridors mentioned and three ways to enhance their connection to other corridors.

Activity 6.8

From your school environment, visit a nearby village or street and do the followings.

(a) Identify the dominant mode of transport in the village

(b) Identify transport related challenges that face the village you have visited and ways they can be resolved.

Railway transport in Tanzania

Tanzania has two railway systems of different gauges that were constructed at different times and for different purposes.

The railway systems have a total length of 3 682 kms, of which 2 707 kms is operated by Reli Asset Holding Company (RAHCO) and Tanzania Railway Limited (TRL) and 975 km by Tanzania-Zambia Railway Authority (TAZARA). In the 1980s, railway transport was the most reliable means of surface transport for both people and goods. The rail subsector transports about 70% of goods for both domestic and transit to and from the neighbouring landlocked countries.

From mid of 1980, the government of Tanzania embarked on an ambitious program to upgrade and construct new roads in the country. However, this program did not go hand in hand with the development of the railway system. This resulted in the decline of railway infrastructure and rolling stock performance. Lack of investment on rolling stock resulted into the decline of locomotive availability and reliability as well as decline in the availability of wagon and coach fleet.

Railway network under RAHCO

The first and oldest system is the Reli/ Railway Asset Holding Company (RAHCO), which was constructed in colonial time. The rail system was constructed to a 1 metre gauge 1 000mm standard. The rail line comprises the central corridor between the port of Dar es Salaam in the east, linking central and western areas of the country and terminating at Kigoma on Lake Tanganyika in the west. The rail system branches from Tabora to Mwanza port on Lake Victoria. A second East-West line from the port of Tanga to Moshi was built between 1899 and 1911 and was subsequently extended to Arusha and linked to the Kenya and Uganda rail system at Voi in 1925. Branch lines were constructed to Mpanda in 1949 and to Kidatu in 1965. Another line was constructed in 1965 linking the central corridor line with the Tanga line from Ruvu northward to Korogwe; branching to Tanga port on the Indian Ocean. Another line runs from Manyoni to Singida. The total system length is 2 707km.

From 1977-2007, it was being operated by the Tanzania Railways Corporation (TRC). After the concession agreement in 2007, it started operating as TRL, which was jointly owned by RITES of India with 51% shares and the government of Tanzania with 49% shares, with the RITES having management responsibility. Simultaneously, with the award of the joint operating partnership, the Government created RAHCO, a government company that owned the assets of the railways. However, this concession experienced major difficulties and could not improve the services, causing the railway system to suffer from further depletion of its services. RITES board members resigned on 22nd July, 2011 and TRL operations were handed over to the Local Interim Management Team on the 26th, July 2011. At present, the Government has invested in the sector by improving railway system in the country and putting in place new management structure to attract effectiveness. Recently, the Tanzania Railway Cooperation renovated the old railway, the northern route, which extends from Dar es salaam to Arusha. Investments have also been made to build

the standard gauge and to make the sector more operational and more effective.

Railway network under TAZARA

TAZARA is the railway in East Africa that link the port of Dar es salaam in East Tanzania with the town of Kapiri Mposhi in Zambias central province. The Tanzania-Zambia Railway Authority (TAZARA) is the second railway system constructed from 1970 to 1975; financed by the People's Republic of China. It was constructed to the cape gauge standard of 1 067 mm, similar to the rail systems of Southern Africa which links with Zambia. The line is 1 860 km in length, of which 975 km are in Tanzania and 885 km in Zambia. An interface was constructed between this railways and the TRL system at Kidatu to facilitate freight traffic interchange between the two rail systems. Commercial operation commenced in July 1976. The railway is jointly owned by the Government of Tanzania and Zambia and is managed by TAZARA. The performance of TAZARA over the past 30 years has been below expectations because it was undercapitalised from the beginning. The railway owes its survival to the continued technical support provided by the Government of China. Since 1976, a total of 14 protocols have been signed between the three governments. These protocols have provided required locomotives, rolling stock, rail infrastructure, and technical assistance to maintain railway operations.

However, Tanzania and Kenya have embarked on upgrading their railways to the standard gauge level. The Mombasa-Nairobi standard gauge railway is already in operation. Construction of a standard gauge railway from Dar es Salaam to Mwanza and Isaka is underway.

Challenges of railway transport in Tanzania

Generally, the railway has been less efficient in the past recent years. The infrastructure is dilapidated and services rendered are below standard due to many reasons; including old age and outdated railway infrastructure. Poor rolling stock such as locomotives and wagons, have also contributed to the low operational performance. TRC operational performance has been constrained mainly by infrastructural problems. There is also a growing competition from the road network in the North Corridor from Mombasa to Kampala. Several incidences of destruction of the railway infrastructure by floods have worsened the situation and made the railway system inefficient. The system is facing a decrease in traffic which is both caused by internal and external factors such as; Poor performance of the economies and political instability of the landlocked countries and change in traffic patterns. Competition from other regional corridors such as the North corridor, Maputo corridor and those in South Africa hamper railway operations in Tanzania. In summary, the railway is affected by age of tracks and track components, insufficient ballast, worn rails and subsidence of track beds. Other problems include lack of spare parts for signalling, operational safety to meet international standards, inadequate maintenance or renovation programmes for rolling stock and fixed installation, shortage of equipment,

poor maintenance of vehicles and poor availability, of rolling stock. Due to insufficient funding, infrastructure are not maintained and upgraded on regular basis. Lack of uniform procedures and old fashioned management, compounded with overstaffing and bureaucratic management which does not consider commercial viability and marketing, have also contributed to the poor performance of the TAZARA.

Immediate solution

On the TRC part, the main focus should be on renovation of the system. This will require some investment in the track, locomotive power and rolling stock as well as working capital to improve train services in the central corridor. Trains must be able to meet business plan requirements and provide effective and predictable services. Improved operating environment will demonstrate whether or not the demand for freight train services will return to the railways operations improvement. A revival plan has demonstrated that train services can be successfully operated and that there is a demand for such services. There should be additional longer term support. This also requires competitive rail services to be introduced. On the TAZARA system, there should be an agreement between the responsible governments on how to restructure the management and railway business operations. It is likely that they could be operated more efficiently with improved capitalisation, business skills, and provision of better quality services to customers. A business plan to unleash the potential of the railway should be a priority action.

Future development plans

In the next 50 years, the government through RAHCO is aiming at: First, upgrading 982 km of railway line from Dar es Salaam to Isaka from the existing 'metre gauge' to 'standard gauge' and to construct about 620 km of new railway line from Isaka-Kigali (Rwanda/Keza/ Gitega to Musongati Burundi). Second, there are plans to upgrade 1 094 km of railway line from Isaka - Mwanza, Tabora, Kigoma and arterial lines (Kidatu and Taveta, Singida and Mpanda) from 'metre gauge' to 'standard gauge'. Third, construction of 12 km of a railway line from Kange to the proposed part at Mwambani in Tanga and about 25 km of a railway line from Kidomole (link line) to the proposed port at Mbegani (Bagamoyo). Forth, construction of about 664 km of a new standard gauge railway line from Arusha to Musoma. The rail will include two branch lines to the already operational fertilizer plant at Minjingu and the other to proposed Soda ash plant at Wosiwosi near Lake Natron. Fifth, upgrading of 435 km from Tanga-Arusha railway line so as to be compatible with the proposed Arusha-Musoma railway line. Sixth, construction of Mtwara-Songea to Mbambabay railway line with spurs to Liganga and Mchuchuma mineral areas. Last, in collaboration with stakeholders, the government aims at undertaking the construction of fibre optic connecting all stations with modern communication technology. This technology is for improving train control system and station control system.

Exercise 6.7

1. Explain five challenges that face railway transport in Tanzania.
2. Examine the significance of railway transport in Tanzania.
3. Describe five current initiatives taken by the government of Tanzania to improve railway transport.
4. Explain the key characteristics of railway transport in Tanzania
5. Suggest at least five future plans to improve transport and communication in Tanzania.

Activity 6.9

In a group;

Sketch a map of Tanzania to show the existing railway network and the proposed railway network.

Activity 6.10

Draw a map of Tanzania to show the following;

(a) Railway network projects under implementation

(b) Future proposed Railway network

Water transport in Tanzania

Tanzania maritime transport is characterised by the presence of major sea ports, which are Dar es Salaam, Tanga and Mtwara, and inland ports on lake Victoria such as Mwanza, Bukoba, Musoma and Kemondo. Kigoma port in lake Tanganyika, and Itungi and Mbamba bay ports in lake Nyasa.These ports are managed and operated by the Tanzania Ports Authority (TPA). TPA's network of ports serve a large market including the whole of the country's hinterland and the neighbouring landlocked countries of Burundi, Rwanda, DRC Congo, Uganda, Zambia and Malawi. The main sea ports, especially Dar es Salaam, provide vital access to world markets for this region. The ports on Lake Victoria, Tanganyika, and Nyasa are also important for local and international trade, although they face competition from road transport in many locations.

The performance of the ports are regularly monitored by both TPA and development partners. The inefficiencies in port operations are a major cause of total delays to cargoes. Ship turnaround time has improved significantly over the years due to the removal of the concession which allowed the Tanzania International Container Terminal Services (TICTS) to increase the number of berths as a strategy for speeding up handling container services. The Government through the TPA has implemented a number of development projects which were designed to modernise the ports by providing additional cargo handling equipment and improve and upgrade infrastructural facilities as shown in Figure 6.17.

Figure 6.17: *Waterway transport in Tanzania*

Challenges of water transport in Tanzania

TPA faces several challenges which affect its efficiency in deriving the required services. These challenges include; low capacity of handling containers at the Dar es Salaam port (250 000 TEUs) compared to an average demand of 300 000 TEUs per annum. There is also limited space to accommodate more containers in the port and inability of the Dar es Salaam port entrance channel to handle ships of PANAMAX size. Other challenges include inadequate transport services from other modes such as railways and road system, and inadequate human resources to adequately manage the maritime transport.

Prospects

Operational efficiency is a major requirement for both Tanzania and its neighbouring countries that rely on the Dar es Salaam port for trade access. The port needs efficiency in its operations and should allow subsectors to provide additional capacity. Port expansion to Mbegani-Bagamoyo will provide additional capacity in the longer term. Development of Mtwara Port to meet the off-shore and on-shore needs and improvement of the Tanga port will greatly reduce the burden in the Dar es salaam port and attract efficiency. Lastly, the development of Lake Ports to meet local trade requirements is another future target for improving the performance of ports.

Exercise 6.8

1. Examine five challenges that face water transport in Tanzania
2. Using four points, explain the extent to which water transport is linked to other modes of transport in Tanzania.
3. Explain the significance of water transport in Tanzania.
4. What are the prospects for operational efficiency of waterways in Tanzania?
5. Examine future development plans of water transport in Tanzania.

Activity 6.11

In a group, do the following;

(a) Sketch a map of Tanzania to locate the lakes and oceans/ports

(b) With your subject teacher, study TPA website and other sources of information to comment on the administration and operation of ports in Tanzania

Air transport in Tanzania

Airports in Tanzania play an important role in the country's transport infrastructure. Tanzania has a total of 29 airports, 27 from the mainland and 2 from Zanzibar. The majority of these airports are privately owned by mining companies and tour operators. However, the number can exceed 29 if all airfields will be counted. Companies that operate domestic air transport in Tanzania include Air Tanzania as shown in Figure 6.18. Precision Air, Air Excel, Air Zara International, As Salaam Air, Auric Air, Coastal Aviation, Flight link, Regional Air, Safari plus, Fly Safari Air Link Ltd, Tropical Air, and ZanAir.

Figure 6.18: *Air transport in Tanzania*
Source: https://dailynews.co.tz/news/2021-09-09613a1c8b9b253.aspx

There are four International Airports namely, Julius Nyerere, Kilimanjaro, Zanzibar, and Mwanza. Out of the four International Airports, two of them, Julius Nyerere and Mwanza International Airport are managed by Tanzania Airport Authority (TAA). Zanzibar International Airport is being managed by the Revolutionary Government of Zanzibar. Kilimanjaro International Airport (KIA) was leased to the private operator since 1998.

Despite its long history in the air transport sector in handling operations of few international airlines and the national airlines, Air Tanzania has not played a significant role in the development of the Air transport industry. The demand for air travel services has remained relatively low and has not developed as fast as in many other countries. High operating costs and limited competition has resulted in high fare structure when compared to other parts of the world. This has also affected the growth of the industry. The sub-sector is highly dependent on capital investment from the government for undertaking airport improvements.

Challenges of air transport in Tanzania

Air transport sector faces numerous challenges that prevent it from achieving its desired goals. This has been mainly due to the following reasons; deficiencies in the provision of international air navigation services, and inadequate airport facilities. Equipment for provision of services in the terminals and aircrafts are inadequate. There is also low human resources capacity to adequately manage and operate the air transport industry. Staff trained in this sector are very few. Sometimes, some maintenance are undertaken by foreign experts. Other challenges include inadequate airport planning and management skills, and weaknesses in the current Civil Aviation Master Plan (CAMP) which contribute to poor performance of the sector. This plan has not accommodated the current changes and it is not comprehensive in nature. There is a weak management system in the sector caused by shortage

of experts in the air industry. Shortage of pilots is another challenge affecting the sector. Trained aircraft engineers are inadequate and other supporting staff are also not enough.

The systems for data management relating to air craft industry are ineffective. Although currently there are efforts to modernise the sector with new technologies, low capital has always affected the sector. Air transport industry requires investment in terminal facilities, security systems and safety equipment.

Current and future measures for improving the sector

The government through the Tanzania Airports Authority (TAA) and Tanzania Civil Aviation Authority (TCAA) implements a number of development projects which are designed to modernise airports. The goal has been to help air transport improve and expand infrastructure in order to foster both domestic and international trade and enhance social economic activities.

Increasing the number of air operators is one of the pending strategies. Various motivational and regulatory strategies are being taken to increase the number of aircraft operators. The number of registered air operators in the country has been increasing year after year. The aviation industry has been steadily growing with an average growth rate of 9% annually. This growth rate is greater than the average of 4% growth rate of the global aviation industry. Revenue collection from airport operations has been increasing. This is another area where the government aspires to improve further. Strategies relating to the collection and proper utilisation of relevant revenues are being implemented. The use of electronic machines and some software is being practiced and the airports infrastructure services and conditions are currently being improved. However, various issues need to be worked on in the future to improve the sector. These include; additional investment in the sub-sector to improve airports across the country and placing emphasis on safety needs. Investments are also needed in the area of safety standards. Making reforms in the management of the subsector by moving towards an autonomous authority will promote better business operations. Moreover, development of new terminals is important to improve the delivery of services. There is also a need to purchase new aircrafts in order to increase service provision capacity. Establishment of various training in colleges and universities that deal with air craft industry will ensure availability of technical capacity and modernise the industry.

Exercise 6.9

1. Describe the role of air transport to the economic development of Tanzania.
2. Explain five challenges that face air transport in Tanzania.
3. Discuss five strategies that the government of Tanzania needs in order to address the challenges of air transport.

4. With four points, explain the future prospects of the airline industry in Tanzania.

Activity 6.12

Draw a map of Tanzania and show the key airports under TAA.

Pipeline transport in Tanzania

Pipeline transport is becoming a potential option to Tanzania. Currently, there are three pipelines in the country; two of which are related to oil and one that transports water from Lake Victoria to Shinyanga, covering a total of 383 kilometres. TAZAMA pipeline is the longest. It transports crude oil from Dar es Salaam port to an oil refinery at Ndola in Zambia over a distance of 1 710 km. There is also a pipeline that transports gas. The Mtwara-Dar es Salaam pipeline transports natural gas from Madimba village in Mtwara to Dar es Salaam via Somanga; where it is joined by the Songosongo Pipeline. The total distance covered by the pipeline is 542 km. The oil and gas industry is currently expanding at a fast pace as new sources of supplies are being discovered.

The development of additional pipelines is in the planning stage, and further developments which are in line with new oil and gas discoveries, are underway. The new investments in pipeline facilities will largely involve the private sector and will be coordinated by the Ministry of Energy and Minerals. In addition, the Hoima to Tanga pipeline is under negotiation and is planned to transport crude oil from Hoima in Uganda to Tanga port in Tanzania; a distance of about 1 145 km. The pipeline is planned to pass through Masaka in Uganda, Bukoba, Shinyanga, Singida, Dodoma and finally to Chongoleani village near the Tanga port in Tanga region.

In urban areas, different water supply authorities manage the supply of clean water to the institutions and homes through pipelines. They are also responsible for managing sewage systems. These includes Dar es Salaam Water Supply and Sanitation Authority (DAWASA) in Dar es Salaam, Dodoma Urban Water Supply and Sewage Authority (DUWASA) in Dodoma, and Morogoro Water Supply and Sanitation Authority (MORUWASA) in Morogoro, to mention few.

Challenges of pipeline transport

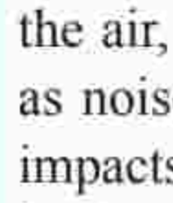
Pipeline transport is affected by political factors especially where it involves several countries. For example, a project between Tanzania and Uganda has been delayed occasionally due to the need to discuss interests of these countries. At lower level, especially housing level where pipelines are used to transport water, the great challenge is also on maintenance and care of the pipelines. Pipelines are destroyed causing loss of water, oil, and gas. Their investment requires huge capital especially when the pipeline is for gas or oil. This has been affecting the need to use this mode of transport.

Current and future measures to improve pipelines transport

Due to the challenge of destruction of pipelines, community involvement is important. The use of local community in reporting incidences of pipes destructed or sabotaged need to be emphasised. For gas transportation, financial mobilisation is important. Pipeline funds need to be re-invested to ensure that the need is extended to other areas. Frequent meetings also need to be convened with partner countries in case the project involves several countries. These meetings should be discussing the strategies to improve the network and experienced challenges. There is also a need to engage the private sector in the construction and running of pipelines. Since the government is unable to implement these projects alone, it has to engage the private sector and local communities.

Exercise 6.10

1. Explain five advantages of pipeline transport.
2. Examine six challenges that face pipeline transport in Tanzania.
3. Explain three measures that should be taken in order to improve the use of pipeline transport in Tanzania.
4. Using four points, show the socio-economic significance of pipelines to the local communities.
5. Assess the contribution of pipeline transport to the socio-economic development of Tanzania.
6. Discuss three efforts that are currently being taken by Tanzania to improve pipeline transport.



Activity 6.13

In a group, organise a quick debate with your classmates and discuss the safety of pipeline transport in the developing countries.

Impacts of transport on the environment

The direct environmental impacts caused by transport are emissions released into the air, oil discharge into water as well as noise. Transport also incurs indirect impacts such as spatial requirements and landscape fragmentation.

Air pollution: Air pollution is the presence of substances in the atmosphere that are harmful to the health of humans and other living things, or cause damage to the environment. Air pollution may be in a form of gases, particulates or biological molecules. The main cause of transport emissions is the use of combustion engines. The quantity of emissions is related directly to the amount of fuel used as well as the consumption of energy. The transport emissions include carbon dioxide, nitrogen oxides, particulate matters, volatile organic compounds, and sulphur dioxide. Freight and passenger transport is the second largest greenhouse gas-emitting sector after energy. Pollutants result from all means of transport such as ships, aircraft, trains, and motor vehicles. The energy

needed in ships is produced mainly by diesel engine. The combustion process of the diesel engines produces compounds that, in larger amount, have undesirable environmental impacts. The most common in these compounds are carbon dioxide (CO_2), Nitrogen oxide (NO), and Sulphur dioxide (SO_2). Nitrogen oxides cause *eutrophication* in water bodies while sulphur dioxide cause *acidification*. Diesel locomotives contribute to air and noise pollution. Direct emissions from railway transport are lower when electrically powered locomotives are used. Railway companies can choose various sources of electricity, which exert an indirect impact of emission. In most areas, road transport is most important, and in many cases, it is the only mode of transport that is available.

Water pollution: This is the contamination of water bodies, in such a manner that it negatively affects the quality of water. Pollution turns water into black or grey colour. Black and grey waters are formed on every ship. Black water is mostly the sewage from toilets. It can cause oxygen depletion and affect life in water. However, waste water from vessels become a particular concern when considering large passenger vessels or ferries. Grey waters originate from showers and wash basins. Oil waste water, ballast water, Cargo Hold washing water and solid wastes from ship also lead to the sea water pollution.

Ozone damage: Emissions of nitrogen oxides (NO) and volatile organic compounds (VOC) and primarily certain types of hydrocarbons (HCs), interact under the influence of sunlight to create ozone and other oxidants in the air. Addition of chlorofluorocarbons (CFCs) in the atmosphere reduce or destroy the Ozone layer. Negative effects include an increase in certain types of skin cancer, eye cataracts, and immune deficiency disorders

Climate change: The main causes of climate change are greenhouse gases (GHGs). Carbon dioxide (CO_2) is the most common greenhouse gas responsible for the global warming caused by human beings. Transportation is largely dependent on fossil fuels, which are the main sources of CO_2. Another major GHG is black carbon (BC), which forms as a result of the incomplete combustion of fossil fuels, biofuels, and biomass. One of the primary sources of black carbon is diesel engine emissions. Black carbon causes global warming because it is strongly light-absorbing and warms the air. When deposited in snow and ice, BC reduces albedo and accelerates the melting of these areas. Climate change exerts consequences on economic and natural systems in addition to the human health, other consequences are rising temperature, shifting rainfall patterns, melting glacier and snow, rising global mean sea level, and most frequent intense extreme weather events.

The anticipated health effects of climate change are indirect by air pollution, notably carbon dioxide (CO_2) and direct effects such as death related to heat waves, floods, and droughts. Other effects are disturbances to complex physical and ecological processes such as changes in the amount and quality of water and in

the patterns of infectious diseases. Some of the health effects are immediate while others take a few years to occur.

Acidification: The burning of fossil fuels is responsible for generating the greatest amount of acidifying agents. The nitrogen compounds emitted into air contribute to problems of nitrogen saturated soil and the eutrophication of the seas.

Acidification is mainly caused by emission of nitrogen oxides (NO) and sulphur dioxides (SO_2) which cause the fall-out of acidifying agents. A considerable amount of emissions, mainly related to nitrogen oxide can be traced to transport. The forest areas, lakes and water sources are at risk of being extensively damaged. In some areas, acidification has penetrated to a depth of several metres and affected the ground water. Acidification cause the soil resources such as nutrients to decrease in quality and certain toxic materials to be released while the availability of certain other agents such as selenium is impaired. Acidified air pollutants also accelerate the degradation of many materials. Significant impact from acidified air pollutants has been weathering of valuable buildings, especially cultural monuments such as older sandstone and limestone buildings. Cultural monuments such as rune stone and rock carvings also display evidences of serious damage as a result of acidifying air pollutants.

Noise pollution: Noise from transport activities disturb people possibly more than any other forms of environmental pollution. It can affect people in both physiological and psychological ways in their daily life. Road, rail, and air traffic noise exert the greatest impact. The effects of noise are enhanced when they interact with other environmental causes of stress such as air pollution and chemicals. The main environmental impact of electrified rail is noise, which is caused by rail-wheel movement.

Land use changes: The construction of infrastructure for road transport and railway transport requires clearance of land. Transport projects may claim agricultural land, forest areas, and even land which harbours endemic species. The road or railway itself with the traffic, operations, and maintenance constitutes a continuous environmental impact on the landscape. The force of this environmental impact depends on the design of the infrastructure facility and the type of traffic. The area of arable land and forest is not only reduced through expansion of the road or railway sites, but also by the disturbance zones that are created on either side.

Transport accidents: Road accidents account for the most significant share of all transport accidents, in terms both of the number of deaths and of injuries per kilometre travelled followed by rail. The number of deaths by air or sea travel is much lower but the fatality rate is higher. Victims of traffic accidents involve the drivers, passengers, and occupants of motor vehicles, pedestrians, and cyclists.

Measures to address transport related environmental impact

The environmental impacts that are

caused by transport can be addressed by taking various initiatives including reduction of the Greenhouse Gases (GHG) emission such as CO_2 and black carbon (BC) emissions. The BC emissions can be reduced by retrofitting diesel vehicles with filters to capture pollutants. Another option could be by switching fuel uses from diesel to natural gas in buses and other types of vehicles.

Moreover, the directives regarding environmental pollution should be adhered to avoid, prevent or reduce the harmful effects of noise pollution. Noise pollution from transport may also be addressed through installing sound filters and pollution reduction systems.

The use of Liquefied Natural Gas (LNG) as an alternative fuel should be promoted. LNG is a natural gas which has been converted into liquid form. Its use reduces nitrogen oxides by 89% and carbon dioxides by 20-30% as compared to a regular diesel engine. LNG does not produce sulphur oxide emissions or particles at all. The use of LNG is possible in engines planned for that purpose, but it is also possible to modify a regular diesel engine to enable it to use the natural gas as fuel.

There is a need to ensure that all passenger vessels treat their sewage. In general, a vessel is allowed to discharge sewage, if it has an approved sewage treatment plant in operation, or if it is discharging disinfected sewage into the sea at a distance of more than 5 km from the nearest shore and untreated sewage at a distance of more than 20 km from land. There is also a need to ensure availability and effective use of equipment for separating oil from water in larger ships. After the separating process, the water can be discharged into the sea. The water discharged into the sea may contain a maximum of 15 parts per million of oil. Oily waste water produced on board is collected in a separate tank which can be emptied in ports under the no-special fee system. It is mandatory for new oil tankers to have double hulls. There should also be established criteria and measures for the control of pollution by noxious liquid substances carried in bulk.

Managing ship borne (solid) waste by sorting specific types of waste produced in specific parts of the vessel or as a result of the overall operation of the ship may be useful. The most common waste types are bio waste, packing materials, glass, paper ,and metal wastes. Hazardous wastes such as fluorescent lamps, batteries, paints, and mainly solvents generated as a result of maintenance operations should be well managed.

Ships are allowed to discharge cargo and hold washing water containing non-harmful cargo residues on route for not less than 20 km from the nearest land, if there are no adequate reception facilities in port. Adequate port reception facilities would be essential so that ships could be washed between offloads and loading points. Harmful cargo residues need to be left at the reception point.

Ships need energy in the ports while loading and offloading. To enable emission restriction requirements, some ports provide onshore power supply for

vessels. Electricity generated onshore replaces energy from the vessels' auxiliary engine. The use of onshore electricity improves air quality in ports. It reduces not only sulphur but other emissions into air. It also reduces ship generated noise in ports which are often located in sites that are densely populated.

Efficiency is an important means to reduce both transportation costs and the environmental impacts of road transportation. For example, energy efficiency can be improved by operating vehicles that are regularly serviced and are in good condition. There is also a need to train drivers on the use of energy-efficient driving techniques. Generally, economic development exerts great impact in energy efficiency and CO_2 emissions. This needs to be very much emphasised in the developing countries.

Exercise 6.11

1. Identify the most common greenhouse gases and discuss their environmental impact.
2. Describe the impact of transport on the environment.
3. With not less than four points, explain different forms of pollution taking place due to transportation.
4. Explain six measures that need to be taken in order to resolve negative impacts of transport on environment.
5. As an expert in geography, what are the benefits that are likely to be gained after pollution is well controlled.

Activity 6.14

1. Use library and internet materials to document the contribution of transport on air pollution in urban and rural areas.
2. With assistance of the subject teacher find and read the national transport policy of Tanzania and do the following;
   (a) Explain the ways the policy addresses environmental issues.
   (b) Identify measures for reducing impact of transport on the environment.
3. Use the library search and web resources to propose measures of resolving the environmental impacts that result from transport activities.

Communication

Communication involves the conveying of information between parts, places, and individuals. The transport agents and routes are important aspects of communication. Communication entails the way information is generated and conveyed from place to place or between one individual and another. The means of communication include verbal, non-verbal, written, listening, and visual. Verbal communication can be face to face, phone, Skype, and zoom. Non-verbal include facial expression, posture, eye contact, and hand communication. Written communication include letter, email, a memo, a report, a Face book post,

a tweet, and a contract. Active listening is important for understanding each other. Visual communication is through photographs, television, face book, video and image. Instagram is an image-only platform and advertisers use imagery to sell products and ideas. The conveyed information may be on a particular area, or region (spatial information). For example, information about resources, population, socio-economic activities, opportunities and challenges, are important to be understood better. The emphasis in this section is placed on the use of Information Communication Technologies (ICTs) for communicating spatial information.

The use of ICTs has evolved rapidly in recent years. Information Communication Technologies (ICTs) refers to systems for producing, storing, sending, and retrieving digital information. The information is in terms of text, sound and images, both still and moving. Information and communication technologies, particularly the internet, transform all human activities in urban and rural areas.

Different means of communication

In the past communication was a simple, one-way flow of information from sender to receiver; usually through the mass media and mail. The norms of the modernisation paradigm emphasised transferring technology and norms globally. With time different means of communicating oral, spatial, and time information emerged. They range from maps, photographs, ICT, Mass media, Newspaper, telephones, mobile phones, and internet.

Geographical maps

Maps are means of communicating geographical information. They communicate information about population, resources, land uses, crops, agriculture, and institutions. These can be used by different communities for planning and development.

Photographs

Photos display different geographical phenomena and information that can be communicated to various communities. Information that depict agricultural types, crops, and infrastructure such as roads and railways can be communicated through photos.

ICT

Development of transport and communication play a very important role in the diffusion of ideas. News can be sent more quickly and people can easily communicate across different parts of the world. Different computer technologies are developed to communicate spatial information. Two common technologies for spatial information are the Geographical Positioning System (GPS) and the Geographical Information Systems (GIS). GPS is an important tool for recording and communicating spatial information. It is a navigation system that uses satellites, a receiver, and algorithms to capture location, velocity and time data for air, sea, and land travel. It is also attached in modern cars and smart mobile phones. Figure 6.19 offers an example of a GPS.

Figure 6.19: *Geographical Positioning System (GPS)*

Source: https://www.amazon.in/Garmin-010-00970-00-GPS-etrex10/dp/B00542NV32

Mass media

Mass media devices such as Radio, TV and news papers are important means of communicating geographical information. Information on tourism, climate, crop prices, pests and diseases may be communicated through TVs and radios. Figure 6.20.

Figure 6.20: *TV and Radio accessories*

Telephone, mobile phones, and internet

Telephone communication is the transmission of speech over a distance either by electric signals propagated through a conductor or by radio signals. It permits communication between people separated by distance. It provides for exchange of information in all areas of human endeavour including industry, agriculture, government, science, culture, public heath, and personal services. Telephone network are for general use in local area, rural, urban, long distance, and international.

Growing technologies in mobile phones (Figure 6.21) and Satellites transmit information globally and are useful in communicating information on agriculture, inputs, climate, war, and markets. Today, farmers in rural areas may access information on availability of markets in towns through internet. They also contact middlemen and buyers in towns through phones. Therefore, the use of ICT has simplified information access at different levels.

Figure 6.21: *Smart phone*

Contribution of ICTs to economic development

ICTs facilitate the flow of information and make communication easier to the general public. It is a system that links

a wider range of actors such as farmers, businessmen, consumers, middlemen and institutions. ICTs help people to understand products that are designed, produced, distributed, and operated. The use of ICT has increased labour productivity in various parts of the country and in neighbouring countries.

ICTs facilitate intelligent production process, intelligent design and operations of products, re-organisation of supply chains and business organisation. It also facilitates intelligent logistics and distribution.

The use of ICTs stimulate new demand of products when consumers are satisfied by the services provided. They also create high-paying jobs which comprise a significant share of GDP. ICTs drive productivity and GDP growth, help in building high-growth companies, and create new sectors and ways of doing business. Communication is also a key source of competitive advantage and it drives innovation as well as knowledge and skills exchange.

Communication also helps farmers to get information about where to purchase agricultural inputs and how to use them. The use of ICTs complements the conventional agricultural extension methods in various places.

ICTs contribute immensely to the national GDP and facilitate improvement of market competitiveness of products and services in the country. The use of ICTs can impact positively on government and other sectors of the economy. In turn, the ICTs can effectively assist international economic integration, improve the living standards, narrow the digital and divide and improve biodiversity utilisation, conservation and management.

African countries need to: establish an environment that encourages networking of goods and services providers. Countries should also promote e-commerce and trade, encourage adoption of programs for goods and services providers, promote the use of internet access in development aspects, establish e-government library, promote e-education and on-line services, strengthen network security, and build and develop a society which uses ICTs.

Challenges of ICTs

Despite the fact that African countries are now aware of the benefits derived from the adoption and use of ICTs, there are many serious challenges which must be addressed. These are: inadequate communication and power infrastructure, shortage of ICTs facilities and ICTs skills, inadequate institutional arrangements, limited financial resources, inadequate public private partnership, limited data management capacity, inadequate horizontal and vertical communication, and inadequate bandwidth nationally and on the Gate way. Some of those challenges can be addressed through smart public private partnerships.

Exercise 6.12

1. Discuss the contribution of information technologies (ICTs) to socio-economic development.
2. Explain six challenges of using ICTs for socio-economic development in Tanzania.

3. Examine the efforts taken by the government of Tanzania to improve communication systems.

4. (a) Describe the five means of communication.

   (b) Show how each means of communication can facilitate development

Activity 6.15

Use the experience from your surrounding to map the opportunities from ICTs in developing your career goals.

Impacts of communication development on environment

Environmental impacts of communication are either positive or negative. The positive impacts include ICT's potential to improve the efficiency of energy-using processes and equipment, facilitate the use of internet, and facilitate the use of ICT in climate change monitoring and modelling. Other positive direct impacts include the use of ICT for the environmental protection purposes such as electronic monitoring of toxic emissions, remote sensing, electronic controls, and improved 'transparency' on the use of environmental services.

Direct negative environmental effects stem from the generation of electronic wastes such as abandoned computers, screens, network cables, and a wide range of gargets displaced as solid waste. Improper disposal of e-waste may lead to the environmental pollution. Some impacts of ICT on the environment can be easily demonstrated by using scientific knowledge and other available information.

Communication in Tanzania

Communication in Tanzania is guided by the National ICT Policy of 2016 (NICTP 2016). The NICTP 2016 provides a national framework for using ICTs in achieving the national development goals and transform Tanzania into a knowledge-based society. Over the past decade, ICTs created a broad range of economic and social activities such as job creation, enhancement productivity and efficiency, hence it contributed to the GDP growth the Tanzania Communications Regulatory Authority (TCRA) regulates the communication sector, which includes telecommunication, broadcasting, and postal services.

The contribution of the communication sector in the socio-economic development

The communication sector has contributed to socio-economic development of the country through job creation, reduction of poverty, and improvement of quality of life. For instance, people are employed in companies such as Vodacom, Tigo, Airtel, Zantel, and Halotel in various operational departments.

ICTs development in Tanzania has contributed to bringing social economic development to the majority of the citizens. For example, the introduction of mobile money platforms in Tanzania

has created a new banking avenue for people who previously did not have access to banking services to freely under bank transactions and tap income generation opportunities. The introduction of mobile money services such as M-Pesa, Tigo-Pesa, Airtel Money, Halotel Money and Easy Pesa, has enabled people to save, send, and spend money including, payment of bills for utilities through mobile platforms. According to TCRA, there were 21.6 million mobile money accounts by December 2017, with transactions reaching 50 trillion in the year 2016-2017. The mobile money sector has been expanding rapidly due to easy access to different mobile money services and direct transaction with other business avenues. The banks offer banking services through mobile platforms which allow their customers to use mobile phones for banking transactions.

ICTs have also contributed to the improvement of both public and private sector service delivery. These include healthcare, formal and informal education, and various e-services.

ICTs development in Tanzania has promoted agricultural production as farmers can access information about agricultural input and market opportunities. This is provided through media services. Manufacturers can easily access information on the availability of raw materials and markets. Weather and climate information that affect various economic undertakings is easily accessed through the use of ICTs.

Challenges of communication sector in Tanzania

Despite the contribution of communication sector to the socio-economic development, there are some challenges, including data access rights, protection of privacy, computer fraud, cybercrime, security, privacy of e-transactions, and limited production of local software for local market. A lot of online content is detrimental by the national culture and poses threats to children welfare. There is improper use of ICTs which affects productivity, cyber security, network management, and costs that need special intervention. Electricity inefficiency, inadequacy skill and in competence of human resources and infrastructure vandalism infringe communication services.

Exercise 6.13

1. Describe various means of communication that are available in your local area.
2. Discuss six negative impacts of ICTs to the environment.
3. Analyse five challenges of using ICTs.
4. Describe six measures that may be taken to address the negative impacts of ICTs on the environment.
5. Explain the contribution of the communication sector to socio-economic development in Tanzania.
6. Examine the role of ICT in creating youth employment opportunities.

Activity 6.16

1. Use the web based resources to compare and contrast the types of communication from any two countries of East Africa.
2. Read different online materials and use observation in your school or neighbourhood to identify five challenges of electronic-wastes on the environment and health.

Activity 6.17

3. With the help of the subject teacher, conduct a study tour in a nearby town to;
   (a) Identify varieties of devices used to facilitate communication
   (b) Compare devices found in the town with those available in your home village

Revision questions

1. Describe different modes of transport available in Tanzania
2. Assess the current efforts made by the government of Tanzania in modernising its railway transport industry.
3. With examples from Tanzania, describe different ways of using ICTs in communicating geographical information.
4. Explain the contribution of transport sector to socio-economic development in Tanzania
5. Discuss six challenges that affect the growth of transport and communication sectors in Tanzania.
6. Explain various measures of addressing the challenges of communication in Tanzania.
7. Explain major challenges that face the communication sector in Tanzania
8. Describe various road transport corridors in Tanzania.
9. Explain various challenges of the Trans-African High way.
10. Examine the advantages and disadvantages of railway transport.
11. Discuss the advantages and disadvantages of air transport.
12. Discuss the advantages and disadvantages of water transport.
13. Examine the role of transport and communication in Africa.
14. (a) Describe three advantages of railway and road transport
    (b) State two disadvantages of using pipelines as a means of transporting oil.

15. Give four advantages of air transport over road transport.

16. Explain four measures which should be taken to improve water transport in Africa.

17. Give four reasons why the government of Tanzania is investing on pipeline transport.

18. Explain the efforts that the Tanzania government has taken to improve air transport.

19. State four ways in which communication contributes to the economic development in Tanzania.

20. Give three reasons why road transport is used more than air transport in East Africa.

21. Discuss ICTs future as they relate to youth employability and entrepreneurship.

Glossary

Air pollution — the contamination of air due to increase in concentration of trace substances, such as carbon monoxide, sulfur dioxide, nitrogen oxides, hydrocarbons, and solid particulates beyond the level that is safe for the living things.

A resource — a substance in the environment that is useful to people, economically and technologically feasible to access, and socially acceptable to use.

Agro-ecological zone — a land resource mapping unit, defined in terms of climate, landforms and soils, and/or land cover, and having a specific range of potentials and constraints for land use.

Alternative tourism — leisure recreation industry set out to be consistent with natural, social and community values opposed to conventional mass tourism.

Biological control — an environmentally sound and effective means of reducing or mitigating pests and pest effects through the use of natural enemies.

Biological diversity — is the variability among living organisms from all sources including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part.

Bulging — a process leading to a rounded swelling which distorts an otherwise flat surface.

Chlorofluorocarbons (CFC) — chemicals containing atoms of carbon, chloride, and flourine.

Cottage industry — manufacturing based in homes rather than in factories, most common prior to the industrial revolution.

Commodification — the act or fact of turning something into an item that can be bought and sold.

Community — a group of people living in the same place or having a particular characteristic in common.

Convention tourism — the kind of tourism which is connected to tracking of conventions or exhibitions.

Chernozem soil are humus-rich grassland soils used extensively for growing cereals or for raising livestock.

Climate change a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer.

Demography a study of human populations including population size, distribution, composition, structure and other related characteristics.

Developed countries countries at a relatively advanced stage of development, sometimes called more developed countries.

Developing Countries countries at a relative early stage of development, sometimes called less developed countries.

Development gap the difference in the level of development between developed and developing countries.

Ecology the study of the relationships between living organisms, including humans, and their physical environment.

Ecotourism/ecological tourism leisure recreation industry and responsible travel to natural areas that conserves the environment and improves the well-being of local people.

Energy the amount of work a system is capable of performing.

Environmentally friendly tourism leisure recreation industry and responsible travel to natural areas that conserves the environment, sustains the well-being of local people and involves interpretation and education.

Environmental Impact Assessment (EIA) a process of evaluating the likely environmental impacts of a proposed project or development, taking into account inter-related socio-economic, cultural, and human-health impacts, both beneficial and adverse.

Eutrophication the process by which a body of water becomes enriched in dissolved nutrients (such as phosphates) that stimulates the growth of aquatic plant life usually resulting in the depletion of

dissolved oxygen.

Fishing — the capture of fish and other seafoods living in the waters. It embraces all aspects of man's pursuit of the aquatic animals in the seas and inland water all over the world.

Fungicides — pesticides that kill or prevent the growth of fungi and their spores

Fossil fuel — an energy source formed from the residue of plants and animals buried millions of years ago.

Gautrain — standard gauge train operating between Johannesburg and Pretoria

Geographical Information System (GIS) — a software tool for collecting and processing geographical data.

Gluten flour — wheat flour made with the bran and starch removed, it is low in carbs and very high in protein.

Gross Domestic Product (GDP) — the total market value of the goods and services produced by a country's economy during a specified period of time.

Highway — major or main roads that connect towns, cities, and countries.

Hospitality — friendly and generous reception and entertainment of guests, visitors or strangers.

Hydrocarbons — are chemical compounds composed of hydrogen and carbon.

Industrial inertia — a tendency for an industry to maintain its activity in a place where the reasons for its introduction are no longer existing.

Insecticides — chemicals used to control insects by killing them or preventing them from engaging in undesirable or destructive behaviours.

In-situ — situated in the original or natural place.

Intermodal linkage — process where one mode of transport can be connected or linked to another in terms of uses.

koBo collect — software found in a smart mobile phone downloaded through play store used for primary data collection.

Malting — the process of converting grains into malt for use in brewing.

Marginal land — a land that has little or no agricultural or industrial value.

Mechanisation — the application of tools, implements and machinery in agricultural activities.

Mine reclamation — the process of restoring land that has been mined to a natural or economically usable state.

Modal competition — a process whereby different modes of transport compete in the transfer of goods and people.

Natural resource — any component of the natural environment with value and utility to human such as soil, water, rangeland, forest, wildlife, and minerals.

ODK collect — software found in a smart mobile phone downloaded through play store, used in survey based data collection.

One-child policy — a policy adopted by China to control population that emphasised on only one child per woman of child bearing (delivering) capacity.

Open Skies Policy — an international policy that liberalizes or lessens rules and regulations of use, operations of air transport. It is mostly used by USA.

Overburden — cover of soil and rock that is extracted to obtain access to the minerals at open-pit mines.

Ozone — a gas that absorbs ultraviolet solar radiation and is found in the stratosphere, a zone 15 to 50 kilometres (9 to 30 miles) above earth's surface.

Paddock — an enclosed area used especially for pasturing.

Pesticides — chemical compounds that are used to kill pests.

Population dynamics — the study of changes in population densities i.e. changes in the number of individuals in specific area.

Population Geography — a branch of geography focusing on the study about population characteristics such as distribution, change, growth and composition.

Prairies	an extensive open area of flat grassland, especially in the central plains of North America.
Rehabilitation	the procedure used to remedy the impacts caused by the mining activities on the environment.
Responsive ecotourism	tries to both minimise and reverse the negative effects of travel, such as overcrowding, the destruction of heritage and the environment, globalization, detrimental social change and many others.
Site factors	location factors related to the costs of production inside a plant, such as land, labour and capital.
Situation factors	location factors related to the transportation of materials into and from a factory.
Sustainable development	a system of progress or advancement that meets the basic needs of all people without compromising the ability of future generations to meet their own life sustaining needs.
Sustainable tourism	leisure recreation and responsible travel industry which meets the needs of the present and host communities while protecting and enhancing the needs of the future generation.
Symbiosis	an interaction between two different organisms living in close physical association, typically to the advantage of both.
Tailings	the waste materials left after the target mineral is extracted from ore.
Two-child policy	policy that encourages bearing two children.
Typology	a system of dividing/classfying things into different categories.
Toll	a charge payable to use a bridge or a road.
Viticulture	the science, study and production of grapes.
Waste rock	material that includes mineralisation with low grade considered not interesting to be mined at a profit.

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