STATISTICS

Statistics is a scientific method of presenting, analyzing and interpreting data.

There are several statistical methods that can be used for representing and interpreting data or information. These include;

1. Graphs

(a) Line graphs

These are divided into

— Simple line graph

— Comparative / group/ multiple line graph

— Compound / cumulative / divided line graph

— Divergence line graph

(b) Bar graphs

These include;

— Simple bar graph

— Comparative/ group / multiple bar graph.

— Divergence bar graph.

— Compound/ cumulative/ divided bar graph

— Simple population pyramid/ age-sex graph

(c) Population pyramids

These include;

— Simple population pyramids

— Compound/ combined/ super imposed pyramid

(d) Circular/ clock graph/ polar graph

These include ;

-Simple circular graphs

-compound circular graphs

(e) Simple bar and curve graph/combined line and bar graph

2. Statistical charts and diagrams

These include;

(a) Pie-charts/Divided circles

These include;

— Simple divided circle / pie chart

— Comparative divided circles/ comparative pie charts
— Proportional divided circles
— Proportional divided semi-circles

(b) Proportional circles

(c) Proportional squares (simple and super imposed)

(d) Proportional cubes

(e) Proportional spheres

(f) Divided rectangles

These include
— Simple divided rectangle
— Compound divided rectangle

(g) Wind roses

— Simple wind rose
— Compound wind rose

(h) Repeated symbol map (non-quantitative repeated symbols and quantitative repeated symbols) / pictograph

3. Statistical maps

These include

1. Dot map/ distribution map
2. Shading map/ choropleth map/ population density map
3. Flow maps and flow charts/ flow diagrams
4. Isoline map/ isopleths map/ isometric map

SIMPLE LINE GRAPH

Is basically drawn from two variables

Procedure of construction

1. Choose an appropriate scale based on the variables .use the independent variables for the horizontal scale and dependent variable for the vertical scale.
2. Draw the x and y axis and indicate the statistical values as on the table.
3. Plot the values of dependent variables against the independent valuables using dots
4. Join the dots with a line or curve to obtain a line or curve graph.

5. Write a key to show the meaning of the symbols used.
6. Write the title of the graph
7. Indicate the scale used.
8. Write the variables on the horizontal and vertical axis.

Advantages of a simple line graph

1. Easy to compare the trend / fluctuations over a given period
2. Gives good visual impression
3. Easy to interpret
4. Does not involve much tedious calculations.
5. Simple/ easy to draw
6. Portrays/represents multiple data

Disadvantages of a simple line graph

1. Consumes a lot of time
2. Difficult to assess the actual values from the graph due to rounding off figures.
3. Difficult to get a convenient vertical scale in case of very small and very large figures.

TRIAL QUESTIONS

1. **Study the table below showing Tea production in country x between 1980 -1986 in 000's of Tons and answer the questions that follow ;**

Year	**1980**	**1881**	**1982**	**1983**	**1984**
Production	**1500**	**1700**	**2586**	**3021**	**5214**

a) Draw simple line graph to represent the data in the table .

b) Outline the merits and demerit of using the above method .

COMPARATIVE LINE GRAPH / GROUP LINE GRAPH/MULTIPLE LINE GRAPH

This graph involves more than one line drawn on the same statistical graph. It is therefore sometimes called a multiple line graph.

This method is particularly useful for comparison purposes and it is preferred when the comparison of trends is significant.

Construction procedure

1. Choose an appropriate scale based on the variables .use the independent variables for the horizontal scale and dependent variable for the vertical scale. Find the highest value and divide it by a constant of 10 /12/14/16 to get the vertical scale and use between 2/3 /4 cm to represent an item of the independent variable depending on their numbers on the horizontal scale.
2. Draw the x and y axis and indicate the statistical values as on the table.
   Plot the values of the dependent variables against the independent valuables using dots, then Join the dots with a lines or curves to obtain the multiple line or curve graph.
3. Write a key to show the meaning of the symbols used, the title of the graph and Indicate the scale used. Write the variables on the horizontal and vertical axis.
4. The lines should be clearly and easily distinguishable from each other by using different colours or methods of drawing (or any variation of these)
5. The maximum number of lines that can be drawn on one statistical graph is probably 5 or 6, but this depends on the space available.
6. It is advantageous to write essential information on each line, but this should not exceed one or utmost two words per line (since there is need to draw attention to comparisons and to reduce dependence upon the key).
7. Crossing of lines should be avoided as much as possible, since it may lead to confusion and increased difficulty in interpretation.
8. Study the data carefully in order to choose a convenient scale (by considering the highest and lowest figures given)

Advantages of group line graph

7. Easy to compare the trend / fluctuations over a given period
8. Gives good visual impression
9. Easy to interpret
10. Does not involve much tedious calculations
11. Consumes less space unlike the group bar graph

12. Simple/ easy to draw
13. Portrays/represents multiple data

Disadvantages of group line graph

4. Consumes a lot of time
5. Difficult to assess the actual values from the graph unlike the group bar graph
6. If many lines are drawn and criss-cross each other , it becomes complicated to interpret / assess
7. Difficult to get a convenient vertical scale (in case of very small and very large figures).

Example:

TRIAL QUESTIONS

COMPOUND / CUMULATIVE / DIVIDED LINE GRAPH/ COMPOSITE LINE GRAPH.

This method shows the component parts of a particular total. A compound line graph gives the impression of continuity; rise and fall (trend) in total production / quantities.

Construction procedure

1. The totals for particular years (or independent variable) should first be established/ determined.
2. Draw a cumulative table showing the progressive totals of the given totals of the given items/ variables. (This helps you to get a scale and even to plot accurately).
3. Determine a convenient scale which can effectively show the smallest individual value and the highest total value (the scale is based on the various totals established)use a constant of 10/12/14/16 to divide the highest total to get the number of cm to use on the vertical scale .
4. Usually the largest component or one that shows the least fluctuation/ variation is drawn first; and a second component drawn above this for any particular year (descending order). Accordingly, the total corresponds to the upper most line graph for any particular year.
5. Due to the cumulative method, the lines cannot cross each other.
6. It is advisable to colour or shade the component parts distinctively for easy interpretation (shade the area between individual line graphs).
7. It is advisable to put on the writings on the graph but should be one or two words for each segment for easy interpretation. (However, you may choose to use a key).

   Note:

- When drawing , maintain the continuity of years as given in the table
- When plotting , use the cumulative table not the original table given
- Do not confuse the compound line graph with comparative line graph. (for the compound line graph , all lines represent cumulative totals; yet for the comparative line graph the value of each individual item is determined from the zero line).

Advantages of compound line graph

1. Represents total values / quantities successfully
2. Good/ suitable for comparison purposes
3. Easy to draw / construct
4. It is relatively easy to interpret
5. Represents a wide range items
6. Consumes less space unlike other methods
7. Gives good visual impression if well drawn
8. Clearly shows the trend (fluctuations over time)

Disadvantages of compound line graph

1. Difficult to determine the actual value of each item for any particular year (due to cumulated values)
2. Consumes a lot of time when drawing
3. Involves a lot of tedious calculations.
4. Difficult to determine a convenient scale (where very large and very figures are involved)

TRIAL QUESTIONS

DIVERGENCE LINE GRAPH

This category of graphs is intended to show divergence or fluctuations (increase or decrease) from the normal or mean value. It can also be used to show the profit or loss, increase or decrease in population as a result of migration among others.

A line graph is drawn with values plotted in relation to a zero line which can represent either the average of the period chosen or a particular year selected for comparison purposes.

Construction procedure

1. Calculate / determine the standard value / the mean / average (show the working and the units)Add all values and divide the total by the number of items added .
2. Draw a divergence table by subtracting the average from the individual values (x-mean). The figures above average become positive (+) and those below average become negative (-).
3. For interpretation purposes or emphasis, the zero is usually thickened.
4. Determine a suitable /convenient scale by considering the divergence values (taking them as absolute values). Avoid exaggeration of the scale.
5. Draw a thick line and mark it zero (average).
   Note: the horizontal axis representing the independent variables should not be confused with the zero line but should occupy its normal place at the base of the graph.
6. Values below average (shortfall values) are plotted the zero line while values above average (increases) are plotted above they zero line.
7. Join the fluctuation values using a line.
8. The significance of the zero line should be stated on or below the graph

Note:

(a) This particular graph does not normally show production , exports, population etc absolute totals , but rather it shows divergences as positive and negative from some particular value or average.

(b) Because of the possibility of confusion arising from crossing of lines , this graph usually drawn for one commodity only/ simple data.

(c) This graph is usually restricted to line rather than curve graphs; and it should not be used as a compound or comparative line graph.

Advantages of divergence line graph

1. Easy to draw / construct
2. Easy to read/ interpret
3. Consumes less time when drawing
4. Clearly shows the trend (increases or decreases in a given variable over time)
5. Gives good visual impression
6. Used for comparison purposes

Disadvantages of divergent line graph

1. represents only simple data i.e. one commodity
2. only shows divergences not actual values , hence a bit confusing
3. involves tedious calculations
4. difficult to get convenient vertical scale
5. consumes a lot of space

Example:

BAR GRAPH

These graphs are drawn on the fact that bars are used to portray statistical information .The length of the bar represents the values of independent variables and the width the values of the dependent valuables.

SIMPLE BAR GRAPH

Here two variables are given; the independent are represented on the horizontal axis and the dependent on the vertical axis

Procedure of construction

1. Choose an appropriate scale based on the variables .use the independent variables for the horizontal scale and dependent variable for the vertical scale.
2. Draw the x and y axis and indicate the statistical values as on the table.
3. Plot the values of dependent variables against the independent valuables using dots
4. Join the dots with bars to obtain a bar graph. Shade the bars to give a good visual impression.
5. Write a key to show the meaning of the symbols used.
6. Write the title of the graph
7. Indicate the scale used.

8. Write the variables on the horizontal and vertical axis.

Advantages of a simple bar graph

14. Easy to compare the trend / fluctuations over a given period
15. Gives good visual impression
16. Easy to interpret
17. Does not involve much tedious calculations.
18. Simple/ easy to draw
19. Portrays/represents multiple data

Disadvantages of a simple bar graph

8. Consumes a lot of time
9. Difficult to assess the actual values from the graph due to rounding off figures.
10. Difficult to get a convenient vertical scale in case of very small and very large figures.

TRIAL QUESTIONS

2. **Study the table below showing Tea production in country x between 1980 -1986 in 000's of Tons and answer the questions that follow ;**

Year	1980	1881	1982	1983	1984
Production	1500	1700	2586	3021	5214

a) Draw simple bar graph to represent the data in the table .

b) Outline the merits and demerit of using the above method .

COMPARATIVE/ GROUP BAR GRAPH/ MULTIPLE BAR GRAPH.

Bars are usually drawn touching each other to give an impression of totality in a given group. Attention is drawn towards quantities rather than rise and fall or fluctuations. It is also called a multiple bar graph.

Construction procedure

1. The method of construction is similar to the simple bar except that groups are used.
2. The bars are grouped together for purposes of comparison
3. Bars are drawn touching each other without a gap between them, but the groups of bars are separated using a uniform space.
4. It is advisable to draw the longest bar on the left, proceeding in descending order to the right. However the bar representing 'others' is placed on the extreme right of the group.
5. The same order of the items must be adopted for all the groups.
6. All bars must be of the same width and drawn at right angles to the horizontal axis.
7. Use of distinctive colours or shadings for different items for purposes of easy comparison (and the same colour should indicate the same item throughout).
8. A key is very necessary for easy interpretation.
9. Study the data carefully and choose a convenient vertical scale; considering the highest and lowest figures given in the table.
10. For the horizontal scale, consider the gap occupied by the whole group for one year or region (depending on the data).

Advantages of divided of comparative bar graph

1. Good for comparison purposes
2. Gives good visual impression
3. Shows totality and individual contribution of each item
4. Easy / simple to draw
5. Easy to interpret
6. Does not involve tedious calculations
7. Represents a wide range of items (multiple data)

Disadvantages of comparative bar graph

1. Consumes a lot of space to draw.

2. Consumes a lot of time when drawing
3. Difficult to get a convenient scale in case of a wide range of values
4. Does not show the general trend of production (unlike line graphs)
5. It is of less value when comparison of totals is important

TRIAL QUESTIONS

Compound/ cumulative/ divided bar graph/ composite bar graph

Is suited for comparison purposes especially where a range of dependable variables are required to be compared .they are drawn by sub dividing one bar into it's component parts .

Construction procedure

1. The totals for particular years (or independent variable) should first be established/ determined.
2. Draw a cumulative table showing the progressive totals of the given totals of the given items/ variables. (This helps you to get a scale and even to plot accurately).
3. Determine a convenient scale which can effectively show the smallest individual value and the highest total value (the scale is based on the various totals established) .Use a constant of 10/12/14/16 to divide the highest total to get the number of cm to use on the vertical scale .
4. Draw the x and y axis using the scale ,label the axis and mark off scales above .
5. Usually the largest component or one that shows the least fluctuation/ variation is drawn first; and a second component drawn above this for any

particular year (descending order). Accordingly, the total corresponds to the upper most bar graph for any particular year.

6. It is advisable to colour or shade the component parts distinctively for easy interpretation (shade the area between individual line graphs).
7. It is advisable to put on the writings on the graph but should be one or two words for each segment for easy interpretation. (However, you may choose to use a key).

Note:

- When drawing , maintain the continuity of years as given in the table
- When plotting , use the cumulative table not the original table given
- Do not confuse the compound bar graph with comparative bar graph. (for the compound bar graph , all bars represent cumulative totals; yet for the comparative bar graph the value of each individual item is determined from the zero line).

TRIAL QUESTIONS

Divergence bar graph

This category of graphs is intended to show divergence or fluctuations (increase or decrease) from the normal or mean value. It can also be used to show the profit or loss, increase or decrease in population as a result of migration among others.
The divergence bar graph is drawn with values plotted in relation to a zero line which can represent either the average of the period chosen or a particular year selected for comparison purposes.

Construction procedure

1. Calculate / determine the standard value / the mean / average (show the working and the units). Add all values and divide the total by the number of items added.
2. Draw a divergence table by subtracting the average from the individual values (x-mean). The figures above average become positive (+) and those below average become negative (-).
3. Determine a suitable /convenient scale by considering the divergence values (taking them as absolute values). Avoid exaggeration of the scale.
4. Draw the x and y axis ,label the axis and mark off the variables .
5. Draw a thick line and mark it zero (average). For interpretation purposes or emphasis, the zero line is usually thickened.
6. Draw bars from the plotted point to the zero line to portray the fluctuation values using a bars.
7. Write a key to describe the graph ,a tittle and the scale used

Note:

1. The horizontal axis representing the independent variables should not be confused with the zero line but should occupy its normal place at the base of the graph.
2. Values below average (shortfall values) are plotted below the zero line while values above average (increases) are plotted above they zero line.
3. The significance of the zero line should be stated on or below the graph
4. This particular graph does not normally show production , exports, population etc absolute totals , but rather it shows divergences as positive and negative from some particular value or average.
5. Because of the possibility of confusion arising from crossing of lines , this graph usually drawn for one commodity only/ simple data.

6. This graph is usually restricted to line rather than curve graphs; and it should not be used as a compound or comparative line graph.

Advantages of divergence bar graph

1. Easy to draw / construct
2. Easy to read/ interpret
3. Consumes less time when drawing
4. Clearly shows the trend (increases or decreases in a given variable over time)
5. Gives good visual impression
6. Used for comparison purposes

Disadvantages of divergent bar graph

1. Represents only simple data i.e. one commodity
2. Only shows divergences not actual values , hence a bit confusing
3. Involves tedious calculations to get deviations.
4. Difficult to get convenient vertical scale
5. consumes a lot of space

Combined bar and line graph

it represents both a simple bar and a simple line graph on the same x and y axis (graph) .It is used where you ought to represent climatic statistics i.e. rainfall and temperature .In this case temperature is represented using a line graph and rainfall using a bar graph .

Construction procedure

Two methods can be used;

a) **putting both temperature and rainfall on the same axis**

1. Get the scale - horizontal basing on the month /days /weeks ;assume how many cm represent a month /day /week; vertical using a constant of 10/12/14/16/18 divide the highest temperature /rainfall value to get the number of cm to use to represent the temperature /rainfall
2. Draw the x and y axis basing on the calculated numbers of cm needed for both temperature and rainfall on the y axis and month /days /weeks on the horizontal axis.

3. Plot the values for rainfall and use the plotted points to draw a bar graph and for temperature and use the plotted points to draw a line graph.
4. Draw a zero line to separate the line and bar graph temperature should be plotted above the zero line and the bar graph below the zero line.
5. Provide a key to interpret the graphs, a tittle to describe the graph and the scale used for accuracy concerns and label the axis.

b) **Putting temperature and rainfall on different sides of the y axis**

1. Get the scale - horizontal basing on the month /days /weeks ;assume how many cm represent a month /day /week; vertical using a constant of 10/12/14/16/18 divide the highest temperature /rainfall value to get the number of cm to use to represent the temperature /rainfall
2. Draw the x and y axis basing on the calculated numbers of cm needed for both temperature and rainfall on the y axis and month /days /weeks on the horizontal axis.
3. Indicate the scale for rainfall and temperature on the different sides of the y- axis.
4. Plot the values for rainfall and use the plotted points to draw a bar graph and for temperature and use the plotted points to draw a line graph.
5. Provide a key to interpret the graphs, a tittle to describe the graph and the scale used for accuracy concerns and label the axis.

   Note;

   The line graph may cross through the bar graph

   Use the knowledge of drawing the line and bar graph in drawing the combined line and bar graph.

Qn1. Study the table below showing the climate data for Lusaka—Zambia, (ALT 1154M)

Month	J	F	M	A	M	J	J	A	S	O	N	D

Temp^{0}c	22	22	21	21	18	17	16	19	22	25	23	22
Rainfall(mm)	224	173	90	19	3	1	0	1	4	17	85	196

Qn 2. Study the table below showing the climatic statistics of Harbin China

Month	J	F	M	A	M	J	J	A	S	O	N	D
Temp^{0}c	-20	-16	-6	6	14	20	23	22	14	6	-7	-17
Rainfall(mm)	4	6	17	23	44	92	167	119	52	36	12	5

Qn.3 Study the table below showing the climatic data of Calgary, Canada

Month	J	F	M	A	M	J	J	A	S	O	N	D
Temp^{0}c	-11	-9	-4	4	8	12	15	13	10	4	0	-7
Rainfall(mm)	27	21	50	57	76	83	66	60	49	51	36	26

Qn.4 Study the table below showing the climatic data for San Francisco (California)

Month	J	F	M	A	M	J	J	A	S	O	N	D
Temp^{0}c	7	10	12	15	15	16	16	17	18	17	15	10
Rainfall(mm)	120	88	79	25	18	7	0	0	13	26	64	112

Qn.5 Study the table below showing the temperature and rainfall data for station A and answer the questions that follow:

Month	J	F	M	A	M	J	J	A	S	O	N	D
Temp^{0}c	14	15	18	21	25	28	29	28	26	24	20	16
Rainfall(mm)	16	16	15	13	14	8	0	0	9	13	15	19

Population pyramid /sex and age graph

This method is used to represent information/statistics concerning population studies or demographic data .Population pyramids are divided into two;

Note: there are two types of data in pyramid construction:

(a) Absolute type of data —where the base line gives the actual population of each age group.

(b) Comparable type of data —where the baseline gives the percentage of the total population in each age group.

a) Simple population pyramid/ Age sex graph

It is drawn to represent the demographic characteristics of one given country or region; males on one side and females on the other side.

The graph is made up of a series of horizontal bars arranged on each side of the vertical axis, each bar representing the numbers of percentage of the population in a certain age group.

Construction Procedure:

1. Get the scales –horizontal using population size /percentages and vertical using age groups.
2. Draw the vertical axis and two horizontal axis leaving a column between them (two graphs opposite each other.)
3. Plot the males on the left side and females on the right (resulting into a pyramidal lay put of the graph)
4. The base of the pyramid represents the youngest people while the apex shows the oldest group.
5. The graph is made up of a series of horizontal bars on each side of the vertical axis, which represent numbers or percentage of the population in a certain age group and sex.
6. Shade / colour the bars to improve the visual appearance of the graph, write the key , scale used and the title .

Advantages of age-sex graph

1. Gives a good summary of population structure/ composition in terms of age and sex
2. They are useful for comparison purposes
3. Gives good visual impression if well drawn
4. Represents a lot of information especially the super imposed pyramid (multiple data)
5. Easy to construct and interpret
6. Does not involve a lot of tedious calculations

Disadvantages of age-sex graph

1. Suitable for only population statistics
2. Occupies a lot of space
3. Consumes a lot of time when drawing
4. Difficult to obtain an appropriate scale for the pyramid

Compound/ combined/ super imposed pyramid

Age-sex graphs can be super-imposed for purposes of comparison of areas/ regions or time period. This means that the pyramid can represent two (2) sets of data. This makes is it easier to compare population pyramids for different countries or the same country but at different censuses.

Super imposed pyramids can be used to examine changes in population composition over time. Here one base line is used for more than one set of data.

Note: in case of super-imposed pyramids , a good method of shading / colouring should be used for clear comparison.

Construction procedure

1. Get a scale horizontal and vertical to represent the different years as in the case of the simple population pyramid .(use the same scale for both .)
2. Draw the vertical axis and two horizontal axis leaving a column between them (two graphs opposite each other.)

3. Plot the males on the left side and females on the right (resulting into a pyramidal lay put of the graph) .The two periods should be plotted along the same axis.
4. The base of the pyramid represents the youngest people while the apex shows the oldest group.
5. The graph is made up of a series of horizontal bars on each side of the vertical axis, which represent numbers or percentage of the population in a certain age group and sex.
6. Shade / colour the bars to improve the visual appearance of the graph, write the key , scale used and the title .

Advantages of age-sex graph

7. Gives a good summary of population structure/ composition in terms of age and sex
8. They are useful for comparison purposes
9. Gives good visual impression if well drawn
10. Represents a lot of information especially the super imposed pyramid (multiple data)
11. Easy to construct and interpret
12. Does not involve a lot of tedious calculations

Disadvantages of age-sex graph

5. Suitable for only population statistics
6. Occupies a lot of space
7. Consumes a lot of time when drawing
8. Difficult to obtain an appropriate scale for the pyramid

Statistical charts and diagrams

Under this category of methods the following will be discussed ;

Divided circles /pie chart/ pie graphs

Divided circles are the most common statistical methods used to represent geographical information. Pie charts are used for a variety of purposes unlike other methods

In this method total quantity is represented by a circle divided into segments proportional in size to the components (i.e. the bigger the segment, the large the value being represented). The target of this method is normally to allow comparison between various components.

The divided circles are categorized as follows:

a) Simple divided circle
b) Comparative divided circles
c) Proportional divided circles
d) Proportional semi-circles

CIRCULAR GRAPH (POLAR GRAPH/ CLOCK GRAPH)

A circular graph comes out as the best statistical method for representing cyclic geographical variables / information. They are normally used to represent geographical variables such as temperature, rainfall and human activities.

It basically shows information that follows a year calendar.

Circular graphs are divided into two ;

a) **Simple circular graphs**.

Are drawn to represent information on month and activities only.

Construction Procedure:

1. Draw a circle of convenient size not very small and not very large.
2. Get a scale by dividing the total sum of angles in a circle by the number of month in a year i.e. 360/12 = 30
3. Bisect/ divide the circle into 12 segments of equal size, each segment equivalent to 30^0. The 12 o'clock represents January and the rest named up to December clockwise.
4. Draw a smaller circle inside the bigger one and another smaller one towards the centre of the bigger circle
5. Write the month in the space between the bigger and the slightly small circle beginning with the month of January and follow clockwise direction till December.
6. Using semi circular shading represents the activities.
7. Provide a key to describe each activity, write a tittle and the scale used.

b) Compound circular graph /complex circular graph

Here more than two variables are given i.e. climate, month and activities

Construction Procedure:

1. Draw a circle of convenient size not very small and not very large.
2. Get a scale by dividing the total sum of angles in a circle by the number of month in a year i.e. 360/12 = 30
3. Bisect/ divide the circle into 12 segments of equal size, each segment equivalent to 30^0. The 12 o'clock represents January and the rest named up to December clockwise.
4. As the graph usually represents climatic data (rainfall or temperature or both), determine the scale and indicate it on either the 12 o'clock line or 6 o'clock line.
5. If both rainfall and temperature are available, one scale should be put on the 12 o'clock line and the other scale on the 6 o'clock line.
6. Temperature variations are indicated by a circular thick line where as rainfall by bars drawn on the inner radius.

7. Avoid congestion in the centre especially when drawing rainfall bars, and hence a circle is always drawn towards the centre. (It is advisable that the inner circle is 2—3 cm radius, and the outer circle is about 8 cm radius).
8. This polar graph can also be used to portray seasonal activities done in a year such as the farmers' calendar, apart from climatic statistics. The outer circle represents climatic statistics while the inner circle shows the seasonal activities done in a certain month using circular bars shaded differently or using line designs. A key is used for easy interpretation.

Note:

- Writing / printing on the graph should as much as possible be horizontal, not to compel the reader to turn the graph continuously which is a difficulty. Do not continue writing around the graph, turning it through 360^0 as you write (avoid information written upside down).
- If there are many seasonal activities to be shown, the size of the inner circle is slightly adjusted. Care must be taken when drawing the circular bars for those activities in the inner circle since a number of activities may fall within the same period/ overlap.

Advantages of circular graphs

1. Represents many variables and much information
2. Gives good visual impression if properly drawn
3. Clearly shows the variation of seasonal activities
4. Conveys the impression of cyclic or continuous progression in information better than any other method (shows the idea of continuity)
5. Shows comparison between 2 or more variables on the same graph

Disadvantages of circular graphs

1. Difficult to determine the exact figures on particular months that are far from the scale.
2. Bars do not stand on a straight line and are not parallel to each other, which makes comparison of their values difficult.
3. Writing/ printing on the circular graph is generally a problem.
4. Consumes a lot of time when drawing (especially with a lot of information)
5. Consumes a lot of space and it is a bit complicated to draw.

6. Generally less successful in representing monthly values and fluctuations than the combined bar and line graph.

Example:

1. The table below shows the climatic statistics for station X and answer the questions that follow :

Months	J	F	M	A	M	J	J	A	S	O	N	D
Temp(^{0}c)	23.8	23.8	23.3	22.7	21.6	20.5	19.4	20.5	21.6	23.3	24.5	24.4
R/Fall(mm)	154.9	109.2	144.8	43.2	5.1	0	0	0	2.5	5.1	30.5	96.5

(a) Draw a circular graph to portray the information above

(b)Determine the:

(i) Annual temperature range

(ii) Mean annual temperature

(iii) Mean annual rainfall, for station x

(c)Describe the climate characteristics of station x

(d) Giving a reason for your answer, state the hemisphere where the above station is located.

2. Study the table and passage below showing the rainfall patterns of Soroti and the activities done in a year

Month	J	F	M	A	M	J	J	A	S	O	N	D
R/fall(mm)	18	64	81	183	206	125	117	173	137	112	76	25

Activities done:

Harvesting of cotton and rice, and planting of finger millet and maize is done between December, January and early February. In the rains of April, May, and June potatoes and cassava are also planted. Cotton planting follows from May to September. Through June and July weeding of cotton , and planting of sorghum and beans.

(a) Construct a suitable graph to illustrate the information above

(b) Explain the influence of climate on the farmer's calendar in soroti
(c) Discuss the likely problems facing farmers of the area.

3. Study the table below showing the farmer's calendar in Teso region (Uganda) and answer the questions that follow:

Month	Rainfall (mm)	Planting	Harvesting
Jan	15	--	---
Feb	33	Millet	Cotton
Mar	76	---	---
Apr	165	Maize	---
May	183	Cotton	---
Jun	152	Cotton	---
Jul	137	---	Millet
Aug	216	Cow peas	Maize
Sep	145	---	---
Oct	127	---	---
Nov	91	---	Cow peas
Dec	23	---	---

(a) Draw a circular graph (clock graph) to represent the information in the table
(b) Explain the influence of climate on farmer's activities in Teso region
(c) With reference to the table and graph drawn, outline the problems faced by the farmers in Teso region.

4. Study the information below showing wheat growing in the prairies (Canada)
--From mid-November to the end of March the ground is frozen and cattle indoors
--Beginning of April to mid-April, it is the thaw/melt period
--From mid-April to mid-may , it is the sowing period/season
--Growing season—mid -May to mid-August
--Harvest period –from mid August towards end of September
--Ploughing follows up to mid-November

--this cycle continues year after year

(a) Draw a suitable graph to portray the above information
(b) Outline the merits and demerits of the above method
(c) what are the likely problems facing wheat growing activities in the prairies?

5. Study the table below showing cocoa growing activities in Ghana

Month	Season	Activity
Jan	DRY SEASON	Preparing land
Feb		
Mar	SEASON OF THE BIG	
Apr	RAINS	Little harvest
May		
Jun		Farm
Jul	SEASON OF THE	improvements
Aug	LITTLE RAINS	
Sep		Pruning trees
Oct		Main harvest
Nov		
Dec	DRY SEASON	

(a) Draw a circular graph to represent the above information
(b) Comment of the information given in the table and graph above
(c) Describe the likely problems facing the cocoa farmers in Ghana

6. Study both the passage (which describes the activities of the farmers of Kasama, northern Zambia in a year) and the table showing the annual rainfall, and answer the questions that follow:
The main tree-cutting season is May and June and after the branches have dried, they are carried and piled on the cleared land. This is a skillful task since the wood must be piled evenly to form a circular layer about two feet high.

The branches are fired in late September and November when a general signal is given, since a stack set ablaze may accidentally set the bush on fire and burn the branches of a neighbour before he had finished pilling them up. The bed of ash which is formed has a high potash content and free from weeds and on this, seed is sown.

The millet crop is not sown until December when the ground is softened by the rain. The seed is broadcast without preliminary hoeing and it is then covered with a thin scatter of earth. A little sorghum and maize may have been sown over the field before the millet.

The maize ripens in February and march and the millet and sorghum in April and May. Reaping is done labouriously by the women who cut each millet head separately with a small reaping knife. It is then stored in the granaries.

Table showing Annual rainfall for Kasama:

Month	J	F	M	A	M	J	J	A	S	O	N	D
Rainfall (mm)	280	245	255	65	10	0	0	0	20	46	145	265

(a) Construct a graph to illustrate the information in both the passage and the table

(b) Discuss the likely problems facing the farmers in the area

(c) Suggest possible solutions to the problems in (b) above

Solution (c)

The likely problems facing the farmers of the area:

- The cutting of trees and uprooting the stump before cultivation is avery difficult activity
- Storage in local granaries is not very safe for such produce
- Burning destroys the humus content in the soil
- Harvesting by cutting each head separately in very labourious and time consuming
- Rudimentary tools are very difficult to use such as small harvesting knife
- Possibility of famine in one season of the year

- Fire are likely to catch neighbouring bushes and destroys farm lands
- The clearing of forests, results into soil erosion during the wet season
- Water shortage during the long dry period between May and October
- Pests and diseases during the wet season destroying the crops
- Etc

Divided rectangles (rectangular graph)

In this method, a rectangle replaces a circle for representing statistical information. This means that the rectangle is sub-divided into components to indicate the constituent parts.

There are two types:

(a) simple divided rectangle

(b) compound divided rectangle

Simple divided rectangle

Two variables are given to be represented on a rectangle .the values are represented by dividing the rectangles into segments.

Construction procedure

1) Get the totals of the values given

2) Using the totals suggest the horizontal scale of the rectangle – divide the total by a constant of 10/12/14/16 to get the number of cm needed to represent the whole totals .
3) Draw the horizontal distance of the rectangle as a area proportional to the total quantity / value of all parts.
4) The rectangle is then subdivided into component parts, uniform in height (the vertical scale is usually constant, preferably 1:10%)
5) Variation in the component parts are indicated by the sub-divisions along the horizontal scale.
6) Show what the horizontal scale represents in values or percentages (horizontal scale is the most important scale).
7) Calculate the segment to represent the different items by expressing their values as a proportion of the total
8) Plot the segments on the rectangle
9) Shade each segment differently and provide a key to help interpret the shading and a title to describe the method.

Note;

Rectangular graphs are best constructed on a graph paper base.

Remember to obtain cumulative figures before plotting for quick division and it is advisable to plot in descending order (biggest first).

Advantages of divided rectangles

1. Gives good visual impression
2. Easy to construct/ draw (especially the simple divided rectangle)
3. Shows many variables / a variety of information
4. Useful for comparison purposes
5. Does not involve many tedious calculations
6. Generally easy to read and interpret

Disadvantages of divided rectangles

1. Choosing a suitable horizontal scale is difficult
2. Occupies a lot of space
3. Difficult to use for location purposes on a map
4. Consumes a lot of time when drawing

5. Where very small figures are involved it becomes a bit complicated to draw
6. Many variables make the graph congested
7. Does not show actual values / area of different items but rather cumulative values

Compound divided rectangle

It is drawn where more than two variables are given. The divisions of the rectangles is done on both the horizontal and vertical axis .

Construction procedure

1. Calculate the horizontal and vertical scales;

–horizontal scale; get the totals of land area and divide it by a constant of 10/12/14/16 to get how much each cm will represent on the horizontal axis.

- Vertical scale ;is expressed as a percentage use a constant of 1 cm : 10 %

2. Draw a rectangle basing on the calculated scale above
3. Calculate the segment parts on the horizontal axis as on a simple divided rectangle.
4. Divide the horizontal axis into segment parts calculated above.
5. Divide the vertical axis into percentages as per the suggested scale by measuring off the percentages of the different items on the vertical axis
6. Shade similar items alike , provide a key to interpret the rectangle ,write the scale used and a title to describe the rectangle

Divided circles /pie charts

Are divided into the following ;

a)Simple divided circle

it is constructed on the principle that 360^0 is equivalalent to 100% . this is the total angle sum of a circle .

Construction procedure

1. Draw a circle of convenient size , that is, avoid too small circles and very big circles
2. The circle is divided into segments which are proportional to the value of the individual components (the larger the value represented , the larger the segment).
3. Calculate the size of the segments (clearly showing your working).
   Method 1—segments are calculated as percentages of the total (1% of the whole circle is equivalent to 3.6^0)
   Method 2—components expressed as a fraction of the total and the formula used is:

$$\frac{\textbf{Component value}}{\textbf{Total}} \times 360^0$$

   The calculations should be organized according the information given
4. The segments are drawn after the calculations accordingly using a protractor.
5. When measuring the segments , we move in a clockwise direction. The largest component is usually placed to the right of the 12 o'clock line.
6. The smallest segments are often placed last. They present a problem in drawing and are best grouped together around the 9 o'clock if possible.
7. Note: the small segments should not be placed last as any error that accumulates such as due to the width of the pencil line will be more noticeable in small segments. Such errors can be absorbed into the larger segments without affecting the accuracy of the whole.
8. To reduce the errors to a minimum angles should be measured on a cumulative basis, the second angle should be added to the preceding one and so on. By working clockwise from the vertical radius , one is most likely to accumulate an error arising from the thickness of the pencil or otherwise). Therefore is advisable that after the first segment one should draw in anti-clockwise direction (i.e. starting with the smallest).
9. The segment representing 'others' should be placed last irrespective of its size.

10. All writing on the pie chart should be in block / capital letters and as far as possible horizontal. Do not write around the pie graph turning it as you write. In case of very small segments, information can be added outside the chart and an arrow drawn from it to the relevant section.
11. It is advisable that absolute values or percentage values be marked /shown on the relevant segment and colour the segments distinctively. (It is not advisable to write too much information on the pie chart).
12. A key may be used for easy interpretation.
13. Different segments should be shaded/ coloured differently / distinctively so as to portray the difference in the segments.
14. Note: small segments should be coloured n with a bright cloour or shaded with some distinctive means.
15. The number of segments will be dictated by the nature of statistics given. 7 or 8 segments would seem to be the maximum. However the bigger the number of segments, the bigger the circle should be.

Advantages of pie charts

1. Easy to construct
2. Shading or colouring gives a good visual impression.
3. Consumes less space
4. Shows the contribution of different sectors to production (good for comparison purposes)
5. Consumes less space and time unlike other methods
6. Easily used alongside maps for location purposes

Disadvantages of pie charts

1. involves tedious calculations
2. very small segments lead to loss of visual effect
3. lacks the exactness of a bar graph , mainly because it is not drawn to scale (reference can not be made to a scale)

Example 1:

Study the table below showing Guinea—Bissau's exports valued in pounds for 1987:

Product	Value

Peanuts	345,823
Coconuts	49,307
Fish and shell fish	59,600
Timber	6,949
Industrial	5,997
Other exports	29,922
Total	497,598

(a) Convert the above values to percentage and to degrees

(b) Draw a divided circle (pie graph) to show Guinea—Bissau's exports as shown in the table above

2. Study the table below showing the leading countries in marine fish catches in 1997 (000 tonnes)

Country	Catches
Japan	21508
USSR	19976
China	16680
Peru	13547
USA	12799
Norway	12550
South Korea	12133
Denmark	11767
Spain	9933
Others	13614
World total	144,507

(a) Construct a simple divided circle to illustrate the above data

(b) Justify the use of the statistical method

(c) Examine the factors promoting marine fish catches in any one country above

Comparative divided circles

The method of construction is similar to the simple pie chart.

Two or more simple divided circles of the same size are used for purposes of comparison provided the emphasis lies on the comparison of components rather than comparison of totals.

Procedure:

1. The pie charts drawn should be of the same size
2. The two or more pie charts should be drawn on the same page side by side to emphasize comparison of the elements/components
3. The same order of items should be followed in the various pie charts for easy comparison
4. Accordingly, the shading of the individual items should be followed for all the pie charts.

Proportional divided circle

Proportional divided circles are used where comparison of totals is of greater importance in representing statistics. it may involve two or more circles each being proportional to the totals given.

Procedure

1. Two or more divided circles are drawn for comparison purposes. The size of the circles drawn depends on the totals given as they must be proportional.
2. The radius of each circle is determined by the formula

$$\text{Area} = \pi r^2$$

$$\text{Total} = \pi r^2$$

3. For each circle components must be expressed as percentages or fraction of the whole as in the simple pie charts.
4. Therefore the angles of the segments are calculated as before (as in the simple pie chart) clearly showing your working.
5. For purposes of comparison, the segments should be arranged in the same order in all the circles.
6. Note: proportional divided circles also mostly apply when totals are more than two such that proportional divided semi-circles do not apply.

7. This method can also be used in conjunction with a map provided alongside the data , in which case various proportional divided circles are drawn in particular positions/locations.

Advantages of proportional divided circles

1. They are simple to construct/ draw
2. Accommodate/ represent multiple data
3. Easy to interpret
4. Good for comparison purposes
5. They can be used alongside a map for location purposes
6. Give good visual impression

Disadvantages of proportional divided circles

1. Consumes mush space unlike semi-circles
2. Drawing many pie charts consumes a lot of time
3. Comparing relative areas is always difficult and lacks the exactness of a bar graph
4. Involves many tedious calculations

Proportional divided semi-circles

These are also drawn for purposes of comparison as the case in the proportional divided circles.

The two semi-circles are drawn adjacent to each other , each semi-circle being proportional to the quantity to be represented.

Construction procedure:

1. Determine the radius of each semi-circle using the formula

$$\text{Total} = \pi r^2$$

Note: you can use a scale value get a manageable radius

2. The method of construction is the same as for the proportional divided circles. However the difference lies in the fact that calculations of degrees are based on half circles.

$$\frac{\text{Componen}^{+}}{\text{Total}} \times 180^0$$

3. Reference is made to a key for clear identification of the components.
4. For easy comparison, the segments should be arranged in the same order.
5. Segments should be expressed as percentages or decimals or fractions of the whole /totals

Advantages of proportional divided semi-circles

1. Occupies relatively less space unlike proportional piecharts
2. Good for comparison of different items
3. Easy to draw and interpret
4. Accommodates multiple data
5. Gives good visual impression

Disadvantages of proportional divided semi-circles

1. Difficult evaluating individual segments since actual values are not shown
2. Involves many tedious calculations
3. Difficult to represent very small values
4. Drawing and shading semi-circles consumes a lot of time

Proportional divided circle (on a map)

Proportional circles

This statistical method is almost similar to the proportional divided circles, only that the proportional circles are not divided. These circles have an area proportional to the quantity represented i.e. the bigger the circles, the bigger the value/ quantity being represented and vice versa.

Note: Proportional circles can be drawn independently or in conjunction with a map.

Procedure:

1. The size of the circles depends on the radius which is determined by the scale chosen.
2. The total (T) is represented by the area of the circle (πr^2) and this gives the formula $T = \pi r^2$.

However since π is a constant it can be omitted in the calculations, and in this case the radius is proportional to the square root of the quantity to be represented.

3. Determine a scale to convert the rooted values to a manageable radius for each circle.
4. Calculate/ determine the radius from the rooted values by dividing the values by the scale. (To determine a convenient/ suitable radius consider the largest and smallest values).
5. Draw the circles in ascending order or descending order, that is, beginning with either the smallest or the biggest. (This implies that the circles must be drawn on the same baseline).
6. If it is necessary to colour the circles, the colour must be one.
7. When using a map, the size of the circles drawn depends on the map scale/ size and the density or closeness of the number of circles. Over lapping of the circles should be avoided as much as possible.
8. Draw proportional circles directly on the base map in their respective boundaries or when their centres are on the point to which the data refers.
9. Use a distinctive colour (e.g. red) to avoid confusion with the black map lines.

Advantages of proportional circles

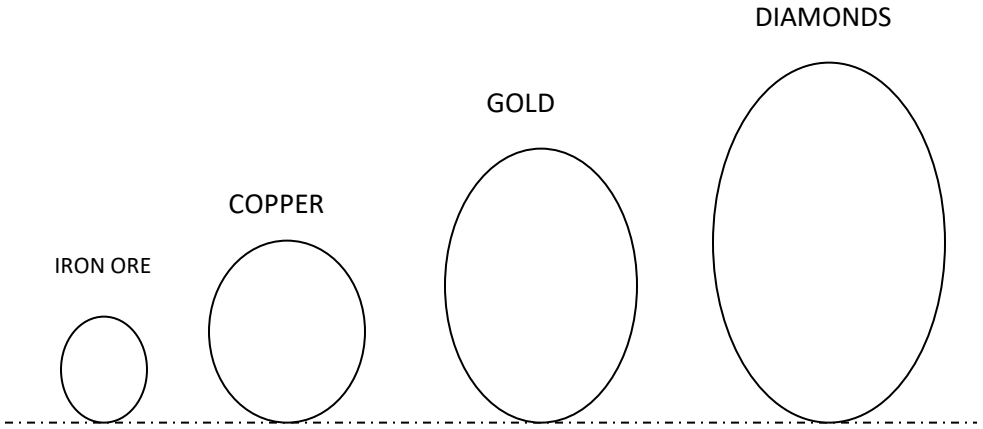
- They are simple/ easy to construct
- They are easy to interpret
- They can be used in conjunction with a map for locational purposes.
- Gives good visual impression.
- Involves less calculations unlike the proportional divided circles.

Disadvantages of proportional circles

- They represent less information unlike proportional divided circles
- Difficult to get a convenient scale to represent all values
- Overlapping brings problems in drawing and interpretation where it is unavoidable.
- Consumes a lot of space.

Example 1

PROPORTIONAL DIVIDED CIRCLES SHOWING MINERAL PRODUCTION IN JOHANNESBURG (SOUTH AFRICA) FOR 1993 (METRIC TONS)



RADIUS=0.8cm 1.2cm 2.1cm 2.6cm

Scale: 1cm represents 200 (of rooted values)

Example 2

Assignment:

1. Study the table below showing the estimated water use in the united states of America for 1990

   Use Volume

	(billions of litres)
Irrigation	1637.85
Public water utilities	1060.74
Industrial & miscellaneous	811.60
Steam electric utilities	1256.87
Rural domestic uses	606.41

(a) Draw proportional circles to illustrate the above information

(b) Why is the above method desirable in representing geographical information?

(c) What are the advantages of using irrigation?

(d) Discuss the factors which have favoured irrigation farming in California (USA)

2. Study the table below showing the production of crude oil in selected states of USA in millions of barrels for 1987:

State	Production
California	472,191
Utah	33,370
Colorado	34,723
Kansas	94,853
New Mexico	138,184
Wyoming	170,345
Montana	47,897
North Dokota	31,998

(a) Using the base map provided, draw proportional circles to represent the data in table above

(b) Comment on the variation in crude oil production as shown in (a) above

(c) Examine the factors which have crude oil production in USA

Proportional squares

Proportional squares can be used in the same way as proportional circles. The area of the square is proportional to the quantity it represents, and hence the side of the square is directly related to the square root of the quantity / number to be represented.

Proportional squares are useful when there is a wide range of numbers to deal with, as the use of square roots reduces the range of values to manageable units/ levels.

Procedure:

1. Calculate the square root of the total to be represented.
2. Determine the scale from the rooted values, which gives you the length of the side of the square.
3. Draw the square accordingly and shade them (if drawn individually, a graph paper is more useful).
4. A key is drawn for easy interpretation.
5. Sometimes it necessary to show part of a whole (sub division), the same process will be followed.
6. If drawn individually it is advisable to draw the squares in ascending or descending order. When drawn on a map the squares are drawn in the respective positions, with their areas proportional to the values they represent.

Note: Proportional squares are generally sited on a map in such a way that the south west corner or north west corner of the square locates the position of the town to which refers or in the respective boundaries.

As a general rule overlapping of the squares should be avoided.

Advantages of proportional squares

1. They can be super imposed on a map for location purposes
2. They are used for purposes of comparison
3. Their relative sizes are easier to assess than circles
4. Squares can be super imposed on each other to show different items or part of a whole

Disadvantages of proportional squares

1. Consumes a lot of space
2. Squares are more difficult to draw than proportional circles
3. Difficult to get an appropriate scale to represent all the values

4. Assessing small differences in total values represented is more difficult than in the case of bar graphs.

Example 1:

…….

Example 2:

Assignment 1:

1. Study the table below showing the harbor tonnage in south Africa in 1998

Harbor	Harbor tones
Durban	38,883,764
Cape Town	18,119,308
Port Elizabeth	17,198,862
East London	12,276,446
Walvis bay	11,416,427

(a) Construct proportional squares to represent the above information

(b) Determine the relative importance of each of the harbors given in the table

(c) Explain the contribution of each Durban or cape town to the economy of the republic of south
Africa

Assignment 2:

Study the table below showing changes in employment on USA's farms in relation to changes in total employees (1950—2000) in 000s

Year	Total employees	Farm employees
1950	44,318	19,938
1960	49,073	12,912
1970	57,371	13,592

1980	62,434	13,449
1990	68,830	12,472

(a) Construct proportional squares to represent the information in the table
(b) Justify the use of the method in (a) above
(c) Comment on the pattern of employment shown in the table and diagrams in (a) above

Proportional cubes

These can also be drawn independently or given locational significance by being located on a base map to show quantitative distribution / production.

Their main advantage is that they introduce a third dimension, and are capable of representing statistics which have an even greater range of values.

Whereas the length of the side of a proportional square varies directly with the square root of the quantity being represented, the side of the cube is directly related to the cuberoot of the quantity.

Procedure:

1. Calculate the cube root of the quantity to be represented (may use calculators or cube root tables)
2. If drawn independently, the cubes should stand individually on a straight line for comparison purposes.
3. When drawn on the base map, the cubes must be drawn to the same pattern.
4. A key should be provided and the cube root values are plotted on the baseline.

Note: However due to difficulty in evaluating the quantities represented by the cubes it is sometimes advisable to write/ print the relevant quantity below the cube.

Advantages of proportional cubes

- Easy to compare information
- Gives a good visual impression
- Can be super imposed on maps
- Involves simple calculations

Disadvantages of proportional cubes

- Consumes a lot of space
- The cube cannot be sub-divided to show components
- Comparison of quantities represented by cubes is extremely difficult unless statistical information ir written on or below the cube.
- A cube is generally less pleasing visually than a sphere

Example 1:

Study the table below showing the commercial catch of fish by major fishing areas of the world (000 metric tonnes)

Area	1991	1995	2001
Inland waters	14,768	21,004	31,320
Pacific ocean	52,358	59,185	63,298
Atlantic ocean	23,792	24,690	26,386
Indian ocean	6,879	8,031	9,204
Total	97,797	112,910	130,208

Source: Food and Agricultural Organization (FAO) of the United Nations

(a) Construct proportional cubes to represent the commercial catch of fish for 2001

(b) Calculate the percentage contribution (relative importance) of each of the major fishing zones

(c) Comment on the variation in the catch of fish as shown in the table and diagrams above

(d) Account for the development of the fishing industry in any one fishing zone shown in the table above

Example 2:

Study the table below showing the production of groundnuts in West Africa for 1992 (000 metric tonnes)

Country	Tonnage
Nigeria	1999
Niger	1252
Mali	1185
Cameroon	1171
Upper Volta	1153

Ghana	1120
Togo	888

(a) Using the outline map provided, construct proportional cubes to illustrate the information in the table.
(b) State the merits of using the above method
(c) Discuss the challenges faced by the agricultural sector in west Africa

Proportional spheres

The proportional sphere is similar in concept to the proportional cube. It serves the same purpose as the cube in that the introduction of a three-dimensional figure allows a very wide range of values to be represented, the volume of the sphere being proportional to the quantity being represented.

Construction procedure:

1. Determine the radius by calculating the cube root of the quantity to be represented.

   Note: The volume of a sphere is $\frac{4}{3}\pi r^3$. But when calculating the radii of more than one sphere,$\frac{4}{3}\pi$ being a constant can be ignored and the cube root only considered. (Working must be clearly shown)
2. The sphere is then drawn in its correct position/ location on the map (proportional spheres are normally used for locational purposes).
3. Selection of various sizes of spheres with information relating to the value of each is done.

Advantages of proportional spheres

- They more visually impressive
- useful when the range of statistics is so great that other methods are difficult
- can be used in conjunction with other methods such as proportional circles to avoid over crowding

Disadvantage of proportional spheres

- they present difficulty in drawing (especially with smaller value spheres)
- involves tedious calculations when determining radius (by referring to cube root tables/ calculators)

- difficulty in assessing the relative volumes / values of different spheres
- a sphere cannot be sub-divided to show constituent parts unlike the pie charts / circles
- writing on a sphere presents much difficulty unlike other methods (like cubes)

Example:

Assignment

1. Study the table below showing the industrial output from Australia for 1992 and answer the questions that follow:

State	Output (tons)
New south Wales	3,474,900
Victoria	2,384,100
Queensland	1,788,000
South Australia	1,144,200
West Australia	956,000

Tasmania		488,600
N. Territory		289,000
Australian territory	capital	3,222,700
Total		

(a) Use the outline map of Australia provided, construct proportional spheres to illustrate the above information

(b) Comment on the pattern / variation of industrial output as shown in (a) above

Repeated symbol map

Geographical/ statistical information can be represented on a map by the repetition of one symbol of uniform size or character, or by a variety of symbols. Location is expressed by placing the symbol in its 'correct' place on the map.

The repeated symbols can be non-quantitative or quantitative.

(a) The non-quantitative type is basically pictorial (such as diagram a cow for ranching, picture of log for forestry /timber production) or descriptive (such as the initial or other letter R-rubber, M-for maize, X—copper, O—oil)

(b) The quantitative type is the most informative and it involves grouping symbols together and seeks to represent totals. Geometric shapes such as squares, triangles, circles, or cubes may also be used to indicate the different categories or types.

Determine a symbol value/ scale to represent quantitative symbols. The scale is very important since the symbols are representing the same value .

Remember that each value should be represented by at least one symbol. The symbols must also be organized in given order.

Determine the appropriate but simple symbols to represent the different items given.

We must use full symbols and use a small number of symbols on the map for easy interpretation (by choosing a convenient scale).

Note: Repeated symbols form one of the simplest methods of representing statistical information and common on map dealing with agricultural products, minerals, maps and guides produced for tourists etc

Advantages of repeated symbol maps

- shows the relative values by adjusting the size of the symbol
- used for comparison purposes
- gives a good visual impression
- easy to interpret
- does not involve a lot of calculations
- can be used to represent a wide range of items on the same map
- When the symbols are grouped together, their total number is proportional to the total quantity being represented. (The total quantity is easily obtained by just counting the symbols when they are very few).

Disadvantages of repeated symbol maps

- Difficult to represent wide range of values on such maps
- Drawing of the repeated symbols is often a tedious and difficult task.
- There is over simplification, since the symbol or group of symbols rarely coincides with the area of production.
- Pictorial representation / repeated symbols results into suppression of statistical accuracy.
- They cover a lot of space and congestion may occur where places are close together

Example 1

Example 2

Assignment

Study the table below showing the production of selected items in Democratic Republic of Congo (Former Zaire) for 1996

Area	000 tonnes

	Gold	Timber	Copper	Palm oil	Cotton
Bas Zaire		60		64	
Bandundu		62		90	
Equatuer		126		164	
Kasai oriental				84	60
Kasai occidental					66
Shaba			194		128
Haut Zaire	90	132		64	108
Kivu	136				26

(a) Using the outline map provided , draw repeated symbols to illustrate the above information (9mks)

(b) Comment on the pattern of output for different items as revealed by the table and map in (a) above

(c) Examine the significance of either copper or timber production on the economy of Democratic Republic of Congo

Dot map (Distribution map)

Dot maps are also widely used to portray geographical information distributed over a given area. Dot maps are somehow similar to the repeated symbol maps and in these maps dots are used to represent a certain quantity and these dots are supposed to be distributed within a given area.

Dot maps are a combination of two ideas i.e. the repeated symbol (dot) and the dispersion map (base map) on which the dots are placed.

Procedure:

1. One needs to have the statistics and an outline map (base map) showing the boundaries of divisions. The map is either provided or drawn first.
2. Choose the dot value considering the information given i.e. how much does each dot on your map represent?
3. When choosing the dot value consider the lowest and highest figures so as to arrive at the suitable value which does not give too many dots or again too few

dots. Then state the dot value on your map such as one(1) dot represents 10,000 people

4. Choose the dot size. But this will always depend on the size of the base map and the number of dots to be placed.
5. Calculate the number of dots to be plotted onto the base map (show your working)
6. Place the dots on the map. But you should determine how exactly each dot will be distributed in a given area (dot density/ distribution). However it is advisable to use objective/ even distribution of dots over the statistical map i.e. the dots arranged in a given uniform order.
7. The dots as much as possible must be of the same size.
8. Avoid running short of dots before you cover that area you want to cover.
9. Do not shy away from putting dots near boundaries of the area on the maps.

Advantages of dot maps

1. Dot maps are very flexible i.e. easy to draw unlike other maps
2. Dot maps are used to portray geographical distribution of phenomena satisfactorily / successfully.
3. They can be used with other methods such as showing the relationship between relief and people
4. Many variables can be represented on the dot map using dots of different sizes.
5. They give the impression of accuracy i.e. just multiplying to get actual figures.
6. Give the impression of comparative densities
7. Several items can be represented using different dot colours

Disadvantages of dot maps

1. Difficult to find a suitable dot value to show both the big figures and small figures
2. Dots give a wrong impression that where a dot exists , a given number of items/ people (equivalent to the dot value) is found which is unrealistic
3. The dots spread over evenly over a given area does not reflect the true distribution (e.g. a dot may be put where there are no people or in a valley, water body)
4. It consumes a lot of time when dotting.

5. Difficult to maintain uniform dot size

Example 1

Example 2

Assignment

Study the table below showing population size for selected African countries and answer the questions that follow:

Country	Population size ('000s)
Angola	13,936
Botswana	1,564
Dem. Rep. Congo	54,275
Lesotho	2,076
Malawi	11,828
Mozambique	18,986
Namibia	1,819
South Africa	44,203
Zambia	10,872
Zimbabwe	13,076

(a) Using the dot map statistical method, represent the information given in the table on the base map provided

(b) Outline the demerits of using the method in (a) above

(c) Account for variations in population distribution in the region shown on the map

Assignment 2 (covered in question bank)

Study table below showing selected countries of Africa (central and eastern) by population for 2003:

Country	Total population (000)
Angola	16,409
C.A.R	9,472
Congo Brazzaville (CB)	8,851
Kenya	31,133
Malawi	14,890
Rwanda	13,592
Burundi	12,336
Tanzania	32,221
Uganda	24,600
DRC	41,034
Zambia	14,365

(a) Using the statistics in the table and the base map provided, prepare a dot map.

(b) Justify the use of the above statistical method

(c) Explain the causes of rapid population increase in any one country in the table above

Shading map (Choropleth map/ population density map)

The shading map uses a system of shading , the intensity of which varies according to the density of items per unit area such as per square km or per square mile within a selected boundaries i.e. an increase in density implies increased intensity of shading.

The term ‘choros’ is a greek word meaning area/ space while ‘plethos’ means multitude/ number. Therefore these maps show the relationship between quantities and area. The shading maps are mostly used to show population density

and hence the name population density maps. However they can also be used to show other items (such as crop production, animal population).

Note: a population density map must not be used to show absolute numerical figures such as population size but rather should show density values.

Procedure:

1. Obtain a base map of the region/ country showing the boundaries of the divisions. (This can be already drawn or should be drawn first).
2. Showing your working, calculate the density values per unit are by dividing the total number of items by the area of that division such as;

$$\text{Population density} = \frac{\text{Total population}}{\text{Total area}}$$

3. Choose a suitable scale to divide the range of values into a number of classes. Care must be taken such that no one shading dominates the final map and try to avoid empty classes on the map by having too many classes.
4. Shading should follow a progressive increase in density.
5. Several methods can be used to determine the range of classes/ groups such as:
   (a) Linear progressive classification (arithmetic progression)
   This is used when there is a small range between the highest and lowest density for example
   1—10,11—20, 21—30, 31—40 OR 0—49,50—99,100—149, 150—199.
   (b) Geometric progression
   The values are doubled for each successive class. This method is useful when dealing with a large range of values/ numbers (i.e. considers both very large and very small values). For example 1—50,51—100,101—200,201—400 OR 1—80,81—160,161—320,321+
6. A scale composed of too few grades gives a wrong impression of comparative uniformity while too many grades may be confusing. Therefore it is advisable to use a maximum 4 to 5 classes/ grades.
7. Examples of shadings are given below:

Population density per km^2

0-19.9

20-39.9

40-59.9
60-79.9
Population density per km^2
1—100
101—200
201—400
401—800

8. Do not combine shading with symbols such as crosses, circles and the like.
9. Do not attempt to show variations in density merely by drawing lines different angles (such as horizontal, vertical, diagonal)
10. Use of the key can be made easier if the boxes are drawn individually.
11. The key should be complete i.e. all the grades of shading should be included on the key.

Advantages of choropleth /shading maps

1. They are relatively easy to construct (especially with a low range of values)
2. Gives a good visual impression
3. Easy to interpret (especially for population data)
4. Useful for comparison purposes
5. Shows quantitative analysis (relates data to area)
6. Some other information can be included on the map

Disadvantages of choropleth maps

1. Variations of density within each boundary are not shown, giving a wrong impression of uniform density.
2. Boundary lines between the density zones give a wrong impression of sudden change in density (assumes abrupt change in density which is unrealistic).
3. Difficult to get appropriate grades or classes especially if a large range of values are involved.
4. Consumes a lot of time when shading

Example:

Study the table below showing the population in the regions of southern Ghana ……..

Flow maps and flow charts

Flow maps portray linear movement i.e. normally used to represent information that stresses movement of goods (direction of trade), movement of people or traffic.

Examples include:

- Movement from area of production to market places
- Exports from one country to another
- Immigrations and emigrations of people to and from other places
- Traffic flow in specific areas and directions such as along railway lines, roads, water etc

There are two (2) types:

(a) Those flow maps that only symbolize the direction of flow by means of a line or lines usually with an arrow head

(b) Those that show varying amounts of flow by varying the design / width of the line. This type is more informative.

Note:

When drawing flow maps note that:

- The direction of the flow is indicated by an arrow at the end of the line
- The amount of flow is indicated by the width of the arrow
- The type of the flow is indicated by the shading or colouring used

Construction procedure:

1. Choose the scale to be used and to be able to choose an appropriate scale consider the lowest and highest quantities involved in addition to the complexity of the outline map (base map) available. (Work out the width of the lines showing your working).
2. Draw the flow arrow proportional to the quantity being represented and avoid drawing very thick or too thin lines.

3. The width of the line is the most important and therefore must be determined using a scale. It is advisable that the widest line is 1cm (or 1.5 cm depending on the data)
4. In case flow lines are required to be drawn on a base map, it is not necessary to follow all the corners and twisting as they are on the base map but a generalized impression (this prevents colliding or over lapping of low lines)
5. Lines may be drawn along the actual route or connecting the origin and destination using straight lines or curved lines. Arrows at the end of the are used to show the direction of movement. The lines drawn should be parallel.
6. Shading of the flow diagrams creates a good visual impression. Different colours can be used to represent categories of commodities such as to distinguish imports and exports (or generally to supply further information).
7. In case of different colours, a key should accompany the flow arrows in order to emphasize easy interpretation.
8. The terminal or collecting point of several flow lines should be represented as a circle or square, such that total values of individual components moving towards or form the collecting centre are clearly shown.
9. Factual information may be written on the flow line or alongside it.

Advantages of flow maps

1. It is the best and only method of representing movement in common use
2. Relatively easy to interpret the direction of flow
3. Gives good visual impression
4. Good for comparison purposes
5. Clearly shows the variations in traffic or flow of an item
6. Does not involve complicated mathematical calculations
7. They can be superimposed on other maps and diagrams

Disadvantages of flow maps and flow charts

1. Consumes a lot of time in drawing
2. They lack immediate or exact interpretation especially for actual quantities
3. Drawing of parallel double track flow lines (even along curved sections) is difficult.
4. It may be confusing in case of many lines
5. The generalization of movement by flow lines is a bit unrealistic

6. Difficult to determine a convenient/ suitable/ appropriate scale

Examples of flow maps and flow charts

Assignment 1:

Study the table below showing total value of exports from Uganda between 2005 and 2007

	000 dollars	
Exports	2005	2006
Kenya	80346	75423
Sudan	93887	104321
Tanzania	19987	20564

(a) Draw a sketch map of Uganda and on it represent the above information using a flow diagram

(b) What are the advantages and disadvantages of the above method?

Assignment 2:

Study the table below showing the export trade of Uruguay in1978:

Importing countries	Value ($000)
United kingdom	47,908
USA	31,699
Italy	13,982
Spain	13,115
West Germany	12,674

The Netherlands	11,533
Brazil	8,455

(a) Using the outline map provided and the table above, draw a flow diagram to illustrate the export trade in Uruguay
(b) Comment on the export trade in Uruguay (5mks)
(c) Assess the impact of export trade in Uruguay (8mks)

Wind rose

As the name suggests, this method is used to show wind-related data i.e. the average frequency and direction of the wind at a given place. Like other methods, it can be given location significance by being drawn in its correct place on a map.

It is essentially a linear method, the direction and length of the line or column representing the direction and frequency of wind respectively. (In case of a compound wind rose the width of the column may also be adjusted to indicate wind speed).

Wind roses are categorized as:

(a) Simple wind rose
(b) Compound wind rose

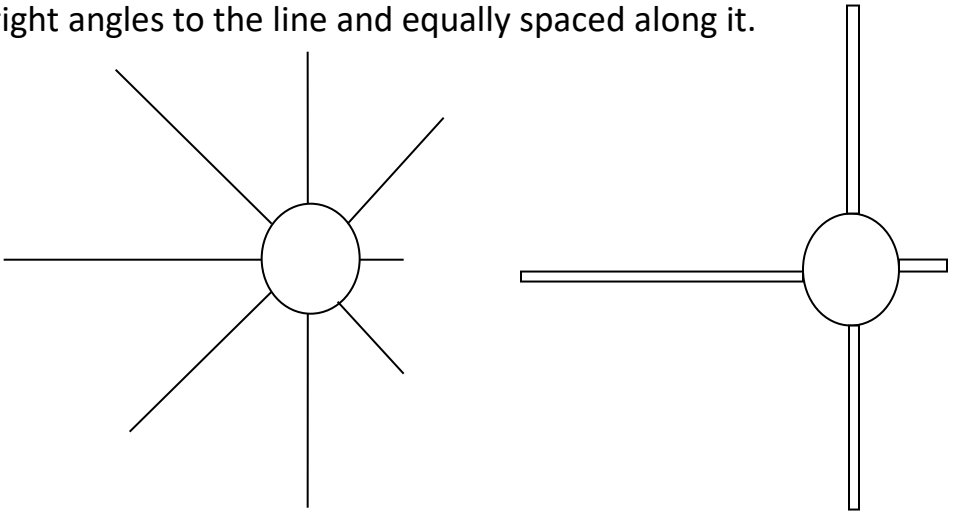
Simple wind rose

This method is for simple data most especially direction of wind and its frequency (in a month).

Construction procedure

1. Draw a circle of convenient size to be the centre of the wind rose
2. The number of days of calm (when there is no wind) are represented separately. They are usually indicated by a figure which is printed / written inside the circle. Note: if percentage values are used in calculating the length of the columns or arms, then calms also should be represented by a percentage scale written inside the circle.
3. Eight (8) points of the compass are usually sufficient (although 16 points can be used if greater detail is required).

4. Determine a scale to enable you determine the length of the bars. Remember that the longer the bar the more frequent the wind is in that direction. (such as 1cm represents 1 day)
5. Draw bars of uniform width but different length i.e. the length of the bars drawn is proportional to the actual number of days.
6. Alternatively the frequency of the wind from each point of the compass may be calculated as a percentage of the whole and a percentage scale added.
   Note: for a percentage scale , the total number of days in a month or year is considered as 100% including the days of calm.
7. Columns can be represented by straight lines of correct relative lengths, the number of days being represented by an equivalent number of small bars drawn at right angles to the line and equally spaced along it.



Example:

1. Study the table below showing the data of the direction and frequency of wind in a month for station A

Direction of wind	N	NE	E	SE	S	SW	W	NW	Calm
Number of days	4	3	1	1	3	6	6	4	2

   (a) Construct a simple wind rose to show the above data
   (b) Outline the merits and demerits of using the above statistical method

2. Study the table below showing the direction and frequency of wind in a month for station X in Africa:

Direction of wind	N	NE	E	SE	S	SW	W	NW	Calm
Number of days	13	7	3	7	10	20	20	13	7

(a) Draw a simple wind rose to represent the information in the table above

(b) What are the limitations of using the above method?

Compound wind rose

This method represents more complex data than the simple wind rose i.e. it does not only indicate wind direction and frequency but also the speed of wind.

Construction procedure

1. The basic method is identical to the simple wind rose , whether actual or percentage values are used
2. The speed of wind is indicated by varying the width of the column i.e. an increase in width signifies an increase in wind speed.
3. The divisions usually chosen are:

   Less than 4 mph

   4—12 mph

   13—24 mph

   More than 24 mph

Wind speed may also be recorded in knots or in metres per second: (1mph=0.8684 knots, I knot =1.152 mph, 1m/sec= 0.447 mph, 1mph=2.237 m/sec)

4. Winds with least velocity are represented nearest to the centre
5. Colouring or shading of the different sections of the column makes interpretation easier
6. A key must be included/ added

Advantages

1. It the most suitable method to show average direction and frequency of wind over a period of time
2. Gives good visual impression
3. Good for comparison purposes such as the variation in wind speeds
4. Shows a variety of items such wind direction, frequency and varying speed

Disadvantages

1. A bit complex to interpret /assess
2. Consumes a lot of time when drawing
3. Difficult to determine a convenient scale
4. It is not versatile / cannot be used for other items
5. Involves a lot of tedious calculations
6. They do not show seasonal patterns and movement of winds

Assignment 1:

Study the table below showing data for wind direction and speed for area X in Africa:

Wind speed	Wind direction by percentage							
	N	NE	E	SE	S	SW	W	NW
Less than 4 mph	1.3	3.2	2.6	3.4	2.2	4.6	2.0	3.6
4—12mph	2.4	4.0	3.1	2.8	1.7	4.4	3.5	2.5
13—24mph	1.6	4.5	3.6	3.9	1.4	3.7	1.0	2.1
More than 24 mph	0.8	2.5	2.6	1.5	0.8	3.4	0.3	1.0
Totals	6.1	14.2	11.9	11.6	6.1	16.1	6.8	9.2
		Calms: 18.0						

(a) Construct a compound wind rose to represent the above data

(b) Comment on the pattern/ variation of wind direction and speed for place X

(c) Explain the influence of wind systems on the climate of Africa

Assignment 2:

Study the table below showing the mean annual frequency of wind and wind speed for station Z

Wind speed	Wind direction by percentage

	N	NE	E	SE	S	SW	W	NW
Less than 4 mph	1.0	3.0	2.4	3.0	2.0	4.0	1.8	3.2
4—12mph	2.4	4.0	3.1	2.8	1.7	4.4	3.5	2.5
13—24mph	1.6	4.0	3.4	3.6	1.4	3.7	1.0	2.1
More than 24 mph	0.8	2.5	2.6	1.5	0.8	3.2	0.3	1.0
Totals	5.2	13.5	11.5	10.9	5.9	15.3	6.6	8.8

Calms: 20

(a) Construct a compound wind rose to represent the above data

(b) Comment on the pattern of wind direction and speed as shown above

(c) Explain the effects of wind on human activities in Africa

Isoline map / Isopleths maps

This is one of the most widely used methods of representing geographical information. Isolines are lines drawn connecting / joining places/ points of equal value (resulting into a pattern of lines showing the nature of distribution).

Note: other terms used for this method are isarithms and isometric lines. However the word isoline (from the greek word 'isos' meaning equal) is commonly used since it is the simplest and easiest to understand.

Examples of isopleths maps include:

- Contour maps (altitude/ height)—contour lines
- Atmospheric pressure—isobars
- Rainfall distribution –isohyets
- Temperature distribution—isotherms
- Sunshine amount—isohels
- Cloudiness—isonephs
- Ocean depth / depth of water—isobaths

- Salinity—isohalines

The main purpose of isopleths is to act as a visual guide to the interpretation of trends and tendencies which the plotted values indicate.

The isoline method like the shading method begins with a average density or a value similarly expressed for each unit (this value is regarded as typical rather than exactly confined to that area).

Each quantity is plotted on the map within its area as a spot-height' value and in between the 'spot heights' lines are drawn to show the trends of the figures. The method assumes that between any pair of spot heights there will be found only intermediate values and never anything larger or smaller than either of them. For example a contour line for 400m will be found between 300m and 500m. A line for 200m or 600m cannot be found between 300m and 500m.

Method of construction

1. Statistics/ data for as many stations/ points as possible are plotted on the basemap in their correct places/ positions
2. Critical values are carefully chosen to emphasize significant features and also take into account the extent/ range of the statistics to be represented. Value intervals chosen can be based on aregular increase such as 50,60,70…. Or on a geometrical progression (often used for population maps) such as 40, 80, 160, 320…..
3. Draw isolines (in pencil) in accordance with the intervals chosen joining points of equal value.

Note:

- Lines showing altitudes and weather data usually have even values and intervals while lines showing population , crop production, land values etc may have geometric progression as determined by the cartographer/ student.
- If it is necessary to insert an isoline when statistics are not available on the map, interpolation is possible—where it is generally assumed that the increase or decrease between the two adjacent points is at a uniform rate.

4. Isolines cannot cross each other
5. To improve the visual appearance of the map, the zones between the successive isolines can be shaded and this also assists in interpretation of the map i.e. it

serves to draw attention to the spaces or areas between the lines rather than the lines themselves.

Note: the shades becoming progressively heavier as the values increase

6. Isolines should be numbered if coluoring is not employed. Values can be written either in a break in the isoline or on the line, but the figures should be as much as possible horizontal.
7. Isoline maps can also be used to represent averages, percentages or ratios. (An average density figure which has been calculated for a particular area or region, may be regarded as applying to the centre of that area).

Advantages of isoline maps

1. Clearly represents places or points of equal value especially in mapping climatic data
2. Isolines indicate small differences within a statistical unit, especially if careful choice of value intervals is made
3. The intervals between isoline maps suggest a gradual not abrupt change unlike shading maps
4. Isoline maps can be combined with other data such as population and crop distribution related to isohyets (isoline maps can be super imposed on other types of maps)
5. Gives a good visual impression
6. Shows quantitative analysis because it relates data to area

Disadvantages of isoline maps

1. Interpolation of value points is subjective , depending on the judgment of an individual.
2. Consumes a lot of time in construction
3. They occupy a lot of space
4. Difficult to choose a suitable / appropriate intervals between isolines
5. Isoline maps give a wrong impression that increase or decrease between one isoline and the next is at a uniform rate.

Example 1:

Using the base map of West Africa provided,

Example 2:
Using the outline map provided, draw an isoline map to show the pressure belts over North America during winter

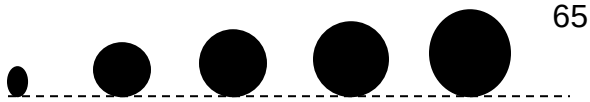
Example 3:
Using the outline map of Uganda provided, produce an isopleth map showing the mean annual rainfall (in mm).

Example 4:
Use the outline map of Kenya showing the mean annual rainfall received and draw an isoline map.

Graduated range of symbols
It is also possible to use a range of symbols which do not depend on a close mathematical relationship to the quantities being represented. Such symbols may be in form of circles or squares, each symbol representing a definite range of values. By an increase in size or its appearance, it indicates increase in quantities.
Note: This method is often used in connection with population maps depicting location and relative sizes of towns and cities.
Procedure:

1. Determine the number of symbols to be used and the range of values each symbol will represent and this is determined by the total range of the statistics given.
2. Note: all values from zero to the maximum should be included, and do not have gaps in the scale.
   Much as it depends on the scale of the map, about 5 or 6 symbols will preferably be adequate.
3. Symbols can range from a small circle or dot to large circle or square. If it is necessary to increase the range of symbols, intermediate values can be represented by the addition of an outer circle or square to the previous symbol.

Note: The range of symbols should give the impression / appearance of increasing values.
Example:



A

B

0—499, 500—999, 1000—1999, 2000—3999, 4000—7999

4. If a graduated range of circles is used (where the number of symbols to be used is small), they should not be confused with proportional circles
5. Indicate both the key and the symbols clearly and accurately.
   Note: As the case with the shading / choropleth maps, it is advisable to prepare the range of symbols which can be readily used when necessary.

Advantages

1. It avoids mathematical calculations such as square roots or cube roots
2. Useful where other methods (such as dots) may result in over crowding
3. The number of symbols used can be adjusted to cover a small or large range of values
4. This method can be used in conjunction with other methods (other statistical maps) to provide additional information on the same map.

Disadvantages

1. Requires constant reference to the key which is tedious
2. It has no direct relationship between the size or the character of the symbol used to represent a particular quantity and the quantity itself (in effect, it is a pictorial or descriptive method with no mathematical basis).

Assignment:

Study the table below showing the population of major towns of The Netherlands, 1992 and answer the questions that follow:

Town	Population size
Amsterdam	1039,000
Utrecht	376,000
Rotterdam	763,000
The Hague	588,000
Leeuwarden	167,000

Groningen	277,000
Zwolle	105,000
Arnhem	163,000
Eindhoven	269,000
Breda	171,000

(a) Using graduated range of symbols and the base map provided, represent the above information

(b) What are the limitations of using the statistical method in (a) above?

AGRICULTURE

Agriculture is the science of growing crops and rearing of livestock. Agriculture is the major activity in many countries contributing a large percentage of the export earnings. It majorly classified as follows:

- Primitive subsistence agriculture
- Intensive subsistence agriculture
- Small holder farming
- Plantation farming
- Nomadic pastoralism
- Livestock ranching
- Dairy farming
- Cooperative farming
- Irrigation farming
- Market gardening and horticulture

NOMADIC PASTORALISM

This is a subsistence form of animal rearing where a herder moves from place to place with his animals grazing them on natural pastures and looking for water. The movement is either constant with no specific direction or seasonal and in specific directions (transhumance).

Nomadic pastoralism is the simplest form of animal rearing and it is common in areas of low and unreliable rainfall-where arable farming is very difficult unless irrigation is employed. Grazing lands are distributed in grasslands and shrub lands for example the dry grasslands of east and West Africa.

Examples of nomadic pastoralists in Africa include:

- The Fulani of northern Nigeria and other parts of the Sahel region
- The Dinka and Nuer of Southern Sudan
- The Berbers and Tuaregs of the Sahara desert
- Somalis of Somalia
- Nama-Herero of Kalahari desert(Namibia)
- Hottentots of south Africa,(and the southern part of Namibia)
- The Maasai of Southern Kenya and Northern Tanzania

- The Turkana of Kenya
- The Bahima and South Western Uganda
- The Karamajong of North Eastern Uganda

Elsewhere the Lapps occupy parts of Europe (northern territories of Norway, Sweden and Finland), the Kirghiz in Turkmenistan in the extreme south of the former USSR and the Bedouin who are the dominant group in Saudi Arabia.

Characteristics of nomadic pastoralism

1) Pastoralists occupy areas of low and unreliable rainfall, which also experience a marked dry season such as Sahara desert, Sahel zone, and Kalahari deserts.
2) The most valued animals are generally cattle although sheep and goats are also common. Camels are kept in the drier areas because they can live for several days without water.
3) Traditional breeds are kept which are usually of low quality and have low milk yields and poor quality meat.
4) The livestock depend on natural pastures which comprise of hard and fibrous grasses and this is attributed to the prolonged drought conditions.
5) The animals are mainly kept for subsistence and the herders do not want to sell off any surplus animal, but this is gradually changing.
6) Large numbers of animals are kept since the pastoralists regard livestock as a source of wealth and prestige /status in society; for performance of social functions (such as paying bride wealth). Large herds offer security against drought, famine or even disease outbreak (some can survive).
7) There is over stocking resulting into over grazing.
8) Grazing is mostly communal, that is, there is no individual ownership of land – land belongs to the whole community.
9) A large amount of grazing land is required to support to support a single herd due to low carrying capacity (number of animals per unit area) of the grazing area.
10) No permanent settlements are put up by herders, since they are ever on the move in search of good pastures and water supply; which movement can be constant or in form of transhumance.

11) No modern scientific methods of animal rearing are used such as spraying against pests and diseases, controlled grazing. Seasonal movements are necessary to ensure sufficient water supply and pasture for animals. During the dry season the pastoralists move near water sources (like rivers, wells).
12) Burning of grass is common during the dry season in anticipation of fresh pastures at the onset of the wet season.

Note: Nomadism is usually confined to the drier regions due to the fear of being interfered with cultivators who prefer well watered areas for cultivation.

Problems facing nomadic pastoralists in Africa

Guiding question

To what are the problems facing the nomadic pastoralists in Africa of their own making?

1. Shortage of water for their livestock since the nomads occupy areas of low and unreliable rainfall. The areas receive rainfall of less than 500mm per year and have severe water shortage for a greater part of the year such as the Sahel parts of West Africa occupied by the Fulani. During the unusually dry years, the pastoralists lose a considerable number of livestock.
2. The pastures are naturally poor in quality given the harsh climatic conditions. The pastures are dominated by coarse grasses which are only nutritious when young. In the dry season, the pastures become parched and brown. The pastures cannot support large of herds of cattle and therefore even poor products are realized. This is this is the case in northern Kenya occupied the Turkana, and Kalahari Desert. The pastures are poor and inadequate; which also explains why the nomads keep moving looking for good pastures.
3. The animals are affected by many pests and diseases. Nagana (trypanosomiasis) is the most common disease transmitted by tsetse flies, most especially in tropical areas between 12^0N—15^0S. Other diseases include: rinderpest, east coastfever, and foot and mouth disease. This has lead to loss of large numbers of animals such as among the Fulani of northern Nigeria. The practice of keeping too many animals results into congestion at the limited water points and this causes easy spread of diseases such as foot and mouth disease. The risk of disease is increased by communal grazing by pastoral

communities leading to overcrowding and mixing of animals of different health status.

4. Periodic invasion of locusts which cause wide spread destruction of vegetation which in turn leads to loss of live stock. The locusts have particularly invaded the Sahel region destroying green vegetation that would support the animals.
5. The native breeds of livestock are of poor quality, they take long to mature and yield little in terms of milk and meat. These however are the only ones capable of surviving in the harsh conditions unlike exotic breeds. The problem is that these native breeds are of little /no commercial value.
6. Long distances moved by the pastoralists with their animals, in search of water and pasture. This results into the thinning of animals/animals losing weight, and hence the decline in quality.
7. Occurrence of wild animals (predators) especially in the tropical parts such as hyenas, lions, wild dogs, and fox. These pose serious threat to the pastoralists and their animals especially as they migrate. The pastoral communities such as the Fulani of northern Nigeria and the Maasai of Kenya and Tanzania are often times in danger.
8. Persistent famine among the pastoralists caused by many factors such as the prolonged drought conditions, infertile sandy soils and cultural conservatism among the pastoral societies such as the Turkana of northern Kenya, and Dinka of Sudan. The pastoralists are on constant move, leaving them with no time to settle down in one area to grow some food crops leading to frequent food shortages.
9. Over stocking resulting into over grazing vegetation destruction and soil erosion. This can be regarded as their own making since the pastoralists keep large herds of livestock for prestigious reasons. This practice results into keeping more animals than the pastures available can adequately support (beyond the carrying capacity).
10. The practice of burning off dead grass during the dry season is wide spread. This however leaves the soil bare, exposing it to soil erosion and worse still it favours the growth of resistant bushes and poorer grasses-less nutritious to livestock. As a result the quality of livestock deteriorates further.

11. Tribal and clan conflicts are also common among the pastoralists, because the pastoralists do not respect international boundaries or other groups of people in their search for good pasture and water supply. They interfere with other tribes and settled cultivators. The problem is worsened by cattle rustling which is a characteristic of African pastoralism. For example the Turkana of Kenya raiding the Karamajong of Uganda. This results into clashes, loss of animals, loss of lives; and this is a problem of their own making.
12. Many pastoral communities are conservative in nature because they do not want to change from their traditional ways of animal rearing. They do not want to immunize or sell off their excessive livestock. This prevents any improvements to be done. They keep large herds of cattle looking at animals as a symbol of wealth, source of bride wealth among others.
    Most of the nomads have negative attitudes towards the construction and maintenance of facilities like bore holes, valley dams—which worsen the quality of their livestock.
13. Hostile attitudes of other people towards the nomadic pastoralists which also compounds their problems such as the negative attitudes of most Kenyans towards the Maasai. This has made the nomads fail to change as they look isolated as a group and they choose to preserve their primitive norms and values other focusing on modernity.
14. Illiteracy/limited or lack of education among the pastoralists since education services have not been effectively extended to them and therefore they are one of the most illiterate communities. This also explains why they are still sticking to their traditional norms and cultures.
15. Remoteness / underdeveloped infrastructure in pastoral areas, making them far from trading centres. The underdeveloped transport networks to the market their animal produce has also prevented the pastoralists from entry into the main stream of economic and political affairs of their respective countries, and hence condemned to remain in a backward subsistence economy. This is the case with the Nama—Herero of the Kalahari Desert.
16. Inadequate/lack of capital to improve their animal rearing. Both the pastoralists and their respective governments do not have the required capital to construct bore holes for water supply and availing drugs- for example the

government of Kenya is not in position to develop the Turkana areas of northwest Kenya. This is due to the low level of economic development and high corruption levels.

17. Government neglect through gazetting large areas of dry lands for national parks, and wildlife reserves. For example in Tanzania the Serengeti national park occupies the dry lands that used to be southern grazing area for the Maasai. More so extension services and model farms (demonstration farms/ranches) have not been extended into many pastoral areas.
18. Rapidly growing population in many parts of Africa which has increased pressure on the pastoral areas such as in parts of West Africa occupied by the Fulani and hence limiting the movement from place to place.

Suggested solutions to the problems faced by the nomadic pastoralists

- Provision of educational services about the value of commercial livestock rearing. For example through adult literacy, seminars, community education, and formal education. The pastoralists are taught about the value of the environment and the need to protect it, how to live a settled way of life which can help them grow some food crops, and also improved methods of livestock rearing. However, the education provided should suit their environment.
- Modification /change of the land tenure system to reduce uncontrolled grazing. Private ownership of land encourages controlled grazing since individuals do not allow the animals of others to graze in their land. This reduces over stocking and hence quality improvement. Land reform also checks the constant movement of pastoralists and makes it easy for government to extend services to them.
- Introduction of demonstration farms—where commercial livestock rearing is practiced through the paddock system, zero grazing, controlled grazing. These are be used as study centres for the nomads to acquire necessary skills to improve their animals and be taught to value quality rather than quantity.
- Provision of extension services/ veterinary services such as the vaccination of animals against disease, hybridization of the animal breeds to improve the quality.

- Provision of permanent water points such as drilling bore holes, building underground tanks. This would encourage the pastoralists to live a settled way of life and practice controlled grazing, and adopting some arable farming.
- Provision of economic infrastructure such as roads, railways, factories and market centres. This can help transform the remote subsistence pastoralism into commercialized livestock farming. In turn the quality of animals improves as monetary value is attached to the animals.
- Diversification of the pastoralists' economy to reduce over dependence on a large number of animals. It can include introducing various activities such as irrigation farming, trade, mining, tourism—which would serve as alternatives to animal rearing.

The Fulani of west Africa

The Fulani are the largest group of cattle keepers in Africa and they are pastoralists scattered over a wide area in the Sahel and savanna zones of West Africa from Senegal to Lake Chad. They are therefore transhumants occupying countries of Senegal, Mauritania, Mali, Niger, Northern Nigeria, Chad, and parts of Cameroon.

The life of the Fulani is adapted to natural conditions of the area characterized by along dry season. The dry season is brought by the dry north easterly Harmattan winds. Rainfall here averages between 750—900mm per annum. In the southern Sahel, rainfall is lower being 500-700mm per annum .The areas also have poor/infertile soils, scarce surface water ,poor pastures and generally remote. The climate supports scattered palms, butter trees, shrubs and during the rainy season short grass. In the southern Sahel the region is more open, trees smaller and vegetation is dominated by thorny bushes.

The Fulani are called transhumants because of their seasonal movements between latitudes. During the dry season they move southwards in order to look for water and pasture. At the onset of the dry season they move together but as the dry season progresses, they diverge into small groups grazing far and wide. In the grazing they move closer to the watering points and often send out scouts to find out where there is grass and water before they can advance. The movement

southwards takes place during the dry season because the tsetse flies will also have migrated further southwards.

During the wet season, when the rains start coming, the nomads start moving northwards. When rains come, the condition of the cattle changes positively, (because during the dry season they become thin and lean due to shortage of water, poor pasture and long distance movement). The Fulani move northwards following the movement of tsetse flies northwards, yet the conditions in the north are at least better.

In their movements, the Fulani try as much as possible to avoid contacts with diseased herds. The Fulani do not undertake any crop cultivation and they engage in barter trade with cultivators.

Among the very many problems facing the Fulani pastoralists, their life is also complicated by the rainy season because the herders would construct temporary houses in muddy camps and the soil conditions also hinder cattle movement due to waterlogged ground. Still during the wet season, there are many flies and increased threat from hyenas. The foot and mouth disease is more common during the wet season.

Reasons why nomadic pastoralism has persisted in various parts of Africa

1. The harsh climatic conditions characterized by low and unreliable rainfall and having a marked dry season. In such areas cultivation of crops is very difficult unless irrigation is practiced. Therefore nomadic pastoralism which can adjust to the harsh climatic conditions tends to offer the best alternative land use such as in the Turkana areas of northern Kenya. They also tend to keep large herds of animals as insurance—that some can survive in case of prolonged drought.
2. The grassland vegetation in the pastoral areas which favours pastoralism in a number of ways. First, it facilitates the movement of both livestock and the herdsmen, it does not favour survival of dangerous pests and diseases, and it is easy to detect enemies such as wild animals. It is easy to burn when old and non-nutritious so that tender grass can grow during the next wet season – making pastoralism to persist. This is the case with the savanna zones of the Fulani in West Africa.

3. Infertile soils in the pastoral areas such as rocky, sandy soils which also prevents a settled way of life such as by limiting arable farming (growing of crops) and forces the pastoralists to stick to traditional animal rearing. For example the sandy soils in Botswana and Namibia.
4. Generally flat relief/landscape in the pastoral areas such as large areas of the Sahel region occupied by the Fulani, Dinka and Nuer among others. This allows easy movement of pastoralists and their animals over a large area.
5. Sparse population of the pastoral areas hence vast areas are empty ,which makes the pastoralists to keep on shifting from one place to another such as the Kalahari desert occupied by the Nama-Herero, Sahara desert occupied by the Tuaregs among other areas. Nomadism persists since other people are not attracted to such areas.
6. Traditional/cultural conservatism of the pastoral communities with many pastoralists look at nomadism as the best way of life. They consider themselves as cattle keepers and are not willing to change their practices away from pastoralism. For example despite government efforts to settle and transform the Maasai, most of them are still nomadic in the southern part of Kenya.
7. The pastoralists greatly depend on their animals as a source of livelihood in form of milk, meat and blood; clothing in form of hides and skins; and transport in case of camels. This is the case with the Dinka and Nuer of Southern Sudan who raise cattle, sheep, and goats for their livelihood. To the pastoralists, therefore their animals can provide almost everything they need, which also explains the persistence of pastoralism.
8. The value attached to the animals by the pastoralists, who look at the animals as a basic payment of bride price, a symbol of wealth, prestige and power in society—such as among the fulani of Mauritania, Senegal, and Northern Nigeria. They therefore keep large herds of livestock regardless of the quality; which also explains the persistence of nomadic pastoralism.
9. Hostility of the nomads to foreigners. They resist any foreigners into their areas because they take it as a threat their land and animals. They often pick up arms to fight foreigners who move in their areas such as the Turkana of

northern Kenya. This has also prompted many people and organizations to ignore the pastoral areas.

10. The land tenure system –communal ownership of land in the pastoral areas. Land does not belong to particular individuals. The pastoralists are therefore free to use the land without any restrictions, which encourages their constant movement from place to place with their animals.
11. Underdeveloped infrastructure such as road network making them remote and far from marketing/trading centres, which has prevented them from entering the main stream economic and political affairs of their respective countries. For example the Nama-Herero and Kavango of Namibia in the Kalahari desert.
12. Insufficient capital for the respective governments leading to the neglect the pastoralists such as the failure to set up ranching schemes and the required infrastructure or irrigation facilities; which factor also greatly explains the persistence of pastoralism.

Qn. Account for the persistence of nomadic pastoralism in the Sahel region of Africa.

Note: Sahel region extends from northern Senegal in the west to eastern Sudan in the east.

Other Questions

1) To what extent are the problems facing nomadic pastoralists in Africa of their own making?
2) Discuss the problems facing the nomadic pastoralists in Sub-Saharan Africa.
3) Discuss the factors for the persistence of nomadic pastoralism in Sub-Saharan Africa.
4) Examine the view that pastoralism is the best land use in the areas where it occurs.
5) Examine the view that the Fulani of northern Nigeria have made the best use of their environment.

Agricultural modernization

Agricultural modernization refers to the application of modern and scientific methods to agriculture and replacing traditional methods to increase quality and quantity of yields. Or This is the transformation of agriculture from the

subsistence sector into an economically dynamic sector that responds to market demand, descent livelihood among others.

Agricultural modernization is based on a number of strategies: agricultural mechanization, intensive farming, land reform, commercialization of farming, agricultural research, agricultural extension, diversification of agriculture, pricing and marketing polices provision of credit facilities among others.

Factors responsible for the low level of agricultural modernization in tropical Africa

1. Low and unreliable rainfall that limits the range of crops grown such as in northern Kenya, Botswana, and central Tanzania (arid and semi-arid regions). It limits planting and causes crop failures after planting. Unreliable rainfall also causes shortage of pastures, hence affecting livestock rearing. On the other hand, very heavy rainfall leads to flooding and destruction of farmlands. All this undermines the effort to modernize farming in the tropics.
2. Infertile soils leading to limited cultivable land and low productivity. Agricultural production requires fertile and easily cultivated soils for the growing of crops and improved pastures for livestock. Large areas of the tropics have infertile soils, shallow and stony soils unsuitable for crop cultivation such as Northern Kenya, North eastern Uganda and parts of Zambia. This undermines agricultural modernization for example it requires increased use of artificial fertilizers and manure which are expensive.
3. Rugged terrain/landscape in some parts /mountainous areas such as Ethiopian highlands, Burundi highlands, Kilimanjaro, Elgon, Mt. Cameroon areas limit agricultural modernization. There is severe soil erosion which reduces soil fertility; landslides which destroy farmlands. Rugged landscape also hinders the development of transport routes and limits agricultural mechanization leading to low and poor yields.
4. Pests and diseases including tsetse flies causing Nagana (trypanosomiasis) in cattle and sleeping sickness in human beings—like the savanna areas of West Africa and central Tanzania. Locusts have also invaded large areas of West Africa and northern Kenya causing widespread destruction of vegetation/ crops. Others include rinderpest, cassava mosaic, coffee berry disease resulting into low and poor quality output.

5. Poor land tenure system for example communal ownership of land doesn't encourage private investment and does not give security for acquiring loans to improve production. Customary ownership and inheritance system in many parts of the tropics has led to land fragmentation and land conflicts; and yet modern farm machinery is difficult to use on very small plots. There are also many cases of absentee landlords which leaves many areas unutilized for agriculture.
6. High degree of conservatism in many parts of the tropics, that is, people are slow in taking up scientific methods due to strong commitment to traditions and cultures. Nomadic pastoralism is associated with overstocking and reluctance to grow crops such as among the Fulani of northern Nigeria and the Turkana oa northern Kenya. In northern Zambia some people are engaged in shifting cultivation which has hindered modernization. In some communities it is believed that tractors reduce soil fertility while in other areas farming is regarded as a job for women.
7. Population pressure due to high population growth in many parts of tropical Africa which negatively affects agricultural modernization. It limits the land available for agriculture in areas with increased populations such as southern Nigeria, kikuyu land in Kenya. Rapid population increase has also led to land fragmentation and hence difficult agricultural mechanization.
8. Inadequate capital to modernize agriculture. Limited mechanization has taken place in many areas due to lack of a wide range of farm implements. There is limited capital to purchase farm machinery, fertilizers, agrochemicals, better seed varieties and improved animal breeds. The maintenance and running cost of agricultural machinery are too high and most farmers cannot afford. In many areas limited or no irrigation has been done.
9. Limited market locally and internationally. Low prices are generally offered and delays in payment to the farmers have greatly discouraged agricultural modernization. There are no well developed agro-based industries to provide ready market. Still some agricultural crops are too cheap to justify mechanization. The foreign market is limited by the competition from synthetic substitutes such as artificial from oil to replace natural rubber,

polyester and nylon to replace cotton and wool. This has also discouraged many farmers from modernizing their activities.

10. Poorly coordinated agricultural education. Many peasant farmers are illiterate and lack skills in modern agriculture, cannot forecast changes in demand and supply conditions. They concentrate on the same crops whose demand may be falling; and yet many still use poor farming methods such as over cropping and monoculture. More so the education system rarely provides agricultural skills of self-sustenance and modernization.
11. Low levels of technology employed since agricultural production is dominated by the use of traditional implements such as the panga, hand hoes, axes; which limits output per unit area. There is limited or no use of tractors, oxen, and irrigation facilities.
12. Under developed transport facilities which hinders the marketing of agricultural products since it is not easy to access market places. It also limits the transportation of agricultural inputs as well as dissemination of the latest agricultural techniques. Most of the feeder roads are dry weather roads and tend to be impassable during the wet season.
13. Limited research in farming activities which limits the development of high yielding crop varieties and better livestock breeds. In many areas research is less organized, with many problems of disseminating research findings to the farmers, shortage of funds and expertise to carry out research. Information dissemination has been a major challenge to agricultural modernization in tropical Africa. This has left many farmers depending on traditional local crops and animal breeds.
14. Limited and ineffective agricultural extension in tropical countries. Where it has been made relatively effective, agricultural extension is usually to the rich successful farmers who may not be necessarily in need of it, and the majority especially women who do the bulk of agricultural work have been neglected.
15. Poor storage facilities for agricultural output. During the peak harvests there is high post-harvest wastage of produce which remains in the rural areas of the tropics such as coffee, maize, beans, groundnuts, destroyed by rats, weevils, other insect pests and leaking storage houses. This reduces farmers' incomes and discourages further agricultural investment. Poor storage facilities are also

a major cause of price fluctuations of agricultural products, which discourage farmers.

16. Endless political instability in many parts of tropical Africa for example in Liberia ,DRC, Ivory coast, Burundi, Angola, Nigeria , Zimbabwe, Somalia,—which political instabilities have led to the abandonment of farmlands as people are often chasing for their lives . The wars have also hindered long-term planning in the agricultural sector. This has increased government spending on wars instead of funding agriculture, and also caused general infrastructure destruction.
17. Unfavourable government policy towards the agricultural sector. Inspite of being the leading sector in the economies, governments have done little to develop it leaving it to the mercy of nature, with prices the lowest yet the marketing has not been streamlined. This has kept the incomes low and people employed in agriculture the poorest. Some governments have emphasized mining (such as copper mining in Zambia and oil mining in Nigeria) and industry (such as in Zimbabwe Mozambique). The poor agricultural planning, pricing policies and lack of affordable credit facilities—all undermining agricultural modernization.
18. Corruption and embezzlement of funds meant for agricultural development. The funds meant for agriculture do not reach the local farmers as intended but instead swindled/diverted by the top officials. The loan funds are also given to farmers selectively—leaving most rural farmers uncovered.

Possible strategies to increase agricultural production in tropical countries

1. Control pests and diseases such as by spraying with chemicals, dipping of cattle.
2. Introduction /developing of improved crop varieties and animal breeds –which are high yielding and disease resistant.
3. Land reform—changing the land tenure system to achieve efficient land utilization. There is need to avoid land fragmentation and put scattered plots together to warrantee mechanization. There is need to promote individual and cooperative ownership of land.

4. Emphasize agricultural education such as through extension services, short courses for farmers, newspapers and television programs for the farmers to adopt modern agriculture.
5. Population control measures need to be emphasized to reduce /minimize land fragmentation.
6. Provision of agricultural credit at affordable terms, for farmers to purchase farm inputs like fertilizers, machinery, improved seeds.
7. Liberalizing marketing of agricultural output and encouraging cooperatives, establishment of processing factories. There is also need for market research to expand foreign markets.
8. Encouraging agricultural diversification to minimize problems of price fluctuations.
9. Improving transport facilities such that markets are accessible.
10. Establishment of more agro-based industries to add value to agricultural output.
11. Empowering women
12. Introduction/emphasize irrigation facilities in the arid and semi-arid areas or other areas where rainfall has become unreliable. This reduces dependence on nature.
13. The governments should address political instability in their respective countries for example through peace talks and also work for regional security.

Guiding questions

1) With reference to either Zambia or Nigeria, examine the factors limiting the modernization of agriculture.
2) With reference to specific examples , account for the low level of agricultural modernization in tropical Africa
3) Discuss the factors limiting increased agricultural production in the developing world.
4) Account for the low level of agricultural productivity in any one country in tropical Africa.

Note: Agricultural productivity refers to the amount of output per unit of land/area. Agricultural development aims at increasing output per unit area, improving quality of produce among others.

PLANTATION FARMING

Plantation farming refers to the growing of one or two crops on large scale using scientific methods, basically for commercial purposes. Under this system the product is either fully processed or semi-processed on the plantation. The system is at times referred to as extensive agriculture.

Plantation farming is found/developed in parts of Asia, Africa, tropical and sub—tropical America. In tropical countries plantations were introduced by Europeans and most of these are still owned by foreign companies. The type of crops grown under plantation depends on the location of the area, rainfall amount and reliability, temperature and the soils. Examples of big plantations include:

- Rubber growing in Malaysia, Indonesia, Thailand, Nigeria, Liberia.
- Sugarcane growing in Brazil and Natal province of South Africa.
- Tea growing in Sri-Lanka, Kenya highlands and Malawi.
- Oil palm in Zaire (DRC), Gabon, Cameroon, and Nigeria.
- Cocoa growing in Brazil
- Tobacco growing in Zimbabwe
- Coffee growing in Brazil

Characteristics of plantation farming

1. Crops are grown on large scale. The plantation estates cover hundreds ands to thousands of hectares of land.
2. Plantations usually specialize in the production of a single crop for a long time (monoculture). In some cases however two or more crops are grown on the same plantation depending on the level of organization.
3. Large numbers of workers are employed –skilled, semi-skilled and unskilled labour. Sufficient labour is recruited from several areas.
4. Involves heavy capital investment to set up the plantation infrastructure such as constructing transport routes, housing estates, setting up processing plants among others.

5. Plantation crops have a long gestation period between 1.5 years to 7 years for any harvest to be made and therefore increasing the costs. For example sugarcane—1.5 years, oil palm—3 years, Cocoa—5 years, and rubber—7 years.
6. Many plantations are owned by foreigners. For example the British own large tea plantations in India, Sri-Lanka and Kenya. The British also own rubber plantations in Malaysia. The French own coffee and cocoa estates in Cameroon.
7. Plantation farming is characterized by high output because large areas of land are cultivated using improved seeds.
8. The plantations are scientifically managed, involving mechanization, application of fertilizers and farm chemicals for quality and quantity output to meet standards and demand.
9. The plantations are highly mechanized involving use of tractors, bulldozers, combined harvesters, sorters, and processors among others.
10. Plantations crops are intended for sale, that is, it is commercial-oriented either for domestic of foreign markets.
11. Plantations are mainly confined to the tropical latitudes such as tropical America, tropical Africa.

Advantages of plantation farming

1. The companies or individuals running the plantations have huge capital and therefore can undertake the processing of the produce efficiently and economically. Plantation agriculture has a considerable advantage in producing crops like palm oil, sugarcane, rubber requiring much processing before marketing.
2. High output is realized because large areas are cultivated using scientific methods. The plantations ensure regular supply of produce, which also accounts for the establishment of factories than exporting bulky raw materials.
3. Provision of many employment opportunities since the plantations are large enterprises, i.e. skilled, semi-skilled, and unskilled workers. People are employed on the plantations, technicians, managers; and from the incomes they get the standards of living improve.
4. Acquisition of skills by the workers on the estates. They get chance to train in special skills without spending. For example skills in maintenance of

machinery, application of fertilizers and farm chemicals, identifying diseased crops, picking and sorting skills. These skills are employed in the rural area leading to rural transformation.

5. Promotion of out grower schemes. Plantation authorities increase output partly by buying produce from farmers (out growers) outside the main plantations. The out growers benefit from the advice, inputs, ready market provided by the plantation authorities –leading to overall agricultural development.
6. Promotion of research since the estate owners undertake research to generate high quality varieties of crops which are fast growing, disease resistant and high yielding leading to higher incomes. There is also research in other types of crops.
7. Generation of government revenue through taxation of the plantation estates, workers' incomes, export duties and land rent. The machinery imported is also taxed. The out grower farmers are also taxed—hence widening the tax collection. The tax revenue helps to support several sectors of the economy such as health, education.
8. Development of infrastructure. As plantations are being developed a number of facilities are put up such as roads, housing estates for the workers, schools for the children of the estate workers, medical facilities, and recreation facilities. These facilities do not only benefit the estate owners and workers but also the community.
9. Foreign exchange generation since the crops grown on the plantations are exported to other countries. For example the rubber in Malaysia is exported to Japan and USA. The foreign currency generated is used in the importation of machinery and consumer goods not produced locally.
10. Promotion of international relations between producing and importing countries or the countries from where the companies originate. This is good for mutual benefit of all economies such as increased trade contacts, investment, foreign aid inflow
11. Marketing of output is easy. This is because the estates are operated on large scale and hence large quantities are put on the market and there is constant

supply throughout the year to satisfy the markets. The estate owners also have contacts in various countries.

12. Promotion of industrial development. Estate farming provides raw materials for the industrial sector , and yet the plantation products have forward and backward linkages such as sugarcane used in the making of sugar and the sugar is used in the making of confectionary products , yet even the by-products are used in making spirits , cardboards, fuel.
13. Promotion of urban development. Urban centres have come up with associated facilities such as hospitals, banking facilities, market centers, and other facilities. For example Sezela, Tongaat and Felix towns owe their development to the sugar cane growing in Natal.
14. It is easy to acquire and extend credit because of enough security. The estates possess large assets which are used as collateral security for obtaining loans. Still due to their large contribution to the economy, the governments often stand in to pay loans if the plantations fail to do so.
15. Ensures that there is no wastage; since every thin g is controlled through administration. For example crushed sugarcane stems can be used as fuel; coffee husks used as fertilizers.

Disadvantages of plantation farming

1. Leads to soil exhaustion (decline in soil fertility) due to the growing of a single crop year after year and therefore lower yields in the long run with diminishing returns. To maintain output high, fertilizers have to be added, but this increases the costs of operation on part of the estate owners.
2. Associated with price fluctuations on the world market due over concentration on a single crop. Over production in particular years/seasons leads to big losses and to maintain themselves in business, the estate owners have to reduce salaries /wages of workers or delay payments. The out grower farmers are also frustrated as the estate authorities may not buy their produce.
3. High costs of starting and maintenance of the plantations. It requires large capital investment including purchase of machinery, setting up the necessary infrastructure (like feeder roads, workers' houses); management of workers; and yet many people in developing countries cannot afford high capital investment. It is for this reason that estate farming is dominated by foreign

investors who tend to exploit the local labourers by paying them very low salaries/wages.

4. There is greater risk of spread of pests and diseases due to growing of a single crop over a large area; yet these are less likely to spread on small peasant holdings with a mixer of crops. Still most plantations are in tropical areas which have conditions conducive for the survival of pests.
5. There is profit repatriation since most plantations are owned by foreigners. They send most of the profits out to their home countries which undermine further investment. For example rubber plantations in Liberia owned by firestone company from USA.
6. Employing a lot of labour leads to diminishing returns to scale and eventual profit decline. Still the effort put in by workers is less than if they were managing their own small plots/farms.
7. Many plantation crops take long to mature such as rubber taking 7 years, cocoa –5 years. This long gestation implies reduced incomes to the farmers during the same period yet they continue paying workers and maintaining the estates.
8. There are problems of clearing and maintenance of access roads to various parts of the plantations. A dense vegetation cover is difficult to clear this has to be done frequently. The plantations occur in tropical areas with heavy rainfall and high temperatures, which conditions favour rapid vegetation growth.
9. There is a likelihood of famine since the plantations are concentrating on cash crops (non-food crops) such as coffee, tea, palm oil, rubber. More so even the out grower farmers tend to concentrate on the plantation crop.
10. Plantations have been one of the major causes of population movements especially the young able-bodied men who seek employment on the estate farms. Production /cultivation in rural areas has been left to women and energetic and less efficient, hence low production in the countryside /rural areas.

SUGARCANE GROWING IN NATAL

Natal is one of the provinces of the republic of South Africa, and it is a coastal area just outside the tropic of Capricorn which at the moment is the most

important sugar cane producing area in Africa. In Natal province sugarcane was first grown in 1851.

Sugarcane growing is confined to a narrow strip of land extending rarely 25km from the coast. Most of the sugar is grown on the coastal plain between Margate and Lake St. Lucia a distance of 400km.

Organization of sugarcane growing in Natal

There are well over 362,000 hectares of Natal's farmland devoted to the growing sugarcane. The 25 vast estates are owned by big companies. Sugarcane takes 18-20 months to mature, and the canes are transported by lorry or railway to factories; sugarcane industry is administered by the South African sugar association (SASA) which is one of the biggest corporations in the world. In addition there are very big farms owned by individual farmers and about 10 % of the natal sugarcane production is produced by single (small scale) farmers. Still at least processed and a Variety of items s extracted.

A sketch map showing sugarcane growing areas in Natal—South Africa

Factors which have favoured sugarcane growing in natal

1. Influence of the warm Mozambique current—southward flowing current keeps the temperatures up over the Natal coast where sugarcane is grown. Sugarcane is a tropical crop and therefore killed by frost yet in natal it grows in the temperate latitudes. It is therefore the warming effect of the Mozambique current which enables the growing of sugarcane up to beyond latitude 30^0s. It is for the same reason that sugarcane growing does not go far away from the coast, because the warming effect does not penetrate far from the coast.
2. The on-shore winds which blow over the warm Mozambique current. These bring in moist conditions to the Natal coast, as they pick up moisture later forming clouds and causing moderate rainfall, which makes sugarcane growing and maturing possible.
3. The general high water table levels, which compensate for the low rainfall received. Natal area receives on average 1000mm of rainfall per annum which is not enough for sugarcane growing (since sugarcane requires rainfall ranging from 1800-2500mm per annum). This shortfall is partly compensated by the

fact that a large area of Natal has a high water table level, and the sugarcane plants easily get their water requirements from underneath.

4. Availability of water provided by rivers like Umkuse, Umgeni, Tugela, Pongola, Umfolosi (and proximity to the Indian Ocean); to supplement rainfall through irrigation for the growth of sugarcane. Besides the water is used in sugar processing industries and for domestic purposes in the labour camps.
5. Low altitude/ low lying coastal land suitable for growing of sugarcane. In this part of South Africa, higher altitude is further inland, which otherwise would mean reduction in temperatures leading to frost. Therefore the low lying nature of the sugarcane growing area helps to keep the temperatures high – avoiding frost.
6. The generally flat landscape of the Natal region which promotes mechanization such as use of tractors, trucks, Lorries, and also favours the development of infrastructure like roads, railways, and accommodation facilities.
7. The deep, dark, fertile alluvial soils washed from the Drakensburg mountain ranges. The coastal soil is kept fertile by constant alluvial erosion and application of fertilizers favouring sugarcane growing.
8. Presence of extensive land for sugarcane growing. The plantations cover over 360,000 hectares; and occupy the coastal plain between Margate and lake St.Lucia, a distance of about 400km.
9. Large supply of skilled and unskilled labour to work in plantation farming. The cheap labour is provided by the Indians, black Africans and migrant workers from surrounding countries (like Lesotho, Malawi, and Swaziland). Many Africans flock to South Africa because it is more developed and offers more job opportunities. Remember that labour is required in sugarcane operations especially planting, weeding and harvesting. There is also trained skilled labour used in the operation and repair of machines, managerial work.
10. Presence of adequate capital to invest in the sugar industry by setting up sugar plantations, processing plants, road network, labour camps; was provided by the South African sugar Association (SASA). There are also big companies and individual business men farmers who have invested in sugarcane growing. The SASA guarantees loans secured by companies to expand their operations.

11. Presence of a large/ ready market for sugar, both domestic and abroad. South Africa has a large European population in the urban centres (like Pretoria, Vereeniging, Witbank, Durban); and Indians with relatively high income to spend on items like sugar. There is a ready market in the industries making confectionery products. The market is also provided by neighboring countries like Namibia, Botswana. Other export markets include: USA, Japan, Canada and UK. This in turn encourages sugarcane production in Natal.
12. Presence of cheap transport facilities in the area especially the railways stretching along the coast and roads in the region where sugarcane growing is concentrated. This enables transportation of sugarcane to the processing plants. Sugarcane is very bulky and yet little is extracted from it and as such cheap transport is necessary. The transport network also provides accessibility to the markets such as Johannesburg and Pretoria, as well as export ports (like Durban).
13. Increased research to develop better varieties of sugarcane which are quick maturing, high yielding and disease resistant. Some varieties were imported from Mauritius and Cuba and localized by South African researchers.
14. Presence of improved technology used for example in planting, and processing of sugarcane has also improved quality and quantity of output. Land is ploughed using tractors among others. This has reduced operation costs since the companies do not have to employ many workers.
15. Supportive government policy towards the sugar industry such as by reducing taxes on machinery used and fertilizers. The government has also set aside a loan scheme through the commercial and development banks to be accessed by sugarcane growers. It also taxes sugar imports heavily to protect local sugar. The government further carries out market research to expand the export market for natal's sugar.

    Uses of sugarcane/sugar

    - Sugar is used for sweetening such in tea, cold drinks
    - Sugar used in baking as a raw material such as biscuits, chocolate, sweets
    - Use in coating drugs / pharmaceuticals
    - Manufacture of alcoholic drinks at jiggery or spirits

- Molasses (remaining liquid after sugar has crystallized) is used to make cattle feeds, manure, polishes, food yeast
- bagasse (remaining cane stalk after removing juice) is used to make straw boards
- bagasse is also used to provide fuel
- Sugarcane tops and trash are also used in the making of animal feeds, paper boards and packing papers.
- Green and dry leaves provide manure.

Importance of sugarcane growing to South Africa

1. Promotion of infrastructural development especially transport routes intended for easy movement of machinery, movement of workers and sugar distribution. There are road and railway networks along the coast running from port Shepstone via Durban to Empangeni, and several feeder roads within the plantations. These networks have supported several other activities such as trade, tourism.
2. Generation of foreign exchange through the exportation of sugar to other countries such as the neighboring Namibia, Botswana. With the ending of apartheid in South Africa; markets were further widened to USA, Japan, UK, Canada, and COMESA countries—leading to increased export earnings from Natal sugar. The foreign currency is used in the repayment of foreign debts, payment of expatriate labour and to import foreign technology and consumer goods not available locally.
3. Generation of employment opportunities for many people of South Africa in the plantations and processing industries. People are employed as casual workers to plant, weed and harvest sugarcane. There are also trained engineers and technicians in the factories, managers, accountants, marketers and distributors. They earn salaries or wages which they use to improve their standards of living/economic welfare.
4. Promotion of industrial development that is, Sugar processing plants have been set up such as at Durban, Shepstone, Hullets, and Tongaat. Still several other industries using sugar as a raw material have developed such as those making biscuits, sweets, bread and other confectionary products. These have added value to exports, hence increasing the export earnings.

5. Generation of government revenue through taxation of sugar companies or individuals engaged either in sugar growing or processing. The government also issues licenses to the companies importing machinery or those exporting sugar or related products. The revenue generated is used to finance several sectors of the economy such health, education. Had it not been plantation agriculture, the government would get less revenue.
6. It has facilitated diversification of the economy. Originally the economy was heavily dependent on mining, but the growing and processing of sugar has widened opportunities for the country (economic base), and hence increased foreign exchange earnings, government revenue as well as job opportunities.
7. Strengthened international relations between South Africa and other countries which import its sugar and sugar products such as USA, UK, Japan, Canada, and African countries. South Africa also relates with other countries engaged in sugar growing (like India, Brazil, Jamaica , Swaziland, Mozambique, Egypt) as a way of sharing ideas about standards of production Some of the benefits arising from such relations include preferential treatment in bi-lateral trade, encouraging foreign direct investment and coming up of various projects in the country.
8. It has promoted the growth of towns because of setting up housing estates for the workers and due to being administrative centres for estates for a long time. The towns include Sezela, Stanger, Margate, and Empangeni. Some towns are ports handling exportation of sugar products and importation of machinery such as Durban, and port Shepstone. Most of Natal's sugar is exported through the port of Durban. The towns/ports are associated with various facilities such as recreation, hospitals, educational facilities, and banking facilities.
9. Promotion of out grower schemes. Out growers are individual farmers outside the main plantations growing sugarcane. The SASA helps the out growers by organizing marketing and negotiating prices. The out growers get fertilizers, pesticides and new varieties from the main estates. They also get advice on all matters connected with sugarcane growing. These out growers have increased production and people's incomes.

10. Promotion of agricultural research. The SASA has a research institute at Mt.Edgecombe which develops new varieties of canes, experiments with pests and disease control, sol improvement and fertilizer application techniques. All the findings are continuously passed on the farmers / members of the sugarcane growing industry.
11. Sugarcane growing has facilitated technological progress for example scientific methods used in the growing of sugarcane, maintenance of machinery and industrial processing technology.
12. Promotion of tourism development for example the sugarcane estates in Natal, processing industries and accompanying infrastructure have attracted researchers, holiday makers and travelers to Natal-south Africa. The tourists bring in foreign currency and provide market for the local products such as food, hand crafts, and furniture.

Negative effects/short comings

1. Encourages rural-urban migration. Many people have left the rural areas in search of jobs in towns which have developed due to sugarcane growing, leading to the shortage of labour in rural areas. Production in the rural areas is left to the women and old people who are less energetic and less efficient. This partly explains rural under development.
2. Sugarcane growing has negatively affected the growing of food crops in some areas, since many people have given up the growing of maize, sweet potatoes, among others ad concentrated on sugarcane which they look at as more paying. The reduction in food production has weakened the country's food security.
3. Associated with profit repatriation since some estates are owned by foreigners. This undermines further investment in the sugarcane growing industry. Still the foreigners exploit local workers by paying them very low wages and salaries.
4. Soil exhaustion due to growing of the same crop (sugarcane) year after year. Reduced soil fertility leads to low yields in the long run and to maintain output high, fertilizers have to be added which are very expensive.
5. High costs of starting and maintenance of plantation farms.
6. Environmental pollution from the resultant industries.

7. Regional imbalance in development, in terms of infrastructure.
8. Plantation farming is associated with urbanization and related problems.

Problems facing sugarcane growing in Natal

1. Pests and diseases which affect the sugarcane especially during the dry season such as stem borers, yellow wilt, ratoon stunting disease.
2. Calamities such as floods by rivers, severe drought; make the whole wealth of the plantations to be destroyed.
3. Inadequate supply of labour required for certain activities such as during the busy periods of weeding and harvesting. With the stopping of apartheid policy, with more freedom many Africans are looking for better jobs away from the sugar plantations such as urban industry—leading to a labour crisis.
4. Labour strikes are common on the estates; involving many blacks who feel exploited. They often times destroy the plantations and plantation infrastructure, and bring work to a standstill.
5. Competition from other sugarcane growing countries on the world market such as Brazil, India, china, Thailand, Mexico, Philippines, Cuba and African producers. For example in the 1970 s the sugar prices went down greatly due to over production, which severely affected sugarcane production.
6. Sometimes there is delay in delivery of canes to processing plants especially from out growers, which also undermines productivity and efficiency.
7. The costs of producing sugarcane are increasing, due to increasing costs of acquisition and use of fertilizers; use of costly irrigation facilities; and because of political changes the black labourers are demanding for higher pay which pushes up the costs of production.
8. Soil exhaustion due to monoculture, leading to low yields.
9. Fire out breaks which sometimes destroy large areas of the plantations

<u>World sugarcane production</u>

Most of South African sugar is produced and output of about 1.5 million tons a year is consumed locally. However a considerable quantity is exported to USA, Japan, UK, Canada and African neighbours.

The large sugar producers in the world in order of production level include: Brazil, India, china (including Taiwan), Thailand, Mexico, Australia, Philippines, South

Africa, and Cuba. Others are: Argentina, Colombia, Peru, Ecuador, Dominican Republic, Jamaica, Egypt, Swaziland, Tanzania, and Uganda.

RUBBER GROWING IN LIBERIA

In tropical Africa the most important country with plantation agriculture is Liberia and the most important crop is rubber, although other crops like coffee, cocoa, oil palm, sugar are also grown. It is a country of West Africa famous for rubber growing and rubber production stared as far back as 1910, when the British planted 800 hectares at Mt. Barclay near Monrovia, but later on abandoned due to falling world prices.

The physical conditions were later examined by the firestone company from USA, when the British wanted to gain monopoly over the Malaysian rubber sources. In 1926, the US based Firestone company obtained a 999 years lease to establish plantations in Liberia and since then rubber has played an important role in the economy of Liberia.

The largest plantation was established at Harbel on the Farmington River with approximately 25km from the coast, and the other at Covalla in the extreme south east of Liberia. In all there are nearly 120,000 hectares devoted to rubber production. About 60,000 hectares belong to Liberia individual farmers.

A sketch map showing rubber growing areas in Liberia

Note: Various types of natural rubber exist in Liberia. The manihot tree, ceara tree and several others grow in the wetter parts of Africa. The hevea tree (now known as hevea braziliensis) from Brazil is also grown in West Africa including Liberia. Other rubber production companies in Liberia include the Liberia Company, Alan L. Grant Company, African Fruit Company, B.F .Goodrich Company, Salala Rubber Corporation, Liberia agricultural company.

Factors for the establishment and development of rubber plantations in Liberia

1. The heavy rainfall averaging over 2500 mm per annum; with a long wet season extending from April to November. Rubber requires evenly distributed throughout the year and reliable rainfall to grow fat and produce a lot of

latex/sap. The heavy rainfall in Liberia is provided by the onshore winds passing over the warm guinea current.

2. Hot temperatures throughout the year ranging from 24-27^{0}c favouring the growth of rubber trees. The area lies within the equatorial region and therefore hot temperatures supporting rubber growing.
3. Presence of well drained fertile soils partly explained by the climatic conditions characterized by heavy rainfall, equatorial vegetation. This also favours growth of rubber trees.
4. Low altitude also partly responsible for the hot temperatures in Liberia, which in turn favour the growth and maturity of the rubber trees-to produce a lot of latex.
5. The generally flat landscape/relief which enables mechanization where rubber growing takes place.
6. The influence of tropical rain forests which provide shade for the seedlings.
7. Availability of extensive land for rubber growing.
8. The failure of the Henrys ford rubber plantations in the Amazon in the 1920s. This prompted the US motor industry led by Firestone Tyre Company to look for alternative source of rubber elsewhere and this was discovered in Liberia. The failure was due to problems of inadequate labour, disease and transport problems. Eventually the firestone company acquired a 999 year lease to grow rubber in Liberia.
9. The monopoly over rubber produced Malaysia by British firms. This also prompted the American motor industry to look for an area where they could get the required rubber. This resulted into setting up large plantations in Liberia such as at Harbel near Farmington River.
10. Presence of adequate capital provided by large to establish plantations/rubber estates such as the Firestone Company from USA. The biggest company plantation is the Harbel plantation situated near Farmington river about 25km from the coast (over 34,000 hectares), and another at Covalla near the border with Sierra Leone. Other companies include: Allan L Grant Company, Salala Rubber Corporation, and B.F. Goodrich Company.
11. Large supply of skilled and unskilled labour. The initial skilled manpower was acquired from USA by the Firestone Company with time more skilled labour

was trained in Liberia like skilled tappers, spraying, industrial workers, mangers, engineers. Many people were recruited from various parts of West Africa to work in the rubber industry.

12. The development of transport infrastructure for example the road and railway networks through the rubber plantations and connected to the coastal ports. This facilitates the movement of farm inputs, movement of workers, and movement of output to export ports.
13. Presence of a large market both local and foreign. There was increased demand for rubber during the Second World War up to 1945 since rubber was needed for making tyres for the armored vehicles and trucks; a factor which assured Liberian rubber ready market at the time. Currently Liberian rubber is mainly exported to USA and the European Union (like Britain).
14. Increased research in rubber growing and this involves production of fast maturing, high yielding and disease resistant varieties. There is also research in soil improvement such the use of better fertilizers. This benefits both the main estates and the out grower farmers.
15. Presence of various factories which process the latex or the milky liquid rubber. The latex is processed into rubber in the processing plants, which is later used as a raw material in other industries at Monrovia, and Buchanan.
16. Supportive government policy towards the rubber growing industry for example the government has encouraged local and foreign investors and rubber research.

Uses of rubber

- Making of tyres
- Making soles of shoes
- Making rubbers which rub out mistakes on paper
- Making cable/electric insulators
- Making water proof materials
- Making balloons
- Making sports equipment
- Making gloves, plastics, rubber toys ,and rubber carpets

Problems facing rubber growing in Liberia

1. Fluctuation of world market prices; which leads to uncertain incomes to the rubber growers.
2. Competition from artificial synthetic rubber on the world market. This is produced from oil in the developed countries which has reduced demand for natural rubber, since the same countries offer the largest market for natural rubber. Artificial rubber also has other advantages: output is easily varied in response to demand; helps developed countries in their desire to cut down imports.
3. Competition from other natural rubber producing countries such as Indonesia, Thailand, Malaysia, Nigeria, Brazil, DRC, Ivory Coast. This reduces the market available.
4. Severe weather conditions such as very heavy rainfall in some years. This disrupts the rubber tapping schedules and reduces production.
5. Poor feeder roads which become flooded during the rainy season.
6. Inadequate labour supply due to low wages offered. With Liberia's small population cheap labour is becoming low in supply on the plantations especially during harvesting, given also that other cash crops are picking up.
7. Competition from other sectors of the economy for government funding. The government is now emphasizing iron ore production which today is the main foreign exchange earner and diversifies the economy. This negatively affects the small-scale producers who often rely on government finance aid.
8. Political instability which affects rubber production. Liberia has experienced many civil wars in the struggle for power and general political instability especially during Taylor's reign. Political instability also led to the resignation of President Taylor and his taking off to exile in 2003. This leads to destruction of various infrastructures and negatively affects rubber production.
9. Pets and diseases which attack rubber trees and are difficult to control because of large scale farms.
10. Soil exhaustion due to monoculture.
11. Forest fires which at times destroy large parts of the plantations.

Guiding questions RUBBER GROWING IN MALAYSIA

Malaysia is found in Southeast Asia, and is the world's third leading producer of natural rubber after Indonesia and Thailand. Malaysia was once the leading producer of natural rubber, but in the early 1990s it was overtaken by Indonesia and Thailand. Other rubber producers are: Nigeria, Sri-Lanka, Liberia, among others.

The plantations account for more than half of the country's rubber production although they cover a smaller area. In Malaysia any individual holding of more than 40 hectares is taken as an estate. But small holding rubber production in Malaysia tends to exceed that from estates.

Most of the largest estates are owned by Europeans for example most estates were originally in the hands of British companies based in London. Most medium-sized estates are owned by the Chinese. However there has been an increase in local ownership –although this accounts for a very small percentage of the total estate area. Other crops grown in Malaysia include: oil palm, cocoa, tea, and rubber.

More than 90% of the country's rubber comes from West Malaysia, although rubber is also an important crop in East Malaysia. In west Malaysia, the greatest of the rubber growing is on the foot hills of the Tahan ranges in districts like Kedah, Perak, Pahang, Melaka, Johor, Negeri Sembilan and Kelantan.

The tapping and processing of rubber is done by local people or by immigrant labourers from Southern India.

A sketch map showing Rubber growing areas in (West) Malaysia.

Factors which have favoured the development of rubber plantations in Malaysia

1. Hot temperature and heavy rainfall which favours the growth and gestation of rubber trees. Malaysia lies in the tropics and therefore experiences an average temperature of about 27^0c, optimal for rubber growing. The area also receives a mean annual rainfall of 1800mm which is well distributed throughout the year. This helps in the formation of latex.
2. Presence of fertile well drained soils/ heavy alluvial soils eroded from the Tahan ranges in the rubber growing areas such as Johor, Melaka, Kelantan and

Pahang. The soils offer nutrients like phosphate, calcium, phosphorous favouring high yields of latex.

3. Generally undulating/ flat landscape which promotes mechanization of the plantation activities such as preparation of fields ; and development of the required infrastructure such as roads, railways, labour camps in various parts of the plantations
4. The nature of vegetation / the tropical rain forests with trees which provide shade for the rubber seedlings and reduce erosion by torrential relief rainfall on the Tahan slopes. The leguminous tropical trees also fix nitrogen and act as a cover, thereby increasing the yields.
5. Availability of extensive land for rubber growing. Land which was suitable for rubber growing was almost uninhabited as the cultivation of wet rice was not suitable in these areas. Therefore a large expanse of land (about 1.5 million hectares) was available in Kedah, Perak, Johor, and Pahang for rubber plantations in Malaysia, with associated infrastructure such as labour camps, roads.
6. Presence of the rubber growing area in the vicinity of the deep water harbor of Penang and Port Kelang (formerly port Swettenham); made the export of rubber easy. Another major export port is George Town.
7. Presence of adequate capital to invest in the rubber industry initially provided by the British firms, Indians, Chinese, and the Malaysian government. The capital favoured the development of economic infrastructure (like roads), purchase of technology (like farm machinery, industrial machinery), and establishing the plantation farms). This has increased the quality and quantity of the rubber produced.
8. Presence of large skilled and unskilled labour supply provided by the Indian immigrants from southern India while the labour on small hodings is provided by the Chinese and local people. Rubber growing is labour-intensive requiring labour for planting, weeding, pruning, and tapping. There is division of labour such as a group in tapping and collecting latex, another in preparation and processing of latex, another in packing sheets of rubber. There is increased effectiveness and efficiency of rubber production.

9. Well developed transport network such as roads and railways such as on the western foothills. The railway and road network from Johor- Biharu in the south to George Town in the north via Kuala Lumpur (capital). Estates are well managed and served with a network of roads radiating out from the processing factories.
10. Presence of a large market both local and foreign because of the reputation of Malaysia as one of the world's leading producers of rubber. Malaysia exports a large quantity of rubber to European countries such as France, Britain, Germany; Asian countries (Japan, South Korea, china) and USA. The export revenue has been re-invested in the rubber industry.
11. Presence of many factories which process latex into rubber. These exist at George Town, Seremban, Taiping, Kelang, and Johor-Biharu.
12. Increasing research in the rubber industry. The government of Malaysia and RISDA (Rubber Industry Small holdings Development Association) established a rubber research institute at Kuala Lumpur in the 1970s- to develop new high yielding varieties, new methods of planting and tapping. This increase the quality and quantity of rubber production as well as rubber export earnings.
13. Supportive / favourable government policy towards the rubber industry. Since independence (1957), the government has maintained a stable political atmosphere which has favoured the rubber industry. The government has also provided grants to the small holders and encouraged establishment of RISDA. It encouraged the rubber research institute at Kuala Lumpur to develop high yielding varieties new planting and tapping methods.

Note: A number of towns have developed as a result of rubber growing such as: Kuala Lumpur (capital), Seremban, Kelang, Melaka, Ipoh, Taiping, Alur Setar, Batu Pahat, Johor- Biharu, and Teluk Intan.

1) Examine the advantages and disadvantages of plantation farming with reference to one tropical country.
2) Examine the factors which have influenced the development of plantation farming in either India or Natal province of South Africa.
3) To by what extent have physical factors contributed to the development of plantation agriculture in either South Africa or Malaysia.

4) Account for the development and importance of plantation farming in either Brazil or Liberia.
5) (a) Assess the role of plantation agriculture in the economy of either Liberia or Malaysia.
   (b) What problems are faced by plantation in the country chosen in (a) above?

RANCHING

Ranching refers to the rearing of animals for beef production. Ranching involves keeping animals/livestock on a defined piece of land called a ranch. The most important ranches are found in Europe, Australia, Argentina, USA, and New Zealand. In Africa model ranches are found in Zambia, Botswana, Zimbabwe, Kenya, Tanzania and Nigeria.

Characteristics of livestock ranching

- Many animal types are kept depending on the region such as Aberdeen Angus, Red Angus, Hereford, Devon, short horn, Galloway plus sheep in the temperate grasslands of Europe, Australia, USA, and New Zealand. In Africa, breeds like improved Zebu and Boran are kept co-existing with goats.
- The pastures are improved such as re-sawn alfalfa , Lucerne, clovers among others; nutritious for livestock
- Grazing is on permanent farms called Estancias in Argentina; ranches in USA, Europe and other parts of the world (implying that there is limited movement from place to place).
- Paddocking is practiced using wire fences or wooden barriers. This facilitates rotational grazing since the animals graze from paddock to paddock.
- There is strict following of the carrying capacity of land and therefore there is no over grazing.
- There is high capital investment to procure the required machinery, veterinary services, and feed troughs.
- The major aim of livestock rearing is commercial.
- There is scientific management of ranches; involving selective breeding for high quality beef, wool, mutton among others.
- It involves regular disease control for example using spraying, dipping, vaccination, de-worming.

- There is individual, cooperative or state ownership of land.
- Record keeping is very important.
- The ranches are large farms covering many hectares.

Differences between ranching and nomadic pastoralism

1. The nomadic pastoralists mainly rear animals for subsistence and less motivated to selloff any while ranchers have their primary goal as commercial.
2. Under nomadism there is communal ownership of land while under ranching there is clear/definite ownership of land (individual, cooperative, state).
3. The ranchers keep improved herds for meat and meat products while the pastoralists are concerned about quantity rather than quality.
4. Under ranching fattening is considered important before slaughtering unlike under pastoralism.
5. Under ranching there is controlled grazing and movement using the Paddocking system while the pastoralists have their movements influenced by seasonal changes, with uncontrolled grazing.
6. Under ranching scientific methods are dominant such as spraying, dipping. The rancher also in most case specializes in rearing one type of animal. All these are non-existent under pastoralism.
7. Improved pastures are used under ranching while the nomadic pastoralists depend on natural pastures.
8. Activities under pastoralism are majorly dictated by the environment they live in especially in the arid and semi-arid areas. However the ranchers depend on individual preference although dominant in well-watered areas.
9. Record keeping is very important under ranching while it does not exist under pastoralism.

RANCHING IN ARGENTINA

Argentina is found in South America. Livestock ranching is major in Argentina including rearing, slaughtering of animals, processing of meat and meat products. The total annual meat production is about 3 million metric tons and ¾ of it comes from cattle. Argentina engages in rearing cattle, sheep and pigs.

Livestock ranching takes place on the Pampas and the ranching farms in Argentina are called Estancias, and they cover over 10,000 hectares. Their

management is under gauchos (cow boys). The smaller farms are called Chacras. Improved grasses like alfalfa were sown to fatten the cattle.
Livestock exports play an important role in foreign trade. Argentina has long ranked as a world leader in the export of raw meat. Cooked and canned meats are also increasingly important exports. Out of the total production, about 15% is exported mainly to Germany, and Arab countries.
Traditionally coarse grasses of poor quality supported cattle yielding poor returns in terms of meat, fats, and hides. However following European settlement especially in the 19th century ranching rose up with many changes. Better cattle breeds particularly shorthorn, Aberdeen Angus, and Herefords were introduced.
Factors responsible for the development of livestock ranching on the Pampas in Argentina

1. The landscape is relatively flat in the Pampas rising only a few hundred metres from the coast allows easy movement of cattle, has provided opportunities for mechanization on the ranches/estancias, setting up roads and railways, and the general establishment of estancias.
2. The open temperate grassland vegetation which is easy to clear and free from most dangerous insects which would otherwise hinder effective management of ranches.
3. The mild winters and moderate rainfall for livestock ranching. The pampas is characterized by winters which are not too cold and the northeastern region free from frost for about 300 days a year (which is the area with the largest ranches). At least 700mm of rainfall is received over most of the pampas and well distributed throughout the year, which implies that there is no marked dry season. Given this there is throughout the year grazing.
4. Presence of fertile soils eroded down from the Andes Mountains by rivers and overland flow which favour the growth of pastures which are feeds to the animals , hence increasing production.
5. Presence of many streams and rivers that cross the Pampas, which assure the region of continued water supply. The chief rivers include: Rio Negro, Colorado, Salado, Ghubut, and Labrado. Although this supply is not enough, underground water pumped by windmills to the surface is also used.

6. Availability of extensive land foe setting up ranches. The Estancias in Argentina cover large areas on the Pampas of over 10,000 hectares. This has increased livestock production.
7. High quality pasture/improved pastures. The traditional grass which used to support grazing has been replaced with improved pastures such as alfalfa (which a fodder grass as well as leguminous plant beneficial to animals and soil). This grows better and faster than natural pastures. Barley, maize and wheat are also used feed the livestock.
8. Presence of adequate capital to invest in the livestock industry. The initial capital was provided by immigrant farmers from Europe, which settlers on the pampas obtained loans from European financiers. Today more capital has been provided by government and individual farmers. The capital is used in buying cattle breeds, building meat packing factories, farm houses, wind mills, and paying labour.
9. Presence of skilled labour to support various activities of livestock ranching such as mangers, research personnel on the estancias, workers in slaughtering of cattle , processing, transportation and exportation of beef and beef products.
10. Presence of a large market, both local and foreign. There is a high per capita consumption of beef in Argentina of about 100kg.The high demand is also attributed to the high populations of Western Europe, South America and Arab countries. The foreign demand provided opportunities for better quality improved beef products.
11. Introduction of improved breeds of animals by the European settlers. The cattle breeds include: Shorthorn, Aberdeen Angus, and Herefords—which yield highly in terms of beef and beef products. It was also upon this that improved fodder grasses were introduced for cattle fattening.
12. The improvement in transport network for example various railway lines were put up connecting the pampas to factories and the export ports. Most of the cattle are transported by railways from the ranches to the factories (in the major towns of Buenos Aires, Rosario); while beef exports are transported mainly by water using ships with refrigerators through the ports of Buenos Aires, La Planta and Bahia Blanca. More so steamer ships with refrigeration

facilities were introduced. This has promoted movement of output and personnel—hence encouraging the expansion of the estancias.

13. High level of technology employed such as well developed storage facilities with refrigeration, mechanized farming activities, windmills used in the pumping of water to the reservoirs.
14. Increased research in the livestock industry. Artificial insemination, cross-breeding is being done to produce better quality breeds that are highly yielding on the estancias. There is also research on improved pastures for the animals such as alfalfa; to get the best results. Modern trends in livestock ranching from other countries (like Australia, USA, and New Zealand) have been adopted to improve Argentina ranching.
15. Favourable/supportive government policy towards livestock ranching. The government attaches considerable importance to livestock ranching as a yardstick for economic progress. The government has therefore provided loans, supported research, pest-disease control, and training of extension staff. The government has also provided leases to foreign investors.
16. Formation of cooperative societies which serve purposes of raising adequate capital, deal with processing and marketing of cattle and cattle products. This has increased the output from the livestock farms.

Contribution of livestock ranching to the economy of Argentina

1. Facilitation of industrial development. Much meat is also processed in canning factories (Saladeros) to make corned beef. Other products of the region are leather from hides, fats or fallow used in margarine and cooking oil, bone meal for fertilizer, glue from horns and hoofs.
2. Has led to improvement in skills of the ranchers; such as maintenance of refrigerated facilities , getting of loans, carrying capacity maintenance , working of windmills and water pumping systems in turn the ranchers have been in position to develop their own ranches to larger scales of performance.
3. Generation of foreign exchange. The meat exported in chilled or frozen form, canned meat and other beef products exported.
4. Ranching has improved the standards of living of the people.
5. Generation of employment opportunities.
6. Promotion of urbanisation.

7. Diversification of the economy.
8. Generation of government revenue.
9. Promotion of infrastructural development.
10. Promotion of international cooperation between Argentina and other countries.
11. Development of other sectors such as the tourism sector.

Short comings/ negative effects

1. High cost of production, which makes many individual farmers cannot afford.
2. Displacements of other activities / ranches occupy land that would be used for other economic activities.
3. Displacement of people to create ranches.
4. Environmental pollution due to resultant industries.
5. Results in Urban-related problems.
6. Regional imbalance in development; in terms of infrastructure.

RANCHING IN BOTSWANA

Botswana is located in southwest part of Africa. The economy greatly depends on cattle and cattle products for her export earnings. It has the most extensive ranching in the whole of Africa and its ranching system has been modernized with the help of the European Union (EU) that it has become a model in Africa and other developing countries.

The physical characteristics of the country make it difficult to engage in other economic activities other than animal rearing. Most of the country receives low and unreliable rainfall plus frequent droughts. The soils are less fertile not favouring large scale cultivation. The country lacks minerals of economic value and there are no big water bodies-hence mining and fishing not viable. Accordingly many people are involved in animal rearing.

Therefore in a bid to modernize the livestock industry, demonstration ranches were set up. The established ranches varied in size from 1600ha to 2800ha which were then sub-divided by fences into large paddocks. Each demonstration ranch was provided with a water supply system. Most of the ranches were set up at Kanye because it is near the market centres like Gaborone city, Lobatse.

The government, NGOs and private investors improved provision of water to farms and transform nomadism to modern ranching. The demonstration farms were set up with the following major objectives:

- To demonstrate modern beef cattle ranching practices.
- To allow farmers to participate in ranching by acquired techniques.
- To allow farmers to bring a maximum of 6 heads of cattle to the demonstration farms for purposes of comparison after fattening.

Factors which have favoured the development of ranching in Botswana

The demonstration farms have proved to be the most important factor in the development of ranching in Botswana. Their contribution is seen in the following:

1. The farmers have been taught the improved methods of rearing beef cattle such as castration, de-warming, spraying, dipping, Paddocking. They are taught how to build simple dams and cattle dips and the need for their regular use.
2. The farmers are allowed to bring their animals to demonstration farms which they compare with the improved ones forcing them to adapt to the changes. These animals are fed on improved pastures and manufactured foods that allow them to quickly fatten. The pastoralists can appreciate the difference-hence they are taught to value quality rather than quantity.
3. Modern management techniques are taught to the farmers on the demonstration ranches such as setting up cooperative farms, writing, implementing and monitoring projects. This has helped farmers to operate on a profitable basis.
4. Farmers on the demonstration farms are taught to consider the carrying capacity of a given piece of land in order to avoid over stocking. They are also taught Paddocking and rotational grazing in a bid to control over grazing of a single paddock.
5. Through the demonstration farms farmers are in position to acquire loans or donor funding. Farmers get chance to meet donors and development bank officials. Donors from the European Union regularly visit the government demonstration farms where the farmers get chance to exchange ideas with them including possible funding/financing from EU and some farmers have benefited from this.

Apart from demonstration farms, there are other factors (physical and human) that have also contributed to the development of the ranching system in Botswana. These include:

1. The country receives low and unreliable rainfall plus frequent droughts—with rainfall totals of 300mm and very hot temperatures, which make it difficult to engage in crop cultivation but allows animal rearing. The government and NGOs therefore realized the need to modernize cattle rearing through modern ranching.
2. The landscape is generally relatively flat which enables easy movement of animals from one place to another and the construction of facilities like transport and communication routes that are important for the marketing system.
3. Limitedness of other land uses in Botswana. The desert-like conditions cannot allow the growth of forests for lumbering activities .the absence of big water bodies (lakes and rivers) limits fishing; yet the mining of limited minerals (like diamond, copper , nickel) was very expensive. Accordingly for many years many people have been engaged in animal keeping –which the government transformed into ranching for the benefit of the country as a whole.
4. Availability of extensive/ vast land for livestock rearing due to a low population density. The area has less than 10 people per square km for example in Kanye, Gaborone, and Lobatse in the east, and hence large land available for establishing and expansion of ranches.
5. Presence of large sums capital needed to set up demonstration ranches which was provided by the government and the European Economic Community (now European Union). This capital was used to set up the demonstration ranches, modernizing the ranches, training the farmers and veterinary staff, both from within and outside.
6. Presence of improved transport and communication network especially railway lines and roads through the ranching areas for easy movement of produce and required implements .the government has constructed all weather roads and railway lines to link cattle rearing areas with major market centres such as Gaborone, Francis town, Mahalapye, and Lobatse.

7. Presence of a large market for beef both domestic and foreign. The government has set up cattle buying centres to promote trade in beef animals such as Gaborone, and Lobatse. The government also assists the farmers to obtain market from the European Union and Arab countries. More so the export of beef has generated enough foreign exchange that is re-invested in the demonstration farms, training veterinary staff among others.
8. Presence of skilled labour to work on the demonstration farms initially from Europe. In addition, the local people had prior experience as cattle keepers. They used to rear poor local breeds, which were later improved following the establishment of demonstration ranches and consequent training of the cattle keepers to acquire modern cattle keeping skills.
9. Supportive government policy to improve production of beef and its management for example through an efficient extension service delivery system from national up to local level. At all levels there is veterinary staff in charge of animal health and quality control. There are also government planners at all levels—which services have helped the farmers to operate effectively in ranching.

<u>Marketing animal products for Botswana</u>

The Botswana meat commission (BMC) is responsible for buying cattle from farmers. The cattle are moved by railway to the Lobatse abattoir – the biggest in Africa and comparable to those in Europe. Here is a large abattoir and factory for meat packing and freezing.

Botswana exports most of its meat to United Kingdom via South African railways. Botswana also exports beef to South Africa, Zambia, Britain, Germany and Arab countries.

Guiding questions

1) To what extent have demonstration farms contributed to the development of ranches in Botswana?
2) Account for the development of extensive livestock rearing in either Argentina or USA.

3) With reference to either Argentina or Botswana, examine the factors responsible for the distribution of ranches.
4) With reference to any one country in Latin America,
   (a) Explain the factors that have led to the growth and development of ranches in that country.
   (b) What are the contributions of ranching to that country?
5) Account for the development of the livestock industry in either Argentina or Denmark.
6) (a) Describe the differences between ranching and nomadic pastoralism.
   (b)Discuss the contribution of livestock ranching to the development of Argentina.

DAIRY FARMING

Dairy farming involves the rearing of animals majorly for milk production and its products. Dairy farming is best developed in the developed countries such as Former USSR, U.S.A, France, Germany, Poland, Denmark, Netherlands, Switzerland, U.K, New Zealand, among others. In Africa, South Africa and Zimbabwe have significant dairy farming output, although this is small by world standards. Others include Kenya highlands.

Most of the world's known breeds of dairy cattle come from Western Europe especially Britain, Netherlands and Switzerland. These include: Ayrshire, Guernsey, Alderney, Jersey, Friesian cattle, the Swiss Brown.

The dairy farming products include: milk-a highly nutritious food containing all the essential minerals and vitamins for human growth. The milk can be processed to make condensed milk, powdered milk, and canned milk, skimmed milk (excellent for pigs). Other products are: cheese, butter chocolate among others.

Characteristics of dairy farming

- The major objective is to rear animals for milk production.
- Animals are reared on a commercial basis.
- Rich and nutritious grass is sawn in addition to natural pastures to feed animals
- Selected breeds of animals are reared which produce a lot of milk such as Guernsey, ayrshire, jersey, Friesian,

- Many farms have their own processing plants or creameries.
- Farms are scientifically managed; dealing with the control of pests and diseases among others.
- Open grazing is carried out all the year in more favourable areas. In some cases however especially during winter, animals are store-fed.
- Capital intensive techniques of production are used with limited labour and the returns are very high.

DAIRY FARMING IN NETHERLANDS (HOLLAND)

Netherlands is located in Western Europe and is one of the Rhineland countries. Netherlands is an important producer of dairy products like other countries of Europe. This occurs on the polder land pastures and has high milk yields. It is a leading exporter of condensed, evaporated and powdered milk.

It is noted that currently about 68% of the gross value of agricultural production is from animal products. Dairy farming is dominant with mainly black Friesian and white Friesian breeds. The major breeding districts are the provinces of Friesland, north Holland South Holland and Drenthe. The cattle are kept in-door throughout winter.

Dutch milk yields are amongst the highest in the world. Other products from Dutch dairy farming are: butter, cheese, powdered milk, condensed milk, skimmed milk powder. Over half the production of each commodity is exported.

<u>Factors which have favoured cattle farming/dairy farming in the Netherlands</u>

Physical factors

1. The cool temperate climate of the country. Netherlands lies in the temperate region and its climate mainly influenced by the sea. It has a mild climate with cool summers and mild winters-which favours the high milk yielding Friesian cattle. Rainfall is evenly distributed throughout the year with an average of 750mm. average summer temperatures are 19-23^{0}c while winters are cold with about -1^{0}c.
2. Presence of fertile soils that is, the clay and peat soils which are moist favouring the growth of pastures and other fodder crops (such as hay,). There is a high use of fodder crops in the Netherlands which and nutritious which are sawn on the polders and help to produce much milk.

3. Availability of a wide extensive land area especially in the polders to enable animal rearing. This is the low lying reclaimed land on the polders –that increases animal rearing area and growing of pastures to feed the livestock. The predominantly flat landscape also favours extensive mechanization of dairy farming activities. Dairy farming has promoted effective use of land especially that not fit for profitable arable farming.
4. Presence of high breed animals such as the black and white Friesians which have very high milk yields. The Friesian breed was the first breed in the low lying polders of the north west Netherlands , but is now used all over the temperate latitudes . Its milk yields are the highest among dairy cattle.
5. Presence of fresh water supply from Lake Yssel for animal use especially during the drought periods. The fresh water lake has been created for farming activities. Water is also supplied by rivers like Meuse and Rhine.

Other factors

6. Availability of adequate capital to develop dairy farming which was provided by the credit banks to upgrade dairy farming especially on the polders. There is also government financing of polderisation /land reclamation and other activities as well as individual farmers who invest capital in the purchase of machinery, farm items –feeding parlors, fertilizers to improve pasture lands.
7. High levels of technology employed such as use of automatic milking machines. In the Netherlands the barns, food stores, cattle sheds and milk parlors are all carefully designed to allow the maximum amount of mechanization. Food and water are automatically distributed to cattle pens. More so a high level of technology was employed in the reclamation of land for agriculture on the polders.
8. Presence of a large market for dairy products, both local and foreign. The domestic market for milk is in the large urban centres like The Hague, Amsterdam, Utrecht, Rotterdam, Groninger; and industrial processing. The geographical location of Netherlands in the centre of developed nations offers a ready market for dairy products (like milk, cheese, butter) to countries like Germany, Britain and Belgium. Its membership in the European Union also widens the market potential further.

9. Presence of a developed transport system in the Netherlands by canals, rivers, land, air, to facilitate the marketing of produce and the distribution of farm implements in different dairying districts like Friesland and North Holland. There is also easy and direct communication by the North Sea to the neighboring countries.
10. Presence of skilled labour force including managers of the dairy farms- who organize the dairy farming activities like feeding, milking, and milk handling to ensure high quality production. Others are farm workers, research personnel, workers in processing industries/plants, transporters of dairy products, and the exporters. There is continuous upgrading of skills to match international standards. There is increased efficiency and productivity in dairy farming in The Netherlands.
11. The development of cooperative societies and these help farmers in the buying and selling of related products at good prices as well as carrying out research. They carry out central purchasing and selling, and provide loans /credit to the farmers. They also undertake the processing of milk and over 85% of Dutch milk is processed in the cooperative societies.
12. Constant research regarding dairy farming in form of improving the animal breeds, the animal fodder grasses, manufacture of animal feeds, and upgrading of fertilizers to improve soil fertility –viable for the growth of pastures /fodder grasses. Remember that in the Netherlands cattle farming is highly scientifically managed.
13. Favourable/supportive government policy towards dairy farming for example carrying out research and giving advice to the farmers. The government is also subsidizing farmers to enable them compete favourably with other dairy producing countries. The government further carries out reclamation of more land from the sea and rivers so as to increase agricultural land.

Problems facing dairy farming in the Netherlands

1. River flooding leading to the destruction of farm lands.
2. Shortage of fresh water during drought periods.
3. Salination of soils due to underground seepage of water from salty sea waters. This reduces the productivity of the land, and calls for continuous use of

fertilizers and manures to enrich the soils for pasture growth. Too much use of fertilizers in turn pollutes the soils.

4. Over production of animal products, leading to a fall in prices.
5. High costs of production especially during winter, because the cattle are kept in-door throughout winter.
6. High land rent on the polders which is costly to the farmers. This in turn promotes intensive dairying on the polders.
7. The infertile sandy soils in a large area less fitting for farming practices such as pasture growth.
8. Excessive water logging and high costs of pumping out of excess water from the polders.
9. Inadequate labour supply.
10. Sea incursions.

DAIRY FARMING IN DENMARK

Denmark is located in Western Europe. Dairy farming is the main agricultural activity in the country and the country is a role model. The major breeds of animals reared include: Friesians, jersey, Guernsey, among others which have the highest milk yields per cow in the world.

The creamaries process milk into a wide range of products such as butter, cheese, cream, and various brands of evaporated, condensed or powdered milk. Denmark is one of the leading exporters of dairy products especially butter. Much mechanical equipment is used such as milking machines, feeders, among others.

Factors responsible for the development of dairy farming in Denmark

Physical

1. The temperate climate with cool summers and generally mild winters. The mean temperature in summer is about 16^0c, with slightly cooler average temperatures in the eastern part of the country. The warm North Atlantic drift also means that there is no severe winter. The average rainfall is about 610mm. All this favours the growth of grass and fodder crops for the livestock.
2. Presence of wide extensive land

3. Generally flat landscape
4. Presence of high breed animals for example the Friesians, jersey and Guernsey-which have the highest milk yields per cow in the world. These are fed on improved pastures and grains –like barley, corns; to ensure high productivity on the dairy farms.
5. Presence of ready water supply

Human

6. Availability of adequate capital to invest in dairy farming provided by private individuals, cooperatives and the government of Denmark. This has been used to establish dairy farms, purchasing farm inputs (—such as automatic milkers, feeding facilities), establishment of processing facilities, financing research, payment of labour on the farms and factories among others.
7. Well developed transport system such water, road and railway. The sea separates Denmark's lands, so ships are vital for moving farm inputs and the dairy products-through the ports of Copenhagen, Arhus and Odense. The road and railway transport system is also used to distribute farm inputs to the dairy farms and dairy farm output to the processing factories (such as in Odense).
8. Presence of a large/ ready market for dairy products such as in the large urban centres with daily demand for fresh milk. In addition, creameries process milk into milk products such as butter, cheese, cream and various brands of evaporated, condensed or powdered milk which are majorly exported to other countries such as Germany, Sweden and Norway.
9. High level of technology employed in dairy farming. The introduction of labour-saving machinery, especially the vacuum milking machine has simplified the tasks of the dairy farmers. The use of automatic milkers and modern processing facilities has improved dairy farming in Denmark. Modern improvements in refrigeration and transportation have facilitated milk distribution
10. Presence of a large skilled labour force/ the sound Danish education which includes formal education and adult education , and this produces veterinary staff and also facilitates the dissemination of the latest technologies to improve dairy farming. There are skilled farm managers, research personnel and factory workers among others.

11. Increased/ intensive research in dairy farming done by the government and cooperative agencies such in animal breeds, animal fodder crops, and milk products. Research has led to higher production and greater use of dairy products and especially the discovery of new industrial uses of milk by-products.
12. The development of cooperative movement which is a significant feature of Danish agriculture. Cooperative associations dominate the production of dairy products. Much of the nations' agricultural produce is sold through marketing cooperatives.(to be discussed in detail)
13. Supportive government policy towards dairy farming such as government supervision of the dairy farming industry which has ensured that cattle/bovine diseases are greatly controlled in Denmark. The government also gives regulations to cooperatives over control for example they should not accept milk from farmers not periodically spraying their cattle. Government has also set up an agency to inspect dairy exports with a label LUNMARK put on those accepted to maintain the quality of the products.

COOPERATIVE FARMING

Cooperative farming is a system of farming where farmers with similar interests pool resources together to increase production and realize greater profits.

It is mainly practiced in developed countries although being employed all over the world.

Characteristics of cooperative farming

a) There is cooperative or collective ownership of resources.
b) Labour is provided by the cooperators.
c) There is official registration of cooperatives, governed by laws and regulations.
d) Officers are chosen from among the members of the cooperatives—hence efficient management.
e) Quality control of products is carried out.
f) Farms are either scattered or consolidated into one piece of land.
g) Technical advice and services are provided by extension staff.
h) Collective marketing is done.

i) Cooperatives carry out research and the members are always updated on the developments.
j) Credit facilities are easily available to members from the collective funds.
k) Profits and losses are equally shared among the members.
l) Cooperatives have processing facilities for the products such as milk, meat, etc.
m) Land ownership may be collective or individual.

Advantages of cooperative farming

1. Cooperatives buy farm inputs at cheaper rates suchas seeds, fertilizers, equipment; which they sell to the members at cheaper prices unlike individual farmers who only require small amounts of any item. Therefore bulk buying reduces production costs.
2. Cooperatives set standards for the agricultural products and this ensures high quality produce.
3. There is high capital and labour productivity since resources are collectively pooled.
4. Facilitate easy marketing of output. Through collecting, grading and storing of produce of many farmers, the cooperatives are able to sell in bulk and at the most favourable rates than individuals can.
5. Cooperatives set up processing facilities such as ginneries, creameries; and hence promote industrialization in the economy.
6. Cooperatives carry out agricultural research and advice on farming. New skills are acquired for efficient production through cooperatives and this reduces government expenditure on training farmers.
7. Cooperatives provide loans to farmers on soft terms to get land, equipment, better breeds etc. this is because of high capital mobilization.
8. Cooperatives ensure self-sufficiency in food production. This is because they are engaged in food production which saves the valuable foreign exchange which would be spent on imports.
9. The farmers' incomes are increased through cooperatives inform of dividends or bonuses from the cooperative society. This in turn improves the standards of living of the farmers.

10. There is increased output through cooperatives and this leads to increased exports and hence increased foreign exchange.
11. Generates employment opportunities to the members/ people in all their activities such as collecting, grading, processing, transportation and exportation.
12. Cooperatives facilitate the development of social and economic services such as health centres, schools, and roads.
13. Government easily assists farmers through cooperatives such as providing massive education and advisory services.

Disadvantages of cooperative farming

1. High level of bureaucracy. They tend to be too bureaucratic in their operation and hence delays in decision making and implementation. This sometimes affects farmers since the products might get spoilt.
2. In some cases cooperatives charge high subscription and membership fees from members and yet they pay little dividends and bonuses. This frustrates many farmers and even blocks others from joining the cooperatives.
3. Delays in payments due to high level of bureaucracy. This sometimes affects farmers, although this is not a very significant of some cooperatives.
4. Cooperatives hinder personal initiatives and hard working members are discouraged by group work. Therefore in most cases young people do not have high interests in these cooperatives.
5. Cooperatives are engaged in agricultural produce whose prices are highly fluctuating, and this affects the planning of cooperatives.
6. In many developing countries, farmers lack confidence in the elected officials. This is because many cooperatives are dominated by nepotism, embezzlement and corruption which are barriers to efficient management of cooperatives.
7. Some cooperatives are unable to compete favourably with the more dynamic businessmen engaged in marketing and processing of the produce who out compete them.

COOPERATIVE FARMING IN DENMARK

Denmark is described as a land of cooperatives and is traditionally an agricultural country. Denmark has nearly 10,000 cooperatives all over the country. The

cooperative movement in Denmark started at Thisted Jutland in1886 and today more than half of the Danish population comprises members of various cooperatives.

The very small land area per farmer in Denmark forced the Danes to opt for cooperative farming by pooling resources together, since Denmark has one of the highest rural population densities in Europe.

The Danish cooperative farming has moved away from the traditional wheat growing economy to scientifically run and mechanized agricultural system largely dominated by dairy farming.

In Denmark the cooperative movement involves the Central Cooperative Committee (CCC), Cooperative Dairies, Cooperative Wholesale Society (CWS) and the Farmers' Cooperative Bank (FCB). Besides dairy farming the cooperatives are also engaged in Ranching, Piggery and Poultry.

<u>Contribution of cooperative farming to the development of dairy farming in Denmark</u>

1. Provision of farm inputs by carrying out bulk purchasing like chemicals, sprays, animal feeds, pumps, milking machines. The farmers therefore benefit from the discounts of trade at subsidized costs to reduce the production costs of the farmers.
2. Cooperatives ensure effective use of land. The cooperative movement has been accompanied by a change of the land tenure system and farmers either voluntarily pool their resources together buy more units of land from neighboring farmers or consolidate their pieces of land into bigger units. Therefore a lot of land has been availed upon which extensive dairy farming is carried out.
3. Cooperatives aid the transportation and distribution of dairy products from individual farms to big marketing or processing centres. Cooperative dairies operate regular milk collection from collection centres to creameries. This has improved farming efforts in terms of quality and hence enhancing the development of dairy farming. More so the central cooperative committee facilitates the export of farm products to EU, Asia, and Africa.
4. Provision of extension services to farmers. Cooperatives in their large numbers have put dairy farmers under close association which enables extension staff

to advise members such as research on new breeds, artificial insemination, disease control, repair on worn out machinery, routine operations on dairy farms. All these have aided the success of dairy farming.

5. Facilitate sharing of knowledge among farmers by creating conditions under which many farmers share experience on how to develop dairy farms, giving them opportunity to discuss backsets and suggest possible solutions ,hence contributing to the success of o dairy farming. The cooperatives regularly organize workshops, seminars and study tours to equip members with modern ideas and skills vital for successful dairy farming.
6. Facilitate the marketing and strengthen the bargaining power of farmers. The cooperatives look for market and set standards to the farmers. They negotiate better prices for the members, which prices the individual farmers would not negotiate.
7. Stabilization of prices for output. Danish cooperatives save their members from making heavy losses through buying their products at standard prices even when the market prices have gone down especially the Cooperative Dairies. This helps to minimize losses to the farmers and hence stabilize prices.
8. Ware housing/ Cooperatives help dairy farmers to store surplus output to reduce waste. Safe and highly modernized storage facilities help to avoid losses.
9. Danish cooperatives carry out the processing of farm output since they have established dairy processing plants, coolants, pasteurization machineries, dryers of milk. Therefore farmers process their milk from dairy farms, and about 85% of Danish milk is processed by cooperatives to produce butter, cheese among others.
10. Provision of credit facilities to the farmers since they possess substantial assets like processing plants, land which they can mortgage to financial institutions as collateral security to secure big loans. In turn they extend these loans to their members at low interest rates which they can use to develop their dairy farms. The Danish cooperative Bank also facilitates extending of credit to dairy farmers.
11. Facilitate research in dairy farming and this involves developing animal breeds that are fast growing , early maturing, disease resistant, high milk yielding,

high longevity(length of time an animal stays producing milk), and high fecundity (length of time an animal stays capable of reproduction). Cooperatives also research into milk handling, and milk processing to improve the quality of output.

12. Cooperatives influence government policy on dairy products for example they advise it on the marketing procedures, taxation on imports of similar products to ensure protectionism against external competition, less taxes on imported farm inputs among other policies. This reduces costs and hence increases benefits to Danish dairy farmers.

Guiding questions:

1) With reference to either one developed country or a developing country, examine the factors which have led to the successful establishment and development of the dairy industry.
2) Account for the development of the livestock industry in either The Netherlands or Nigeria.
3) Assess the contribution of cooperatives to the development of dairy farming in Denmark. OR To what extent has the cooperative movement influenced the development of dairy farming in Denmark?
4) Assess the role of cooperative farming to the economy of either a developed country or a developing country.
5) (a) Describe the main characteristics of dairy farming.
   (b) Discuss the contribution of cooperative farming to the economy of any one developed country.

IRRIGATION FARMING

Irrigation is the artificial supply of water to an area which has insufficient rainfall to support plant growth.

It should be emphasized that drainage and irrigation are interdependent. Where irrigation is used it is important also to provide drainage facilities, so that the irrigation water can be kept moving and thus not stagnant. Under irrigation, the extra amount of water needed depends much on the type of crops grown, the prevailing temperature and humidity, the kind of soil and other conditions in the area.

Advantages of irrigation

a) The supply of water by irrigation is regular and reliable, where as rainfall is often seasonal or unpredictable. In the desert areas, the use of irrigation allows cultivation to take place where it could otherwise be difficult.
b) Irrigation water supplied by rivers during flood times carries much silt which adds to soil fertility and hence increasing crop yields.
c) Under irrigation, cultivation can be done all year round and not only during the rainy season. This implies better use of land.
d) In desert areas the constant flow of irrigation water through the soil helps to reduce the salinity of the soil. When the water evaporates in the fields the salt content increases.
e) Modern multi-purpose dams not only support irrigation but also help to control floods, generate power, and improve the navigability of rivers.

Types of irrigation

1) Basin irrigation

When the river rises in summer, part of the flood-water is allowed to flood i basin-like fields on either side of the river. The water is controlled by sluices. This has occurred in Egypt for many years .

2) Gravity flow irrigation(flooding)
3) Tank irrigation

Tanks are small reservoirs used for storing water which falls in the rainy season. The water stored is rarely sufficient for use all the year round but lengthens the growing season. This is noted in southern India and Sri Lanka.

4) Canal irrigation

In this case canals lead irrigation water from rivers or storage lakes into the irrigated farmlands. Perennial canals are fed by water stored behind a large dam or barrage and therefore water can be supplied all year round. Storage barrages feed canals below the dam and above (higher level canals by raising the level of the river behind the dam).

5) Over head irrigation(sprinkler irrigation)

It is a modern system practiced in many parts of the world. The sprays or sprinklers are set up in the fields and supplied with water from public water

supplies. The initial cost of equipment is high and water must be pumped continuously. It is common in USA, Britain, and other parts of Europe.

6) Lifting devices

Water may be simply lifted from a well, a river or a canal by a bucket to the fields. In modern times diesel, steam or electrically operated pumps can be used; especially where water is obtained from a deep well rather than from canals.

Note: Irrigation may involve artificial application of water permanently or temporarily. Irrigation is mainly in areas of low rainfall and where flooding is common. Irrigation is one of the oldest agricultural techniques practiced by man, although it has been done at different levels at different times. It deals with water management to enhance agricultural development.

Irrigation is majorly in the semi-desert or desert areas of Sub-Saharan Africa, south and south west USA, Central Australia and Central China.

Examples of major irrigation schemes in Africa include:

- Gezira irrigation scheme in Sudan
- Richard toll scheme in Senegal
- Awash valley authority in Ethiopia.
- Irrigation on Niger river
- Kilombero scheme in Tanzania

Elsewhere large-scale irrigation occurs in:

- The Rhone and durance development scheme in France
- The Yangtze and Sichuan schemes in china
- The Volga and don projects in Russia
- Mangalu and Tarbela in Pakistan
- The Central Valley of California(USA)

Necessary conditions for successful irrigation:

a) There should be constant supply of water such as fro m a lake or river
b) Large storage facilities for water are needed from where water is controlled into the fields such as tanks and dams.
c) The source of water should be fresh and not saline
d) Pumping machines for water needed or naturally sloping land, to allow flow of water into farmlands by gravity flow.

e) Large amount of capital to open up farmland for irrigation and farming.
f) Sufficient labour to cultivate the crops under large scale irrigation, construct canals etc.
g) A hot climate necessary to reduce water logging through evaporation.

GEZIRA IRRIGATION SCHEME IN SUDAN

The Gezira scheme is located between the Blue Nile and the White Nile, north of Sennar dam but south of Khartoum in Sudan. The region receives low and unreliable rainfall less than 500mm per annum. There was need for irrigation in order to grow crops. The Sennar dam was built in 1925 in order control water and various canals leading water to the fields were constructed.

The Gezira scheme was started in 1911 by the British and Sudan government nationalized it in 1950 and set up the Sudan Gezira board to manage it up to date. The Gezira scheme is about 480,000 hectares which was earlier set up. Later in 1962, the Managil extension was completed and farmland increased. This Managil extension is about 324,000 hectares.

There are two main canals from which thousands of kilometers of smaller channels developed on rectangular system carrying water throughout the whole scheme.

Organization of the Gezira scheme

The Sudan government and the Gezira board jointly own the Gezira scheme. The Sudan government provides the land and is responsible for its irrigation. The tenants (over 10,000 today) work on the land and produce crops especially cotton. They use the land rent-free only to work satisfactorily. They also grow other crops for food as well as cash. These crops include: groundnuts, Dura, maize, lubia (a bean for food and cattle fodder), rice, sorghum, and sugarcane. The Sudan Gezira board manages the processing and selling of crops, supplies seeds, fertilizers and gives advice to farmers. It also looks after the light railway system, farm machinery and distribution of profits. The income depends on the price of cotton. After all expenses have been deducted the distribution is as follows: 36%nto government, 50% to the tenants, 4% to village councils and social services, and 10% to the Sudan Gezira board.

<u>Objectives of the Gezira irrigation scheme</u>

- To open up more land for both settlement and farming
- To provide water for irrigation all year round.
- To modernize the economy from pastoral nomadism to settled agriculture
- To diversify the agricultural sector(to grow food crops in addition to cotton)
- To encourage economic development of Sudan.

Factors which have favoured the establishment and development of Gezira irrigation scheme in Sudan

1. Availability of ready water supply for irrigation from the Blue Nile and White Nile. The Gezira plain receives less than 500mm of rainfall per annum, which cannot support perennial agriculture. Therefore the presence of the Blue Nile and White Nile with their reservoirs at Sennar dam and Jabel Aulia dam , has made available plenty of water throughout the year for growing of cotton and other crops like maize , rice , lubia ,groundnuts.
2. The gently sloping landscape from the Blue Nile towards the White Nile, and therefore both irrigation and drainage can be done using gravity flow. For the canals it is only minimum pumping necessary during low water season on the Blue Nile –hence low irrigation costs, and thus large-scale production. The gently sloping landscape has also favoured the construction of transport network and mechanization of farming made possible such as the use of tractors.
3. Availability of vast/extensive land due to sparse population. The vast gently sloping semi-arid land, which was originally occupied by the nomadic Dinka and Nuer people, provided the best ground for irrigation farming. Therefore a large expanse of land was put under irrigation between 1925 and 1965, with mechanized farming and development of infrastructure like labour camps and railway networks.
4. Presence of fertile alluvial soils of the Gezira plain from seasonal flooding of the Nile favouring the growth of crops. The dark-brown clay soil rich in minerals (like phosphorus, phosphates, calcium) only lack water, but when water is availed to it from the Nile crops could be supported. In the early years, crops could do well in the scheme without application of fertilizers although today artificial fertilizers are applied to maximize production.

5. The soils have high clay content and hence impervious to water sinking away. This saved the construction of water-proof lining (concrete channel) when canals were filled with water.
6. The land is well above the water table and so water-logging never occurs.
7. The arid climate of the area also favoured irrigation farming because there was no expensive clearing of bush/forests. The arid climate necessitated use of irrigation so as to make the fertile land productive by supplementing the little unreliable rainfall. This climate was also ideal for cotton growing intended to be the main cash crop. The sunny arid climate favours the ripening and harvesting of crops especially cotton.
8. Availability of cheap labour in the area because people were already in the area cultivating poor cereals (on the mercy of rains) and herders with skinny cattle such as nomadic Dinka and Nuer. All that was necessary was to re-arrange the people. The unskilled labour was used in the cultivation, weeding and sorting of cotton and other crops. The tenants were allocated 10-20 hectares of land for cultivation at the start.
9. Presence of skilled labour and at the beginning it was provided by the British and Egyptian experts who were used in the construction of the dams, canals, operation of machinery, textile industries and ginneries, grading, general management to enhance production.
10. Availability of adequate capital provided by the government and the British to set up the Gezira scheme. Later the Gezira board was set up to control finance. The capital was used in purchase of agricultural machinery like tractors , irrigation systems , payment of research personnel and establishment of socio-economic infrastructure like labour camps ,road and railway networks, textile industries
11. Availability of large supply of electricity especially hydro-electric power generated by Sennar dam and Jabel Aulia dam(Roseires dam), which has been used for pumping water from the reservoirs into the canals / to the fields and running machines in the ginneries and textile industries at Khartoum, Wadi Medani etc; and also used in labour camps .
12. Presence of improved transport infrastructure such as the extension of the railway line from Wadi Halfa in the north to Kosti via Khartoum, Wadi Medani

and Sennar; the development of the triangular road network from Khartoum to Sennar, Kosti to Khartoum, and Sennar to Kosti has greatly opened up the Gezira scheme. This provides accessibility to ginneries (at Barakat, Manangan, and Hasa Heisa); textile industries and sugar refineries. The transport net work also helps in moving inputs into the fields leading to the development of the scheme.

13. The high level of technology/ The introduction of modern machinery such as such as caterpillars and tractors for digging channels and large scale cultivation respectively; multiple seed drills for large scale planting ; helped the development of Gezira scheme. Also the introduction of different methods of irrigation such as gravity flow irrigation, over-head irrigation, and tank irrigation has increased efficiency of production on the Gezira irrigation scheme.
14. Availability of ready market for crops grown both local and foreign. There are ginneries and textile industries at Khartoum, Hasa Heisa, Barakat, and Wadi Medani. Sudan mainly exports cotton to Germany, Italy, UK, Japan, and India.
15. The desire to achieve self-sufficiency in food production and reduce food imports also explains the development of large-scale irrigation in Sudan. The government resorted to development of farming through irrigation, and it set up the necessary infrastructure and also provided advice to the farmers on modern farming through the Gezira board.
16. Supportive/ favourable government policy such as by setting up the scheme to allow people to settle down to produce food and cash crops to ensure economic development of Sudan. The government in 1925 secured loans from Britain for opening the scheme (purchase land, technology and hire expert labour). The government also established economic infrastructure for accessibility and also built the Sennar and Jabel Aulia dams to provide reservoirs and generate power to pump water and run the textiles.
17. Increased research in soils, drainage and crop growing.

Contribution of the Gezira irrigation scheme to the economy of Sudan

1. Promotes agricultural modernization both within the Gezira plains and throughout Sudan. The Gezira can well be referred to as agricultural revolution it provided a shift from primitive subsistence farming to highly

mechanized scientific farming based on irrigation, application of fertilizers and pesticides on a large scale.

2. Increased production of both food and cash crops by the farmers such as cotton, lubia, maize, dura, among others. This is because the farmers have learnt modern farming. As such there are increased incomes to the farmers leading to a higher standard of living. The Gezira scheme and the Managil extension have served to reduce poverty as the inhabitants were allocated land to grow various crops.
3. The scheme has promoted education and training for the people in the area such as training centres set up. There is also adult education benefiting the local people to enhance farming and also improve the general welfare. The tenants have also been trained to develop fruit gardens, which has also improved production in the region.
4. Generation of employment opportunities to many people on the scheme both the skilled and the unskilled labourforce. Many people participate in planting, weeding, harvesting and sorting cotton and also growing of other crops. Still many other people are mangers, accountants, extension officers on the large farmlands and water pumping systems for irrigation. These people earn incomes to improve the standards of living.
5. Promoted development of social services such as sporting and leisure facilities, educational facilities, health facilities, piped water in many areas such as Sennar, Wadi Medani, Kosti, among others. These have resulted from the revenue accruing from the Gezira scheme and symbolize development since they improve the general economic welfare.
6. Development of transport infrastructure especially within the Gezira plain for example the railway line extended from Wadi Halfa to Kosti via Khartoum, Wadi Medani and Sennar; plus the triangular road net work. These are used for transporting cotton and other farm products to the factories and to the market. They also facilitate the movement of farm inputs to the fields. These networks have ended up serving the general economy.
7. Promoted development of the industrial sector for example the high quality cotton produced has promoted the growth of ginneries and textile industries at Hasa Heisa, Barakat, and Manangan. There are also grain milling, oil milling,

and fertilizer industries at Khartoum , Wadi Medani, Kosti, Sennar, and Omdurman since agricultural crops like cotton, maize, rice, sugarcane, provide raw materials. Such industries improve the quality of output for market as well as providing more employment to the people of the area.

8. The Gezira scheme generates foreign exchange to Sudan through the export of crops particularly cotton to the outside countries like Germany, Italy, UK, Japan, and India. The industrial products (like oil, fertilizers, flour) are also exported with value-added. This generates foreign currency that is used to purchase foreign technology and consumer goods, as well as settling foreign debts.
9. The scheme has promoted urbanization in the Gezira plains in that with its establishment a number of urban centre have come up such as Wadi Medani, Kosti, Sennar, Hasa Heisa, and Al Husa Ayhisah among others. These developed as labour camps, market centres, industrial centres; hence attracting a large population.
10. The Gezira scheme has also emphasized the planting of forests of eucalyptus trees. The afforestation program benefits in a number of ways such as providing building wood/poles, natural beauty among others.
11. The scheme has promoted cooperation among the tenants and therefore cooperatives have been introduced for marketing the produce among other opportunities.
12. Promoted international cooperation between Sudan and other countries
13. Diversification of the economy
14. Promotion of the tourism sector
15. Facilitated technological development.

Shortcomings of the Gezira irrigation scheme

1. Silting of the irrigation canals. They keep silting up as irrigation water deposits its suspension material in them. Regular dredging is necessary which is quite costly.
2. Salination due to the high rates of evaporation in the Gezira scheme. This has affected plant root growth which in turn has limited yields of cotton sugarcane among other crops. Still large quantities of water are lost through evaporation.

3. The reservoirs are shallow leading to flooding of farmlands and this has increased the spread of pests and diseases such as Bilharzia.
4. Displacement of people as land was being consolidated for the scheme. The Gezira scheme is located on land formerly occupied by the Dinka and Nuer nomads who used to graze their animals in the area. Many people were displaced south into the swampy areas of southern Bhar El Gazel; especially those who retained animal herding.
5. The Gezira scheme was very expensive to undertake. It involved high costs of establishing farmlands, irrigation channels, dams, plus high costs of maintaining the irrigation scheme—hence straining the government budget.
6. Industrial—related problems due to ginneries, textiles, grain milling at Omdurman, Khartoum, Wadi Medani. The problems like pollution through emission of fumes and disposal of wastes which negatively affect the environment.
7. Urban—related problems in the urban centers which have come up such as Barakat, Sennar, Omdurman; and the problems include: slum growth, alcoholism, robbery, gambling,-all of which impact negatively of the economy.

Note: other irrigation schemes in Sudan include: Kenana sugar scheme (south of Sennar), the Rahad river scheme, Danazin scheme.

Central valley of California (USA)

California has the largest irrigated area on the continent of North America, particularly the central valley irrigation project. From the north to the south, this valley can be divided into four regions: the Sacramento River valley, the delta land of the southern Joaquin and Sacramento rivers, the San Joaquin valley, and the southern basin of inland drainage. Water is transferred from the north to the south where irrigation farming takes place using great water dams, canals and aqueducts. The largest canal to the west is the Delta-Mendota canal. It carries water southward up to Mendota where it joins the San Joaquin river valley. Other canals are All American canal, Friant Kern canal, and East side canal.

Water storage and distribution has become increasingly important due to increasing urbanization, with cities such as San Francisco, San Diego, Stockton, Los Angeles, Yuma, and Santa Barbara which need large amounts water besides food.

Due to irrigation farming the central valley of California has been completely transformed and its agriculture has out matched even that practiced in areas which are naturally endowed with the ideal climate all the year round.
The major crops grown include cotton, barley, wheat, and rice. Fruits which include grapes, lemons, oranges, orchards, citrus fruits, straw berry, apricots, dates, peaches, melons, pears, orchards, passion fruits, lettuce, olives, avocado.
A wide range of vegetables such as tomatoes, carrots, onions, and cabbage.
Fodder crops are also grown such as alfalfa to feed the animals.
A sketch map of the central valley of California irrigation project

Factors for the development of large scale irrigation farming in (the central valley of) California
Several physical and human factors explain the success of irrigation farming in California, and the physical factors are discussed below:

1. The dry climate of California (the region experiences low and unreliable rainfall) which necessitated irrigation farming to support crop growing. The dry climate is also not conducive for most crop pests and disease causing organisms. This in turn supported the growing of high quality and quantity crops under irrigation.
2. The dry climate also favours the maturity and ripening of irrigated crops. Fruit growing does well under irrigation, since the it enables farmers to control the amount of water required by various fruit trees.
3. Availability of ready water supply for irrigation from the rivers like Sacramento and San Joaquin. It is possible to regulate the flow of surplus water from these rivers to the arid farms lands to sustain various crops. This in turn leads to increase in crop production.
4. The gently sloping landscape of the area which allows the transfer of water from reservoirs to farmlands. The central valley and the southern lowlands are generally flat and this has allowed the construction of canals. The landscape allows extensive mechanization of the farms / use of machines like tractors leading to high quantity and quality of output.
5. Availability of extensive land –in the central valley partly explained by the dry climate leading to sparse population settlement in the region. This has

enabled the setting up of very large farms such as in the Sacramento and san Joaquin valleys; hence resulting into high farm output.

6. Presence of fertile alluvial soils due to the silt deposits by the numerous rivers originating from the nearby Sierra Nevada Mountains. The soils are light and easy to cultivate, hence favouring the growing of crops like cotton, fruits especially in the San Joaquin valley.

However, physical factors cannot sufficiently explain the success of irrigation farming in California and hence human factors have also contributed to irrigation farming as explained below:

7. Presence of cheap and skilled labour employed in irrigation farming. The cheap labour from Latin America and Asian immigrants available for a wide range of farm activities including construction of irrigation canals. The labour force consists of mainly immigrants from East Asia, Oklahoma, Mexico, and some Philippines. The highly skilled labour handles farm research to develop high quality varieties, development of farm technology, pruning, spraying, harvesting and grading of farm output.
8. Availability of large sums of capital which has been invested in purchase of land, water conservation and irrigation programs using dams, canals and aqueducts; funding farm research from the state funds and federal funds to develop better varieties and market suvery. Perhaps California is the state in the whole world with the highest capital investment in farming activities; hence qualitative and quantitative increase in output.
9. Efficient/modern transport facilities developed in all irrigation lands such as the railway and road network in southern California to transport farm inputs and workers, the development of refrigerated rail cars have enabled the movement of fresh fruits to the Eastern markets. There is also developed water transport, which increases accessibility to foreign markets, hence promoting agricultural production.
10. The high level of technology employed in supplying water and attending to the irrigated crops such as construction of canals, and aqueducts. For example in places where water has to be moved across high relief, aqueducts and pumps are used to lift it. In addition, harvesters have been developed for quick

harvesting of crops like tomatoes and grapes. Modern technology has therefore increased the quality and quantity of production.

11. Presence of ready/ large market for the crops grown both local and foreign. Market is provided by both the ever-rising population in California and the people in the eastern states of USA. The export market especially for fruits is found in Europe (Britain, Germany, France, Switzerland) and Asia. The large market therefore encourages further investment in irrigation farming.
12. The development of many processing industries such as in Bakersfield, Fresno and Sacramento has also contributed to the success of irrigation farming. California has the capacity to process all her fruits into finished products such as canned fruits, hence adding value. This increases the marketability of farm output and thus enhancing irrigation production.
13. Advanced research in soils, drainage and crop growing. There is continuous research to improve the productivity of the soils, to improve the transfer of water to irrigation farmlands, to develop new fast growing and high yielding crop varieties. This in turn increases the quality and quantity of farm production.
14. Presence of efficient marketing system for the irrigated crops. Farmers have well established marketing agencies which sell their products such as varieties of oranges, orchards, and barley. This gives the farmers high profits to offset the competitive irrigation water and which encourages further farm production.
15. Supportive government policy towards irrigation farming such as ensuring efficient management and organization of the water supplying schemes. For example, through the Federal Bureau of Reclamation and the California State Water Plan which have streamlined water supply to the farmers by minimizing inadequacy and extravagance. The federal governments also provide loans, and subsidies to the farmers for purchase of land, farm machinery and funding research. There was also desire for California to increase food production due to the increasing population.
16. The cooperative movement in the central valley of California, in which farmers have organized themselves by pooling resources together. The cooperatives have helped them in obtaining loans from financial institutions, purchasing

farm inputs at low cost, obtaining new skills, sharing experiences and easy marketing of farm output through collective bargaining. This further encourages irrigation farming.

17. Political stability of California/ USA which has encouraged both local and foreign investors in irrigation farming. It has given them confidence in the modernization of farming by constructing more canals, establishing more fruit and vegetable farms. This in turn encourages irrigation farming.

Significance of the irrigation farming in California

- More land has been put to effective and profitable use. About 8.6million acres are under irrigated crops such as large fruit farms established. Large areas of dry land have been put to use via irrigation farming, hence better natural resource utilization.
- Promotes agricultural modernization both within the California and outside. Irrigation farming can well be referred to as agricultural revolution it provided a shift from primitive subsistence farming to highly mechanized scientific farming based on irrigation, application of fertilizers and pesticides on a large scale. This in turn increases national income.
- Increased production of both food and cash crops by the farmers such as cotton, rice , wheat, and fruits. This is because the farmers have learnt modern farming. As such there are increased incomes to the farmers leading to a higher standard of living.
- Irrigation farming has stimulated research in better crop varieties. Research centres have been established in the central valley and elsewhere in the state. Here crops like oranges and grapes have been modified to increase their marketability. This results into qualitative and quantitative increase in output.
- The scheme has promoted education and training for the people in the area such as training centres set up. There is also adult education benefiting the local people to enhance farming and also improve the general welfare. The tenants have also been trained to develop fruit gardens, which has also improved production in the region.
- Generation of employment opportunities to many people on the scheme both the skilled and the unskilled labourforce. People participate in planting, weeding, harvesting and sorting various crops. Still many other people are

mangers, accountants, extension officers on the large farmlands and water pumping systems for irrigation. These people earn incomes to improve the standards of living.

- Promotes development of social services such as sporting and leisure facilities, educational facilities, health facilities, piped water in many areas such as Fresno, Bakersfield and San Diego. These have resulted from the revenue accruing from the irrigation scheme and symbolize development since they improve the general economic welfare.
- Development of transport infrastructure especially within the central valley of California for example the railway line plus the triangular road network used for transporting cotton, barley, oranges and other farm products to the factories and to the market. They also facilitate the movement of farm inputs to the fields. These networks have ended up serving the general economy/ other sectors of the economy like tourism.
- It has promoted the development of the industrial sector for example the high quality cotton produced has promoted the growth of ginneries and textile industries at Los Angeles and Stockton. There are also fruit processing factories at San Francisco. Such industries improve the quality of output for market, which increases incomes as well as providing more employment to the people of the area.
- The irrigation schemes generate foreign exchange to California through the export of crops particularly cotton, orchards, grapes to the outside countries like Germany, Italy, UK, Japan, and India. The industrial products (like oil, fertilizers, flour) are also exported with value-added. This generates foreign currency that is used to purchase foreign technology and consumer goods, as well as settling foreign debts.
- The scheme has promoted urbanization in the plains in that, with its establishment a number of urban centres have come up such as Fresno, Stockton and San Diego. These developed as labour camps, market centres, industrial centres but have expanded due to attracting a large population; hence more associated facilities like education, health and recreation facilities.
- The irrigation project has controlled flooding which used to destroy farms in the low-lying lands b y constructing dams. For example the Hoover dam which

has controlled the flow of river Colorado. This in turn has increased production and the genral standard of living.

- Diversification of the economy by developing irrigation agriculture. Originally California was a land for cattle ranches but today a variety of crops including grapes, orchards, barley, wheat, and cotton are grown all the year round. Besides there are alfalfa and other fodder crops to feed the animals. this has supplemented on income from other sectors, hence increase in national income.
- Promotion of the tourism sector for example many tourists are interested in viewing and studying the irrigation canals, dams, aqueducts, and the extensive fruit farms amidst the desert. This in turn increases the inflow of foreign currency which is used to purchase foreign goods and technology.
- Facilitated technological development such as through the use of dams which are reservoirs and also pumping water for irrigation, canals and aqueducts leading water to irrigation farmlands, farm machinery and industrial processing technology. This in turn promotes the quality and quantity of production.

Shortcomings of the irrigation scheme

- Silting of the irrigation canals as irrigation water deposits its suspension material in them. Regular dredging is necessary which is quite costly.
- Irrigation has led to salination (increased saltiness of the soil) due to the high rates of evaporation in the irrigation scheme. This has reduces the biological value of the soils and thus limits plant root growth which in turn has limited yields.
- Some reservoirs are shallow leading to flooding of farmlands and this has increased the spread of pests and diseases such as Bilharzia; which undermines the standards of living.
- Displacement of people as land was being consolidated for the scheme. The scheme is located on land formerly occupied by the nomads who used to graze their animals in the area. Many people were displaced especially those who retained animal herding, and such people are costly to relocate.

- The scheme was very expensive to undertake. It involved high costs of establishing farmlands, irrigation channels, dams, pumps plus high costs of maintaining the irrigation scheme—hence straining the government budget.
- Irrigation encourages environmental pollution. The chemicals used in controlling crop pests and diseases especially over head spraying leads to both air and water pollution. Also through emission of fumes and disposal of wastes from the resulting processing factories.
- Urban—related problems in the urban centers which have come up such as Sacramento, and Bakersfield ; and the problems include: slum growth, alcoholism, robbery, gambling,-all of which impact negatively of the economy. These problems are very costly to eradicate.
- By encouraging settlement in the formerly dry areas, irrigation has created a problem of land scarcity. Today there is competition for land between farmers and industrialists.

<u>Guiding questions:</u>

7) Account for the development of large scale irrigation farming in either California or Senegal
8) Discuss the contribution of Gezira irrigation scheme to the economy of Sudan
9) Assess the extent to which irrigation farming has benefited either Sudan or California

MULTI-PURPOSE PROJECTS

Multi-purpose projects are those put up to serve a number of purposes. These are examples of how rivers can be fully utilized to yield benefits for that particular country.

Examples of multi-purpose projects in the world include:

- Tennessee valley Authority (TVA) project in USA.
- Hoover dam in California.
- Aswan high dam project in Egypt.
- Akasombo dam project/Volta river project in Ghana.

Tennessee Valley Authority (TVA)-USA

The Tennessee valley authority is a major (multi-purpose) project found in the Tennessee River valley basin in USA. The Tennessee River is a tributary of R. Ohio, which itself is a tributary of Mississippi river. The Tennessee valley authority is a corporation formed for large-scale rehabilitation of a vast region of the seven adjoining states of Tennessee, Kentucky, Virginia, North Carolina, Alabama, Georgia, and Mississippi.

Before the TVA the region had many problems such as; soil erosion, constant flooding of rivers due to heavy rains, diseases due to flooding, silting of rivers, unnavigable river Tennessee, unemployment and poverty plus lack of power/electricity. Therefore in 1933, the government had to step in and the TVA was established to rehabilitate and develop the region. It was started after the seven states agreed to cooperate for the purpose.

<u>Aims of the Tennessee valley authority project</u>

The primary aims of the TVA were:

1) To control floods and harness the rivers for self-reliance to raise the living standards.
2) To conserve soils such as through controlling soil erosion
3) To generate hydro electric power in the region

But the project was involved in many related activities such as:

- To promote industrial development within the region
- To promote forestry and wildlife conservation such as through afforestation and reforestation.
- To teach local people better methods of farming
- To improve navigation on the river so as to allow large vessels to sail on the river and its tributaries.
- To improve methods of mining of various minerals
- Above all it was to transform the economic and social environment involving: industrial development, road and railway construction, town planning, and sound agricultural techniques.

The basis of the scheme was the construction of dams; 9 on the main Tennessee River over its 1450 km long course and another 23 on its tributaries. All dams are capable of controlling floods, assisting in navigation and generating hydro-

electricity. The major dams include Norris dam, Cherokee dam, Douglas dam, Fort Loudon dam, Fontana dam, Hiwassee dam, Watts bar dam, Chickamauga dam, Guntersville dam, Wilson dam, Pickwick dam, and Kentucky dam, among others. The huge reservoirs created by the dams hold back large quantities of water, reducing floods and this water also released for irrigation purposes. The project also involved construction of a deep navigation channel.

Contribution of the Tennessee valley authority project to the development of the region

1. The region is now agriculturally productive since better methods were introduced to control soil such as contour ploughing, strip cropping, crop rotation and also better varieties of crops brought. Afforestation and reforestation have controlled soil erosion.
2. The farmers were encouraged to used modern farming methods in order to conserve soil and maintain fertility. The factories in the region now provide cheap fertilizers to be used in the farmlands. There is soil and crop research was carried out and farmers were given advice on how to solve the problems facing them. Farm machinery especially adapted to hilly conditions was introduced and manufactured locally. Demonstration farms were also set up to teach farmers.

   More so free agricultural extension services have been provided to farmers on problems they were facing such as by agricultural engineers and assistants on terracing, modern irrigation techniques.
3. Incomes have been increased in agricultural production and from employment provided by the emerging industries. For example the many farmers growing cotton and rice which have high demand in the country. When the rivers were controlled, soil quality improved tremendously and crop yields increased –hence increased farmers' incomes so that hope and prosperity returned to a region which had been impoverished for many years.
4. Flooding has been controlled by the dams (such as Norris dam, Kentucky dam, and Douglas dam) that were constructed with their reservoirs, dredging and deepening of the river channel. The huge reservoirs hold back a lot of water, thereby controlling flooding in the region. By fighting soil erosion, the silting which causes flooding has also been reduced.

5. Diseases were controlled through controlling flooding in the Tennessee valley region. Bilharzia has been controlled since stagnant water from floods has been limited, which has also improved the living standards. There was also spraying and swamp reclamation. Cultivation near river banks was also discouraged by the authorities.
6. Generation of hydroelectric power for industrial and domestic purposes in the region since over 30 dams were constructed. Examples of dams include: Fontana dam, Cherokee dam, Wilson dam, Kentucky dam. The HEP generation has also reduced the rate of deforestation. By 1953, 80% of the homes had been electrified, hence better standards of living.
7. The TVA has promoted industrial growth due to controlled flooding and the hydroelectric power generated. Industries include: chemical industries, fertilizer, farm machinery, electrical appliances, aluminium smelting, pulp and paper mills, and food processing. Such industries provide jobs to people, pay taxes to government and uplift the general welfare.
8. Transport along the river/navigation has been improved especially between Kentucky and Knoxville. The river has been made navigable for about 630miles by regulating water flow. The dredging and widening of river channel has improved water transport. The ma-made lakes are also navigable. This has uplifted a number of activities such as promoting inter-state trade and commerce.
9. Promotion of the tourism sector in the Tennessee region with many tourists from Canada, Western Europe and south East Asia attracted to the recreation facilities at wildlife reservations, national parks, game reserves, improved scenic beauty, man-made lakes among others. They come for camping, hunting, climbing mountains, sport fishing, canoeing, and swimming among others. This generates foreign exchange as well as employment in the region.
10. Promotion of urbanization with many towns developed such as Paouchah, Nashville, Chattanooga, Knoxville, these towns are industrial centres, commercial centres, employment centres, mining centres, health centres, recreation centres among others.
11. Promoted development of fishing activities.
12. There has been technological development in the Tennessee region.

13. The Tennessee has become a model for multi-purpose projects in the river valleys worldwide.

Short comings /negative effects of the Tennessee valley project

1. Displacement of people.
2. Expensive resettlement of the displaced people.
3. Industrial-related problems.
4. Urban-related problems.
5. The TVA was very expensive to undertake—hence straining the budget.
6. etc

Guiding questions:

1) Examine the significance of the Tennessee valley authority multi-purpose river development project to the economy of USA.
2) Discuss the contribution of multi-purpose development projects to economic development with reference to either USA or Ghana.

FISHING

The term fishing refers to the extraction of aquatic animals from the seas/ oceans and inland water bodies. The aquatic animals include fish, whales, seals, pearls, crabs, shrimps etc. Fishing is one the oldest occupations of man.

Due to advancements in technology and increased demand for proteins, fishing is increasingly becoming an important occupation.

A well developed fishing industry can provide cheap proteins and essential minerals (like calcium, iodine, phosphorus), fish liver oils; employment , industrial development (e.g. making animal feeds, glue, soap, margarine, paints, ink, medicine, perfumes and cosmetics). Today there is protection of international waters to check on the impact of the fishing industry, in order to ensure sustainable exploitation of aquatic life.

Distribution of Major fishing grounds in the world

The world's major fishing grounds (fisheries) are located in the cool waters of the northern hemisphere, although there is also fishing in the southern hemisphere. The fishing grounds include:

1. North West Pacific fishing grounds
2. North East Pacific fishing grounds
3. North West Atlantic fishing grounds
4. North East Atlantic fishing grounds

Other important fishing grounds are:

a) The Caribbean region
b) The Peruvian-Chilean coastlines

c) Maghreb region (North West Africa)
d) South African coast upto Angola

World fish types

1. Salt –water fish

   These spend their entire lives in oceans and seas, and they are categorized as:

   (a)Pelagic fish

   Fish stay at or near the water surface of seas/ oceans. Examples are herrings, mackerel, sardines, pilchards, brisling, anchovies/anchoveta, menhaden, tuna, swordfish, marlin, mahi-mahi, and sprat.

   (b) Demersal fish

   This lives at the bottom of the seas/ oceans or in deep waters. Fish species include cod, haddock, halibut, hake, plaice, Pollock, flounders, sole, cusk, and Rose fish.

2. Fresh water fish

   This is found in inland streams, rivers and lakes. Also in ponds, paddy fields etc the fish species include: Sturgeon, Carp, Roach, Tilapia Nilotica, Nile perch etc

3. Anadromous fish

   These stay in both salt and fresh waters. The best example is salmon (which is extensively fished in North America, particularly from Alaska to Oregon on the pacific coast). The young salmon live in the sea but after 2 to 5 years, they return to stream where they were born to lay their own eggs or die. (They move in large shoals and find their original breeding / spawning ground. Their migration routes and spawning ground. Their migration routes and spawning grounds are readily spotted and they are easily caught by traps or nets).

4. Crustaceous fish. These are often called shellfish. They are not really fish but are more of sea animals. They differ from real fish in that they have exo-skeletons. They live at great depth of the oceans near the bottom such as crabs, oysters, shrimps, prawns and lobsters. These are also caught using fish traps and divers.

Modern/commercial fishing methods

1. Gill netting (drifting)

This is a method used to catch pelagic fish. A net is suspended in water with floats at the top and weights at the bottom. The net hangs vertically in water and the fish are caught by their gills as they try to pass through the net. Once trapped they can move neither forward or backward. When the fish has been caught the net is removed onto the drifter/ ship for processing.

Illustration of drifting method

2. Purse seining

   This method is also used to catch pelagic fish living near the water surface. A purse seine net is laid out in a circular form below the water to trap a shoal of fish. The fish shoals are located using an eco-sounder. At the bottom of the net a ring exists through which a rope attached to a small boat passes. The small boat is used to lay the net, which net is suspended by floats at the top and weights at the bottom. The net has a close mesh where fish are caught by gills. After the circle has been made, the rope is pulled to close the bottom of the net thereby engulfing/ trapping the fish. The net is lifted onto the boat/ seiner.

   Illustration of purse seining

3. Long lining

   This method is used to catch demersal fish found in deep water. It involves the use of a long main line with attached drop lines which have hooks with baits. The main line / main rope can stretch for several kilometers with about 200 drop lines. The fish are caught as they try to eat the baits. When enough fish has been caught, the line is pulled out of water onto the ship and fish removed for processing.

   Illustration of the long lining method

4. Trawling

   This method is used to catch demersal fish living in deep waters. A cone-shaped net is dragged behind a ship/ boat called a trawler. A trawl net is a bag-shaped net whose mouth is kept open by otter boards (either wooden or metal) and has weights at the bottom and a slim cod end. Any fish that enters the net is trapped at the cod end and after the trawl net is pulled out of water and emptied onto the ship for processing. The process is repeated.

   Illustration of trawling method

Other methods include whaling and sealing. Whaling involves catching of whales. They are located by spotter planes or an eco-sounder and catcher boats with explosives are later used for killing the whales and floated in ships to the processing factories. Sealing involves catching of amphibians called seals that live both in marine and inland water. Seal herds are chased from the sea/ ocean where they are easily killed using game guns and later processed.

The above modern methods are more advantageous than traditional methods which are common in developing countries. The traditional methods include basket method, spear method, hooking, bows and arrows, beach seining, fish poisoning etc in still some countries electricity is used (fish paralyzed by electric shocks but this is dangerous).

NORTH WEST PACIFIC FISHING GROUNDS

The North West Pacific fishing ground is the area from the Bering Sea to the East China Sea and it is the world's greatest fishing region. Japan is the greatest contributor to the total annual fish yields in the North West Pacific fishing grounds. The rest is shared by china, North and South Korea, and the eastern former Soviet Republics.

Within the enclosed sea –the Sea of Okhotsk, Sea of Japan, yellow sea, East China Sea are intensive for both inshore and deep-sea fishing.

FISHING IN JAPAN

In the North West pacific, Japan has an outstanding fishing industry and today it is the world's leading fishing nation in all activities of fishing. Japan accounts for about 15%of the world's output. Japan greatly exports fish products in addition to industrial items. Japan is an island country making fishing a major economic activity in the Pacific waters to the east of the country, Sea of Japan, Sea of Okhotsk, and the East China Sea. The major fish species are: sardines, herrings, mackerel, salmon, yellow tail, cuttlefish, tuna, shell fish, cod, bonito, Pollock etc. In addition, Crabs, shrimps whales and pearls are caught.

Almost 3 million (a large number of) Japanese are directly dependent upon fishing for a living. Every Japanese village fronting the sea is engaged in fishing. There is coastal fishing by small boats, offshore fishing by medium-sized boats, and deep-sea fishing by large vessels.

Factors that have favoured the development of fishing in Japan

Physical factors

1. Presence of a broad continental shelf with shallow waters especially off northern Kyushu and southwest Honshu and this allows sunlight to easily reach the seabed providing ideal conditions for the growth of planktons which fish feed on, hence survival of large populations of fish. Besides the concentration of planktons along the coast attracts pelagic fish like mackerel and sardines to be easily caught. This in turn leads to large quantities of fish caught.
2. The meeting of the warm Kuroshio (Kuro siwo) and the cold Oyashio (Oya siwo) currents which also creates ideal conditions for plankton growth and as a result pelagic and demersal fish is abundant in the area. The Japanese islands are located in the zone of convergence /mixing between the two great water masses, which causes upwelling of water and this keeps the planktons floating or drifting along , hence large fish stocks leading to increased fish catch.

   The warm Kuroshio Current also provides warm conditions which prevent the freezing of water, thereby allowing fishing to go on throughout the year.
3. Presence of a long and highly indented coastline which has promoted the development of coastal fish landing ports in the numerous bays and sheltered

inlets. The ports include Tokyo, Yokohama, Nagoya, Osaka, Kobe, Toyama, Kagoshima, and Hakodate which increase accessibility to many fishing villages and handling of fish exports. Besides the indented coastline provides good breeding grounds for fish since the strong water waves that would carry the eggs are sheltered off; leads to increased multiplication of fish.

4. Japan is made up of islands and the huge islands include Honshu (the largest), Hokkaido, Shikoku and Kyushu. In addition to these, there are over 3000 islands which has increased the fishing villages and in turn increasing the quantity of fish caught and distributed. This has also made the Japanese traditionally sea ferring people and hence many have become fishermen.
5. The mountainous nature of Japan's landscape with limited lowland. Much of the available agricultural land is used in the production of staple food crops like rice and therefore less left for dairy and ranching. This has emphasized fishing as a major source of animal protein supplying about 60% of animal protein in the Japanese diet.

   Still the mountainous nature of the landscape has made the population to be concentrated on/near the coast, which releases labour to the fishing industry as well as ready market. This increases production in the fishing sector.
6. Existence of large forests to support fishing since originally many islands of Japan were forested. This plus the forested former Soviet Republics provided the required timber for ship building for carrying out fish extraction, construction of ports for landing fish and handling fish exports and even making packaging boxes for fish. This increases production in the fishing industry.
7. Presence of a variety of valuable fish species fished during various seasons both pelagic and demersal; and which exist in large quantities. These include sardines, mackerel, yellow tail, cuttlefish, herrings, salmon, lobsters, cod, shellfish, tuna, and Pollock. These have a variety of uses such as making drugs, cosmetics and glue—hence commanding a large market. This encourages large-scale investment in the fishing industry.
8. Northly location of Japan in the cool waters of the northern hemisphere and this points to the natural productivity of the cool waters surrounding Japan, in terms of planktons, large quantities of the fish species such as cod, haddock , plaice; and yet the cool climate makes fish preservation easy. For example cool water

support the growth of phyto-planktons in large quantities and also allow the planktons to float near the surface since cold water has a high density, hence attracting large concentrations of fish.

9. Presence of many rivers and streams which bring in mineral salts from inland dissolved in water and this facilitates plankton growth and in turn existence of large stocks of marine fish. The streams/ rivers also provide good breeding grounds for certain fish species like salmon, hence favouring the multiplication of fish, and thus sustainable exploitation. The rivers include: Shinano (the longest) in central Honshu flowing to the Sea of Japan; Tone River and Ishikari River.
10. Presence of large fishing grounds/ large water bodies. Japan is bordered by the large pacific ocean which is the major fishing ground containing many fish species like tuna and mackerel. There are also rivers flowing from the interior which act as fishing grounds like Shinano River. These large fishing zones promote large scale fishing investment due to large quantities of fish caught.
11. Presence of a smooth ocean floor which promotes the use of modern fishing methods like trawling, and long lining in the Japanese fishing zones and this results into large quantities of fish caught and marketed. A large part ocean floor is free from rock outcrops that could affect the landing of fishing vessels and destroy the fishing nets.

Human factors

12. Availability of large sums of capital to invest in the fishing industry accumulated from the strong industrial sector and provided by investors. The capital is used to purchase of modern machinery for catching fish and the construction of ports for landing fish. There are large corporations carrying out fishing in Japan and these possess big and sophisticated fleets/equipment, processing and canning facilities. These corporations are managed and corporate worldwide. There is high quality and quantity production.
13. Large supply of highly skilled labour employed in the sector since most settlements are near the coast and fishing being a major sector in the Japanese economy. Many people have been trained in fish extraction, fish processing, transportation and marketing. The coastal settlement has also given the

Japanese a long experience in fishing activities. This has led to long-term and large scale fishing investment.

14. Availability of a large market both domestic and foreign, for fish and fish products. Japan has a generally large population (over 130 million) and yet it is concentrated along the coast, hence providing a ready home market. Fish also provides about 60% of proteins to the Japanese diet. Besides Japan is located to the proximity of mainland Asia, which countries have large populations to support the Japanese fishing industry (countries like North Korea, South Korea, and china). There is large-scale fisheries investment to support the ready market.
15. Advancement in technology employed in the sector (Japan leads the world in the invention of modern fishing technology). Modern fishing methods are employed such as trawling and long lining leading to large quantities of fish catch; refrigeration plants, floating canneries /factory ships and other processing facilities for the preservation of the fish caught for a long period. For example tuna and salmon are caught and processed on spot. This technology has increased efficiency in the fishing industry.
16. Adequate/continuous research in the fishing industry which has led to many innovations to improve fishing activities. There is research in the breeding habits, feeding and maturation of various fish species. There are also hatching/ breeding techniques used such as for shellfish; which are then released into the waters. This in turn promotes the multiplication of fish and thus sustainable fishing in Japan.
17. Efficient transport system such as a well-developed sea transport with over 2000 fishing ports (like Nagasaki, Otaru, Tokyo, Yawata,) and modern vessels; which facilitates fishing operations/ extraction, distribution and marketing of fish. There is also a modern electrified railway network connecting various fishing ports and urban centres. This increases the supply of fish in the processing factories and the large market.
18. Political stability of Japan for long period since the Second World War, which increases the confidence of investors and workers in the fishing industry. This factor has enabled long-term and large-scale investment in the fishing industry such as construction of modern fishing ports and modern fishing vessels.

19. Ability of the Japanese to put fish to many uses, which has kept the demand for fish high. Through technology many industries using fish as an input have come up such as making fish meal, fish oils, cosmetics, perfumes, glue, drugs, fish manure; and thus increase in the fish products on the market. This has prompted further investment in the fishing industry.
20. Supportive / positive government policy towards the fishing industry such as spearheading research in fishing such as fish spoting, breeding habits of certain species; leading to increased multiplication of fish. It has also encouraged fisheries investment by large corporations and undertakes fisheries controls. This results into sustainable exploitation of fisheries resources.
21. International cooperation

Problems facing the fishing industry in Japan

1. Restrictions in the fishing grounds and this has come from excessive efficiency of Japanese fishing fleets. Reductions in fish stocks resulting from over fishing have forced many countries to protect their fishing waters from foreign interference and as such Japan falls a victim.
   a) South Korea imposed the Rehee—line in the Korean straits as the limit beyond which the Japanese fleets should not go.
   b) Salmon fishing is limited by a convention with former USSR that sets 48^0N as the Japanese fishing limit in north pacific waters ; where as that of USA and Canada is 170^0West.
   c) There are problems with Australia over the use of the Australian coastline water for pearl fishing.
2. Over fishing and important species are getting extinct especially the herrings and tuna due efficient fishing methods. Whales are really extinct in the region. Accordingly today there is an international ban on whaling. This reduces the quantity of fish production and more so threatens future production.
3. The US tests her atomic and hydrogen bombs in the pacific, which interferes with the fishermen's schedules and increases the rate of water pollution. This reduces the quality of fish.
4. Water pollution problems due to discharge of toxic substances into the water especially where industries are along the coast and this negatively affects fish survival/ death of fish. This reduces the quantity of fish caught.

5. Competition from other major fishing nations such as Norway, Canada, Peru especially in the control of foreign markets. This limits the foreign market available for fish and fish products.
6. Competition from other sectors of the economy such as industry, which attract labour away from the fishing sector. This limits the quantity and quality of production.
7. Accidents occur due to strong winds that develop due to pressure difference between the sea and the land—leading to strong water waves. This interferes with fishing schedules and limits the volume of fish production.
8. Indiscriminate fishing in some areas involving the use of some methods which scoop large quantities of fish of all sizes and age such as beach seining and traps; and this is leading to the extinction of some valuable species like halibut and cod.
9. Freezing of some rivers during winter also limits fishing sector. For example it limits the movement of some fish species which breed in fresh waters to the spawning grounds.

Assignment (write essay)

Qn. Examine the impact of the fishing industry on the economy of Japan.

FISHING IN CHINA

China is also a major fishing country in the North East Pacific fishing grounds and has large waters of its own. This includes the Bohai Sea, Yellow sea, East China Sea and South China Sea. The major marine fish species include mackerel, great yellow croaker, Hairtail, herring, conger pike, flounder, butterfish, porgy, cod, black scraper, sardine, globefish, anchovy and shell fish.

Fishing is an important activity in the provinces of Guangdong, Fujian, Zhejiang, and Jiaangsu. The major marine fishing ports include Shanghai, Hong Kong, Dalian, Tientsin, and Guangzhou.

In addition to marine fisheries, the inland rivers and lakes also have fishing activities. Major rivers are Yangtze, Yellow, Hwang Ho, Zhujiang, and Si-kiang. Major lakes are Oinghaihu, Boyanghu, Tihu, Dongting Hu. The main fresh water fish species are black carp, big head carp, common carp, bream, eel, catfish, rainbow trout, sturgeon, perch, and pangolin.

(The factors for the growth and development of the fishing industry are similar to Japan)

NORTH EAST PACIFIC FISHING GROUNDS

This occurs in the sea waters off the western coast of North America extending from Alaska in the north to California in the south. The coastline is about 11200km and is highly fiorded /indented. In the middle belt British Columbia is the most important region.

A variety of fish species occur which include: salmon, hake, herrings, tuna, sardines, sole, halibut, mackerel, flounders and a variety of shell fish. There are also marine sea animals such as whales, oysters, shrimps, and small crabs. Drifting and trawling are the most important methods employed. To a small scale seining and lining are also used. The major fishing and processing ports are: Prince Rupert, Vancouver, Seattle, San Francisco, and San Diego.

A sketch map showing the North East Pacific fishing grounds

Factors for the development of fishing in the North East pacific

Physical factors

1. Presence of a wide and shallow continental shelf (for the whole coast of western North America from Alaska to California) and this allows sunlight to easily reach the seabed providing ideal conditions for the growth of abundant planktons which act as fish food, hence survival of large populations of fish. Besides the concentration of planktons along the coast attracts pelagic fish like mackerel herrings and tuna to be easily caught.
2. The meeting/mixing of the warm and cold ocean currents, that is, the warm North Pacific current and the cold California current in the North East Pacific waters. This also creates ideal conditions for plankton growth and as a result pelagic and demersal fish is abundant in the area. The warm north pacific Current also provides warm conditions which prevent the freezing of water, thereby allowing fishing to go on throughout the year, and thus large quantity of production per year.

3. Presence of a highly indented/fiorded coastline which has promoted the development of coastal fish landing ports (in the numerous bays and sheltered inlets). The ports include: Prince Rupert, Vancouver, Seattle, San Francisco, San Jose, Anchorage, San Diego; and these increase accessibility to many fishing villages as well as handling fish exports. Besides the indented coastline provides good breeding/spawning grounds for fish since the strong water waves that would carry the eggs are sheltered off, hence the multiplication of fish.
4. Presence of off-shore islands and these include Vancouver, Queen Charlotte Islands; which have increased the fishing villages/ fishing area; hence large quantities of fish caught and distributed.
5. Limited agricultural resources on the mainland partly due to the thin infertile soils which characterize much of the adjacent mainland especially to the north of the fishing ground due to past Glaciation. More so, the rugged mountainous terrain (such as the Rocky Mountains, Sierra Nevada ranges) has made mechanized farming more difficult and this in turn has driven many people to the coast to engage in fishing as investors and as workers. This leads to large-scale investment in the fishing sector.
6. Presence of large stretches of forests to support fishing for example the temperate forests of British Columbia (with species like firs, pines, hemlock) provided the required timber for construction of fishing vessels to help in catching fish, construction of ports to support the landing of fish and even making packaging boxes for fish. This increase the quality and quantity of fish.
7. Presence of a variety of valuable fish species and in large quantities fished during various seasons both pelagic and demersal. These include salmon, hake, sardines, mackerel, sole, halibut, cuttlefish, herrings, lobsters, cod, shellfish, and tuna, which have a variety of uses (such as making drugs, cosmetics and edible oil). Salmon is the most important because it is both a fresh water and marine species and commands a large market in America and Europe. There are also marine animals caught like whales, shrimps, oysters and small crabs. This leads to increase in production.
8. The cool temperate climate in the region, which ensures cool waters for the growth of abundant planktons and survival of various fish species; hence encouraging large scale fish exploitation. Still the cool temperate climate helps

in fish preservation and transportation of fish to distant markets while still fresh; which encourages further fisheries investment.

9. Presence of many rivers and streams running from the Rockies to the pacific coast such as Colorado River, Columbia River, Fraser River, and Sacramento River. These rivers bring in mineral salts from inland dissolved in water and this facilitates plankton growth and in turn existence of large quantities of fish. The streams/ rivers also provide good breeding grounds for certain fish species which breed in fresh waters like salmon. Columbia River is the main salmon stream in the region.
10. Presence of large fishing grounds/ large water bodies particularly the Pacific Ocean, which is the major fishing ground containing many fish species like tuna, salmon, sole, and mackerel. There are also rivers flowing from the interior which act as fishing grounds like Columbia River. These large fishing zones leads to large quantities of fish catch and thus promote large scale fishing investment.
11. Presence of a smooth ocean floor which promotes the use of modern fishing methods like trawling, and long lining in the North East Pacific fishing zones; leading to large quantities of fish caught. A large part ocean floor free from rock outcrops that could affect the landing of fishing vessels or destroy the fishing nets.

Human factors

12. Availability of large sums of capital to invest in the fishing industry since Canada and USA are developed and highly industrialized countries . The capital is provided by the governments and private investors. This has been used in the purchase of modern vessels andequipment used in the extraction of fish, the construction of ports for landing of fish, and carrying out fisheries research to develop large quantities of fish. This increases the quality and quantity of fish.
13. Large supply of skilled and unskilled labour employed in the sector. Most settlements are near the coast since the interior is forested or rugged –hence releasing the necessary labour for fishing activities such as fish extraction, fish processing, transportation and marketing. The coastal settlement has also given the people a long experience in fishing activities. This has made fishing a long term investment sector in the North East Pacific.

14. Presence of a large market for fish and fish products both domestic and foreign. USA has a generally large population (over 300 million) and yet many people are concentrated along the coast, hence providing a ready market. There is a large market in the major urban centres of Canada and most especially USA (such as Los Angeles, San Francisco, Seattle, Salt Lake City, and Las Vegas). Still the fish species especially salmon are highly demanded in European markets, which has encouraged fish extraction and marketing.
15. High level of technology employed in fishing that is, use of modern fishing methods such as trawling and drifting which enable catching of large quantities of fish. There are also modern preservation involving refrigeration, floating cannaries and other processing facilities, which add value to fish and enable it to be marketed in distant markets. This in turn increases efficiency in the fishing industry.
16. Continuous research in the fishing industry which leads to many innovations to improve fishing activities. There is research in the breeding habits, feeding and maturation of various fish species. There are also hatching/ breeding techniques used and the fish species are then released into the waters to mature. This in turn promotes the multiplication of fish and thus sustainable fishing in Japan.
17. Efficient/developed transport system involving sea transport with many fishing ports (like Anchorage, San Diego, Seattle, Vancouver,) and modern vessels; which facilitates fishing operations, distribution and marketing of fish. There is also a modern road and electrified railway networks connecting various fishing ports to market centres in the interior.
18. Political stability of the region. North America has been politically stable for a long time which increases the confidence of investors and workers in the fishing sector. This in turn has enabled long-term and large-scale investment in the fishing industry such as construction of modern fishing ports and modern fishing vessels.
19. Supportive / positive government policy towards the fishing industry. The governments of Canada and USA control fishing activities to limit over fishing, and encroachment on the fishing grounds by foreign vessels. USA and Canada put up 170^0West against fishing by Japanese vessels. The governments have also

encouraged fisheries investment by large companies and spearheaded fisheries research, resulting into sustainable fishing.

Problems facing the fishing industry in North East Pacific

1. International restrictions in the fishing grounds. Fishing is not allowed beyond 200miles from the coast due to conventions with other countries like Japan, Australia. The reductions in fish stocks resulting from over fishing have forced many countries to protect their fishing waters from foreign interference.
2. Over fishing due to advanced methods of catching fish. Therefore there is great danger of wiping out some of the species for example salmon fish which is often trapped on its way back to the ocean water after breeding in the fresh waters. The fish stocks are rapidly decreasing. Accordingly today there is an international ban on whaling.
3. The US tests her atomic and hydrogen bombs in the pacific, which interferes with the fishermen's schedules and increases the rate of water pollution.
4. Water pollution problems due to discharge of toxic substances/industrial wastes into the water especially where industries are along the coast. These contain poisonous chemicals which affect fish survival. Still the barks of logs are poisonous to the fish in the rivers.
5. Competition from other major fishing nations such as Japan, Norway, Peru, china, especially in the control of foreign markets and thus causing price fluctuations and fluctuations in incomes.
6. Shortage of labour for fishing sector due to the small population especially for Canada and due to the fact that many people are employed in other sectors such as forestry, mining and industry. This in turn limits fisheries production.
7. Accidents which occur due to strong winds that develop due to pressure difference between the sea and the land—leading to strong water waves that at times lead to capsizing of boats and hence limiting production.
8. Indiscriminate fishing in some areas involving the use of methods that scoop fish of all sizes including young ones. Accordingly some valuable species are threatening extinction like halibut and salmon; and thus threatening future production.

9. Freezing of some rivers during winter and this negatively affects fishing activities especially in the higher latitudes such as by limiting the movement of fish to the breeding grounds.
10. Construction of dams on rivers / damming of rivers from the Rockies due to great demand for power in the US and Canada. This has adversely affected fish spawning / breeding of especially salmon fish which is prevented from reaching the breeding area and hence decline in fish stocks.

Steps being taken to solve the above problems

1. Controlling of fishing activities by government in order to reduce over fishing and indiscriminate fishing. There are stringent regulations/ laws on fishing in particular seasons of the year such as when the salmon fish is moving down to marine waters after breeding.
2. Treating and proper disposal of industrial wastes in order to control pollution of waters.
3. Exporting fish and fish products to other countries to solve the problem of small domestic market. This is coupled with carrying out market research.
4. Setting up more factories that use fish as a raw material such as those producing animal feeds, glue, fertilizers, oil to increase the market for fish.
5. Diversifying fish sources such as by introducing fish farming to supplement the natural sources of fish.
6. Increasing mechanization to minimize the problem of shortage of labour.
7. Signing international fishing agreements to solve conflicts over territorial waters. These agreements recognize fishing rights and grounds for each country.
8. Constructing of ladders for fish to move across the dams. These ladders assist salmon fish to overcome areas where dams have been constructed so that they can reach their spawning / breeding areas upstream.
9. Diversifying the economy to avoid over dependence on fish exports.

NORTH WEST ATLANTIC FISHING GROUNDS

This region is located along the eastern shores of Canada and USA. It extends from eastern Canada coastal lands downwards to the Georgia bank. The North West Atlantic fishing grounds has along coastline of about 8000km, with a fishing area of about 520,000km^2. The fishing region is categorized as follows:

Canadian fisheries

a) Newfoundland and Labrador—the eastern most province of Canada. Newfoundland is an island and Labrador is on the mainland of Canada. Here fishing provides employment to the vast majority of the population. The region was formerly the world's richest cod fishing area, although catches have declined due to over fishing.

   This region also includes the Labrador coast on the mainland of Canada.

b) Maritime Provinces, including lower st.lawrence. The maritime provinces of Canada include: Prince Edward, New Brunswick and Nova Scotia.

In the Canadian fisheries today the main species are: flounder, turbot, halibut, crabs, lobsters, shrimps, herrings, plaice, haddock, oyster, cod, and salmon among others.

USA fisheries

a) New England. The species are similar to those in Canadian fisheries. Larger vessels are based on larger ports like Boston, Gloucester, Portland, and New Haven.

b) Central and south coast of USA. Among the variety of fish caught (similar to Canadian fisheries), there is also oyster fishing based at Delaware and Chesapeake bays, crab fishing.

A sketch map showing the North West Atlantic fishing grounds

Note: In the North West Atlantic fishing grounds more workers are employed in fish processing than catching. However increased mechanization is making the process capital intensive. The largest percentage of Canada's catch (about 2/3) is exported to USA given its large population (high demand) despite having large-scale fishing.

Factors which have favoured the development of fishing in the northwest Atlantic

Physical factors

1. Presence of a wide/ broad and shallow continental shelf extending from southern New England to Newfoundland area which provides an excellent

breeding ground for fish. It also allows the penetration of sunlight to the ocean floor/ sea bed and this facilitates the growth of planktons-which act as fish food and thus multiplication of large quantities of fish. Besides the concentration of planktons along the coast attracts pelagic fish like sardines, mackerel to be easily fished.

2. The convergence of the cold Labrador Current and the warm gulf stream. This occurs off Newfoundland at about latitude 45^0—55^0N which condition favours the existence of abundant planktons and hence large stocks of fish. Based on the tides and the general small storms, there is increased supply of oxygen required for life. Still the ice bergs which come south with the Labrador Current bring in minerals from the land important for plankton growth.

   Besides the warm gulfstream which washes the Northeast coastline of North America results into the melting of ice which enables fishing activities to go on throughout the year.
3. The cool temperate climate which ensures cool waters which favour the growth of abundant planktons and the survival of various marine fish species, hence large-scale commercial fishing. It also favours the preservation and storage of fish which has promoted export trade in fish. However modern canning and refrigeration facilities have also been put up.
4. Presence of a variety of valuable fish species and which exist in large quantities which include: flounders, turbot, halibut, herrings, lobsters, plaice, haddock, mackerel, salmon, sardines, cod, shell fish, menhaden in the Canadian and US fisheries. The fish species command a large market since many products are got from them such as oil, fish meal, fertilizers, glue, cosmetics. There are also marine animals like oysters, crabs, and shrimps. This leads to increase in the quantity of fish caught.
5. The highly indented coastline which has encouraged fish breeding since it shelters off the strong water waves that would carry away the eggs of the fish. It has also favoured the development of modern fishing ports which include: St. John's, Stephenville, Saint John, Boston, Portland, Providence, Bridgeport, New Haven, and Halifax which support fish landing, processing and exportation.

6. Presence of many offshore islands which include Newfoundland (the main island), Anticosti island in the Gulf of St. Lawrence, Prince Edward island, Cape Breton island, and Sable island. These have increased the fishing villages and hence increased fish catch, processing and marketing.
7. Presence of large stretches of temperate forests which were used by the early settlers (like the Dutch) to make fishing vessels/crafts to extract fish. Still many other Europeans crossed the Atlantic ocean and settled at various points like Boston, Halifax and st. john; and used the timber to make vessels, packaging boxes for fish and also in the construction of ports to handle fish landing, processing and exportation.
8. Limited productive natural resources in many parts of the mainland. There are very few minerals on the mainland of New England, yet the soils are poor, thin, rocky, and infertile –implying limited agricultural opportunities. The area also has a short growing season. The Appalachian Mountains deep inland also limit the agricultural opportunities further especially mechanization. All this has driven many people to the sea to seek a livelihood, hence large supply of labour for fishing and therefore large-scale fisheries investment.
9. Presence of many rivers and streams which include St. John River, St.Croix River and Restigouche River in Brunswick; Jupiter River on Anticosti Island, Churchill River in Labrador; Exploits River and Gander River on Newfoundland. These rivers bring in mineral salts from the land that facilitate plankton growth and in turn the existence of large stocks of fish. The rivers/streams also act as breeding grounds for certain fish species, hence the multiplication of fish.
10. Presence of large fishing grounds/ large water bodies.
11. Presence of a smooth ocean floor.

Others factors/ human factors

12. Availability of large sums of capital invested in the fishing industry provided by the US federal governments (of Massachusetts, New Hampshire, Maine, Delaware etc) and the Canadian federal governments (of Newfoundland, New Brunswick, Nova Scotia etc). There are also private fishing companies. The capital is used to purchase modern vessels for fish extraction, contruction of modern processing factories and paying fisheries workers. This leads to increased fisheries production.

13. Presence of a large market, both local and foreign. The local market is especially provided by the urbanized north east of USA (including towns like Boston, St. John, New Haven, Newyork etc). For example St. John is a large settlement zone with about ¼ of Newfoundland's population. There is also market in the eastern cities of Canada. However there is also exportation to other countries especially of processed fish products. This encourages further fisheries production.
14. Availability of skilled labour to work in the fishing sector.
15. Advancement in technology.
16. The developed transport system.
17. Political stability of the region.
18. Supportive/ favourable government policy towards fishing.
19. Continuous research in the fishing industry.

Problems facing the fishing industry in NW Atlantic

1. Overfishing leading to depletion of fish stocks. This is due to large-scale operation and modern technology. Some fish species are being threatened by extinction most notable being cod fish which used to be the dominant species in the region.
2. Water pollution problems, since the fishing ground is located along the coastline of one of the most industrialized regions of the world. There is heavy discharge of waste material/ substances into the water which endanger fish survival and in turn humans who consume fish.
3. Poor visibility due to the dense fog. Therefore, the fishing vessels often run into one another causing accidents. However today vessels are equipped with a radar system which can be used to detect approaching vessels/ships.
4. Indiscriminate fishing in some coastal areas and this involves catching of even young fish and the endangered species; and this limits sustainable fishing.
5. International conflicts over territorial boundaries. The demarcation of legal fishing grounds per country has often created conflicts over boundaries (which are in most cases imaginary) between USA and Canada; and with European countries.
6. Competition from other major fishing nations such as Japan, Norway, Peru, china, especially in the control of foreign markets. This causes price fluctuations and fluctuations in incomes.

7. Shortage of labour for fishing sector due to the small population especially for Canada and the fact that many people are employed in other sectors such as forestry, mining and industry. This limits production in the fishing sector.
8. Freezing of some rivers during winter and this negatively affects fishing activities especially in the higher latitudes. For example limits the movement of fishing vessels.

Evaluation question

To what extent have physical factors favoured the development of the fishing industry in either Canada or USA?

Note: In this question consider both the North East Pacific fishing grounds and the North West Atlantic fishing grounds.

NORTH EAST ATLANTIC FISHING GROUNDS

This region extends from Iceland to Mediterranean shores. Fishing is highly organized by the European countries especially Norway, Denmark, Spain, Iceland, and United Kingdom. Fishing is carried out all round the year in the shallow waters of the North Sea, although spring is the busiest fishing season (but also the most hazardous due to the stormy weather). The major fish species are: herring, cod and mackerel. Others are haddock, turbot, halibut, hake, plaice, sole, anchovies, pilchards, sardines, skate etc. The major fishing methods are trawling, seining and lining.

Fishing is generally best developed where there are least opportunities for alternative gainful employment on land. For example commercial fishing is less important in countries like Sweden, Holland, Belgium where agriculture and forestry are crucial for the livelihood of the citizens.

NORWEGIAN FISHERIES

Norway is the greatest fishing country in Europe and one of the world's leading fishing nations. Norway is located in the North East Atlantic fishing grounds (and the fishing zones are the North Sea areas in the southern coast of the country, the western coastal waters, and the Barents Sea on the northern coastline). The main fish species in the Norwegian fisheries include herring (which contributes 65% of the total fish catch), cod, tuna, brisling, mackerel, Sprat, red fish, and coalfish. The

main fishing ports include Haugesund, Stavanger, Bergen, Tromso, Oslo, Hammerfest, and Alesund.

The leading Norwegian ferring port is Haugesund and it exports mainly herrings to many parts of the world. Stavanger specializes in canning of brisling fish and sardines, and has one of the most advanced canning industries of Europe. The major fishing methods are: drifting, trawling, and lining. In Norway, there is both in-shore and deep-sea fishing. Besides catching fish, the Norwegians also do sealing and whaling.

A sketch map showing the fishing grounds in Norway

Factors for the development of the Norwegian fishing industry

Physical factors

1. Presence of large fishing grounds/ large water bodies. Norway is bordered by the large Atlantic ocean (which includes the Norwegian sea and the North sea) which are the major fishing grounds containing many commercial fish species. There are also rivers flowing from the interior which act as fishing grounds. These large fishing zones lead to large quantities of fish caught and thus promote large scale fishing investment.
2. Presence of a smooth ocean floor free from rock outcrops that could affect the landing of fishing vessels and also destroy the fishing nets. The smooth ocean floor therefore promotes the use of modern fishing methods like trawling and lining in the Norwegian fishing zones, and thus large quantities of fish caught.
3. Extensive/wide and Shallow continental shelf which allows the penetration of sunlight to the seabed and this promotes the growth of phyto-planktons. The planktons act as fish food that helps in the multiplication and maturing of fish such as herrings, cod, and brisling. Besides the wide and shallow continental shelf from Stavanger to Hammerfest promotes easy catching of pelagic fish like herrings.
4. Favourable conditions at the continental shelf such as cool waters, which also contain a variety of mineral salts resulting in the abundance of planktons, which also float on water, and this attracts abundant marine fish. The northly position and cool temperate climate makes the preservation of fish relatively easy-as fish

cannot easily be spoilt, and thus enabling the marketing of fish in distant markets.

5. The effect of the warm north Atlantic drift which enables fishing to be carried out all year round, by keeping the waters open through the winters. It enables ice to melt but water remains cool enough for fish survival. This leads to large quantities of fish caught per year.
6. Presence of many rivers and streams that provide good breeding grounds for various fish species, which breed especially in fresh waters. The rivers also bring in mineral salts from inland dissolved in water and this facilitates plankton growth and in turn existence of large stocks of fish. The rivers include: River Glama (Glomma) in the east, River Tana in the north and several other small streams.
7. Presence of a highly fiorded/ indented coastline which has promoted the development of fishing ports such as Stavanger, Trondheim, Bergen, and Oslo in the sheltered areas, which enable fish landing and exportation. The fiords also provide suitable grounds for fish breeding, since it shelters off the strong water waves that would carry away eggs of fish; and thus enabling the multiplication of fish. The long fiorded coast between Stavanger and Hammerfest is noted for cod fishing.
8. Presence of off—shore islands which increase on the fishing villages, right from Tromso to Kristiansand. The Lofoten islands form the greatest cod fishing area. Other smaller islands are Vesteralen islands, Vega Island, Andoya and Shetland islands. This results into increase in the fishing areas and thus increased fish caught and this attracts more investment in the fishing industry
9. The poor agricultural resources such as rugged terrain / mountainous landscape and infertile soils which has driven people to seek a livelihood at the sea and more labour supply. This has led to increased investment in the fishing industry. Approximately 75% of Norway is of high altitude rugged terrain with steep slopes of unproductive land. This in turn increases fisheries investment.
10. Existence of many valuable/ commercial fish species such as herrings, cod, tuna, brisling, mackerel, halibut, pilchards, haddock, dogfish, and capelin. Cod particularly exist in large numbers especially in the coastal waters of the Lofoten

islands. These species are of high commercial value and in large quantities which has attracted large scale investment in the fishing industry.

11. Presence of extensive forests (Norwegian forests) with species like spruce, firs, pines favouring the building of ships and boats at Bergen, Stavanger, and Tromso. These ships are used in hauling fishnets and transportation of fish to processing centres/ports. The timber is also used in the construction of modern ports for fish landing and making packaging boxes for fish.

Human factors

12. Norwegians have a long Sea ferring tradition and this dates back from the times of the Vikings and Norsemen (kings). These encouraged quite often people to become sailors and fishermen. As such, fishing is rooted in culture. This has led to large scale and long-term investment in the fishing industry in Norway.
13. The cooperative movement/ highly organized and developed cooperatives engaged in all fishing activities such as fish extraction, processing, preservation and marketing of fish. The cooperatives also enable fishermen to raise adequate capital to invest in all those activities. This leads to increased quantity and quality of production.
14. Presence of large sums of capital to invest in the fishing industry.
15. Most settlements are at or near the coast/ availability of labour, both skilled and unskilled. Even farmers do fishing on part-time basis.
16. Presence of a large market, both internal and external. Norway is located close to industriliazed countries of Europe such as France, Italy, Spain, and Belgium, which provide a ready market for fish and fish products. It also exports to Latin America.
17. Well developed fishing technology
18. Continuous research in the fishing industry.
19. Efficient transport system
20. Political stability of the country.
21. Supportive / favourable government policy towards fishing.
22. International cooperation

Contribution of the fishing industry to the Norwegian economy

1. Fishing has promoted industrial development by providing raw materials. Many industries are now engaged in processing of fish products such as cod liver oil,

fish meal, fertilizer, glue. There are various industries at Stavanger specializing in modern canning of brisling fish. Inferior and undersized fish are converted into fishmeal for animal feeding or used in making of fish manure. There are also industries making fishing inputs like ship building and making of nets.

2. Generation of employment opportunities in Norway both direct and indirect employment in the fishing industry such as fish extraction, processing, transportation and marketing. These employees earn incomes which help them to improve their standards of living. They also pay tax to the government to raise revenue.
3. Generation of foreign exchange through the exportation of fish and fish products to various countries like France, Portugal, Italy, Belgium, Sweden, and Spain. Fish is exported in various forms like frozen, dried, pickled(preserved in salt water) and canned. The foreign currency earned is used in the importation of foreign technology and consumer goods not available domestically.
4. Fishing has promoted urbanization and port development. The port of Haugesund is the greatest Norwegian port handling herrings and exports cured/preserved fish to various countries. Other important ports are Stavanger, Bergen, Tromso, Oslo, Hammerfest and Trondheim. These ports have trade links with many parts of the world and they are developed urban centres due to increased population and thus the concentration of associated activities like trading, banking, and recreation.
5. Fishing has promoted technological advancement and research due to the necessity to improve fishing technology, preservation and processing in order to keep pace with other fishing countries (like Japan, Canada). Fishing has also led to research into various fish species such as cod, tuna, and sardines—in breeding habits, fish feeding habits, which has increased efficiency in fishing.
6. Development of other sectors especially agriculture. Fishing provides fertilizers which improve crop farming like wheat, corns and sugarcane. It also provides animal feeds for dairy farming at Stavanger and Trondheim. This also helps to improve the standard of living of the people and government revenue.
7. Provision of government revenue through taxation of the fishing companies, fish exporting companies, and individuals' incomes. This is in turn used to develop many sectors such as health, recreation, and education.

8. Promotes international relations between Norway and other countries, which import the fish and fish products such as Sweden, Portugal, Denmark, Holland, Finland, Spain, France, Belgium, and some African countries. It also relates with other major fishing countries like Japan, Canada, and Peru due to sharing ideas regarding the fishing industry. This in turn promotes economic contacts and increases the rate of capital inflow in Norway.
9. Development of transport infrastructure in Norway that is, the construction of roads and rail networks along the coast to access the fishing grounds such as Oslo-Stavanger road and railway. Besides the revenue from fish exports has been used in the rehabilitation and opening up of new feeder roads.
10. Development of tourism because many tourists are attracted by large-scale fishing by use of modern technology such as trawler boats, and factory ships. The various fish species like cod, sardines, and brisling also attract many tourists. This also generates foreign currency and creates market for the local goods.
11. Promoted diversification of the economy by acting as an alternative source of income for Norway instead of depending on industry or forestry. This makes the economy to remain stable and more so it widens the export base of the country. Besides the fishing industry has minimized the problem of population pressure on land, which land is of poor quality.

Shortcomings/ negative effects

1. Over fishing and hence reduction in fish stocks due to the use of efficient fishing methods like trawling and drifting which in turn leads to lowering of fish output.
2. Indiscriminate fishing which also reduces fish stocks. This involves catching young fish and endangered species and this leads to inadequate production.
3. It is a source of international conflicts over boundaries (which are in most cases imaginary) between Norway and its neighbours such as Denmark, Iceland, Sweden, Finland, and USA. These conflicts are a barrier to beneficial diplomatic relations.
4. Fishing is associated with accidents leading to loss of life and property. This interferes with fishing schedules.
5. Depletion of forest resources due to the high demand for temperate forest species (like firs, pines) for boat making and shipbuilding at Bergen, Tromso has led to depletion of forest resources.

6. Industrial-related problems for example pollution due to discharge of toxic gases and other substances which impacts negatively on the environment such as by contaminating water.
7. Urban-related problems. Fishing has led to growth of urban centres (such as Bergen, Oslo, and Tromso) but these are associated with many problems such as slum growth, poor sanitation, and hooliganism. The fighting of such social evils is costly to the government.
8. It has caused regional imbalance in development. The coastal areas are more developed than the vast interior areas in terms of infrastructure such as recreation, education, and health facilities.
9. The fishing sector has attracted labour away from other sectors like agriculture, and industry; hence undermining their development.
10. Straining the government budget when financing various fishing—related activities such as research, quality control. This undermines investment in other sectors of the economy.

Problems facing the Norwegian fishing industry

1. Over fishing leading to reduction in fish stocks. There are many fishing countries in the North East Atlantic which all use sophisticated weapons. As a result this has reduced fish stocks. For example Norway has about half of the world's whaling vessels, a factor that has led to the almost extinction of whales in the North Sea.
2. Water pollution problems since industrialized countries border the North Sea where the Norwegian fishing industry is confined. The toxic waste disposals into the water cause death of fish and endanger plankton survival, also humans who consume the fish.
3. Competition from other fishing countries on the world market such as Japan, USA, which all flood the markets with the best fish types with or compared to Norway. This leads to fluctuations in the prices and incomes.
4. Competition from other countries in the North Atlantic fishing grounds. There are interferences from international fishing lanes because some of the fishing grounds are located in the waters internationally used for fishing purposes. The competitors include Iceland, Denmark, Sweden, and USA. This limits fish production.

5. Restrictions in the fishing grounds. Fishing by foreign vessels is often restricted over a variable distance from the land. This has been prompted by rapidly improving technology in fishing vessels and equipment, and if not restricted this would mean depleted grounds. For example the Norwegian were refused to fish in their reserved fishing grounds.
6. Accidents occur especially during the spring season –which is the busiest fishing season and the most hazardous. During this time, the North Sea is characterized by big waves due to pressure difference between the sea and the land. This interferes with the fishing schedules.
7. Seasonal variation in fish availability. There is migration of fish from the north to the south and fish stays in waters off the coast from summer until the end of autumn. This has limited fishing activities.
8. Alternative employment opportunities offered especially in industry has also attracted the labourforce away from the fishing industry of recent. This also tends to limit fishing activities.

SOUTH PACIFIC FISHING GROUNDS

FISHING IN PERU

Peru is located in South America bordering the Pacific Ocean and is an important fishing nation, (although fishing is a recent development). Peru is found in the South Pacific fishing grounds and is one of the world's fishing nations. In fact, by 1970, Peru was the world's leading fishing nation and at that time it accounted for almost 30% of the world's total catch. However today catches have declined mainly due to indiscriminate fishing.

The main species of fish caught include anchovy, pilchards, tuna, haddock, sole, mackerel, smelt, flounder, lobster, sardines, and shrimp, among other marine species. Anchovy is the most important and is used for making fish meal, a product in which Peru leads the world. Fish meal is used in animal feed and fertilizer. There are over 50 important fishing ports on the coast of Peru, but Chimbote and Callao are the most important. Other ports are Ilo, Atico, Pisco, Vegueta, Casma, Trijillo, and Cheilayo.

Modern fishing is employed and government controls processing of fish with a corporation called Pesca-Peru. The corporation monopolizes the processing of fish meal and fish oils. It also engages in the canning and freezing of especially tuna fish.

Today there are over 100 fish processing factories (producing, fish oil, fishmeal, glue, fertilizer and medicines) and the fish and fish products presently account for over 40% of Peru's export earnings. Much of the products are exported to USA, USSR, china, and the European Union.

A sketch map showing the Peruvian fishing ground

Factors for the growth and development of the Peruvian fishing industry

Physical factors

1. Presence of along coastline of over 2000km and this ensures a large fishing area and commercial deep-sea fishing off the Peruvian coast, which leads to large quantities of fish caught. It is not surprising that there are over 50 fishing ports along the coast, and thus increased fish landing and exportation.
2. Presence of a relatively indented coastline which has provided good sites for construction of fishing ports such as Chimbote, Callao, Trujillo, Piura, Pisco, and Chiclayo for fish landing and exportation. The indented coastline also provide suitable grounds for fish breeding, since it shelters off the strong water waves that would carry away eggs of fish-hence increased multiplication of fish.
3. Extensive and Shallow continental shelf which allows the penetration of sunlight to the seabed, which promotes the growth of phyto-planktons. The planktons act as fish food that helps in the multiplication and maturing of fish such as anchovy, tuna, and sardines—hence favouring fisheries development.
4. Existence of many valuable/ commercial fish species such as anchovies, tuna, mackerel, bonito, sardines, pilchard, haddock, sole, smelt, flounder, lobster, shrimps. There are more than 50 species caught commercially and anchovies are particularly found in large quantities—which has attracted large scale investment in the fishing industry.
5. The influence of the cold Humboldt Current (Peruvian current) which creates cool conditions for large quantities of phyto-planktons and in turn large populations of fish survive for example anchovy. This leads to increased fish catches.

6. Presence of many birds which provide guano for plankton growth. There are millions of birds at the coast of peru and their droppings (guano) fertilize the ocean floor leading to the growth of abundant plantons on which the fish feed.
7. *Presence of some small off—shore islands which increase on the fishing villages for example San Lorenzo Island and other smaller islands. This results into increased quantities of fish caught and thus large scale investment in the fishing industry.
8. The limited productive natural resources on the mainland such as due to presence of the Atacama Desert stretching from Peru to the south of Chile and the Andes mountains, and this limits settlement and agricultural production. The minerals which exist such as silver and iron ore occur in small quantities hence cannot support the export economy. This has led to increased investment in the fishing industry as the alternative source of livelihood.
9. Presence of large fishing grounds/ large water bodies.
10. Presence of a smooth ocean floor

    Human factors
11. Presence of adequate capital to invest in the fishing industry. This was provided by the government which looked for the alternative to the economy and the vision set to fishing.
12. The development of many processing plants at the coast such as Chimbote, Callao, and Lima. These process fish into fish meal, fish oil, and animal feeds.
13. Supportive / favourable government policy towards fishing. The government has spearheaded research and also extended monopoly over the fishing grounds in the south pacific from 22km to 370km from the coast to cut-off competition from foreign vessels. It also restricts on the local fishing seasons.
14. Presence of a large and ready market, both internal and external.
15. Improved fishing technology
16. Continuous research in the fishing industry.
17. Improved transport system
18. Relative political stability of the country.

Problems facing the fishing industry in Peru

1. Over fishing which has drastically reduced the fisheries potential. This has been brought about by improved technology used and the invasion by the US and

Japanese fishing fleets to the Peruvian waters. Over fishing partly accounts for the decline of the anchovy fish in Peruvian waters.

2. Reduction in guano. The establishment of a fertilizer plant using guano as a raw material has greatly reduced the guano available as fertilizer to the ocean water planktons and hence a decrease in fish stocks. This is because guano is very rich in phosphorous, nitrogen and potassium which is very essential in fertilizer manufacture.
3. Stiff competition from other fish exporting countries on the world market since 1970s such as Japan, china, USA, Norway, and Canada. To her disadvantage, Peru only exports fish meal and fish oil from one fish species (anchovy) compared to other countries exporting a variety of fish species—hence outcompeting Peru.
4. Competition from other sectors of the economy for government funding. Although fishing in early 1970s received great government funding but over time it has come under stiff competition from other sectors such as tourism and industry. This has been worsened by the declining fish species due to over fishing.
5. Limited valuable fish species. Peru unlike other countries has been noted for one valuable species in abundance –anchovy, which has limited the growth of Peruvian fisheries. However there is in unedible fish species on the Peruvian coast, which hinder fisheries development due to limited uses of such species.
9. Water pollution problems due industries along the coast. The toxic waste disposals into the water cause death of fish and endanger plankton survival, also humans who consume the fish.
6. Inadequate capital to develop the fishing industry such as improving port facilities and funding research. More so there is limited industrial development. Apart from the fertilizer industry , fish meal and fish oil, Peruvian industries have not explored other fish processing factories like cosmetic , glue etc partly attributed to limited capital.
7. The El Niño weather phenomenon. Towards the end and beginning of every year (between December and March) strong winds cross the equator and bring warm water south wards along the Peruvian coast which spread over the cool waters of the Peruvian current. This is mostly a problem during the abnormal years

when the north wind is very strong. This causes fish to migrate southwards into Chilean fishing grounds. It also creates unfavourable conditions for plankton growth and hence affecting fish survival.

8. Political problems. After the military coup in 1970 that overthrew president Allende, it led to a decline in the fishing industry given the fact that it scared off the potential investors.
9. Low levels of technology used in some regions evidenced by people using poor fishing nets that catch even young fish. Some people even use poor fishing gears , hence limiting production.
10. Poorly developed transport facilities in some regions, since Peru is a developing country; yet fish requires efficient transport to the market and processing centres.
11. Shortage of labor to work in the fishing industry. This is because Peru's coastal lands are arid and therefore poorly settled, yet even most of the labour is unskilled; hence resulting into under production.
12. Accidents occur during fishing for example the capsizing of fishing vessels leading to loss of life and the fish caught.

Steps taken to develop the fishing industry in Peru

1. Conservation measures have been taken to ensure constant fish stocks and to increase fish stocks such as restrictions on the fishing seasons to avoid over fishing.
2. The government has extended the territorial waters from 22km to 370km away from the coastline. This is designed to keep off the invading American and Japanese fishing fleets, making monopoly of fishing in this region to Peru.
3. Fisheries research has been adopted for example at Chimbote in the available fish stocks, its behavior and fluctuations. The intention is better conservation for sustainable fishing.
4. Control of processing by a government corporation called Pesca-Peru, to ensure that all profits that accrue are ploughed back in the fishing industry.
5. Encouraging local people to consume fish in order to increase the home market for fish.
6. Stocking inland waters with improved species to improve on the fish catch.

7. Continuous improvement on the techniques of fishing, freezing, packing and canning.
8. Improvement in transport and communication facilities.
9. Continuous training of manpower to acquire the necessary skills for the fishing sector.

FISHING IN AFRICA

It should be noted that the fishing industry in Africa is not well developed. A few countries can afford big ships and other fishing equipment; although the situation is gradually changing.

In Africa the countries with a developed marine fishing industry include: South Africa, Namibia, Angola, Nigeria, Ghana, Morocco, Mauritania, and Senegal. These are countries that export fish and fish products (with regard to marine fishing).

The species of marine fish from African coastal waters include: sardines, stock fish, hake, anchovy, barracuda, sole, pilchards, mackerel, lobsters etc. Africa only contributes about 6% of the world total catch and unfortunately many African countries import fish.

Reasons for the low level of development of marine fishing in Africa

1. African coasts are generally straight with few indentations, unlike the coasts of the North Sea or Europe. As such it is not easy to develop ports and does not allow breeding of fish since even young fish require less turbulent water where they cannot easily be carried away by waves. The young fish also do not require open water where they may be eaten by large fish or marine animals.
2. Small continental shelf for most of the African coastline rarely extending for many kilometers from the coast. This doesn't allow easy penetration of sunlight for photosynthesis in phyto-planktons. It also limits the use of profitable methods like trawling (for the fish sunk to the bottom). The east African continental shelf is extremely limited to only 15km from the mainland and the operation is very small.
3. Influence of warm ocean currents such as the Mozambique current, which do not favour the growth of planktons and therefore low fish populations. Still some ocean currents are strong and interfere with plankton distribution and movement of vessels, many of which are actually non-motorized.

4. Large areas of Africa are located within the tropics, where temperatures are hot making waters generally warm. This discourages the growth of planktons, encourages poor fish species and limited fish stocks. The fish that mostly develop in this warm water are always oily and not of good taste. The hot temperatures also make fish spoilt easily; and this limiting fisheries production.
5. Ideal climate for agriculture. A reasonable area of Africa receives heavy rainfall which can sustain farming. Many people therefore look at farming as the main source of livelihood and backbone for development. It is only in areas like Namibia, Angola and Morocco with poor agricultural resources where fishing is developed.
6. Africa has few offshore islands; which otherwise would have been used to increase the fishing villages. (The few islands include Canary Islands, East African islands of mafia and Pemba). This limits the fishing area and thus limited fish production.
7. Existence of coral reefs particularly along the East African coast. These coral reefs interfere with fishing and movement of vessels, fishing nets especially trawl to be used in deep waters. This discourages many investors and this limiting production.
8. Scattered fish species that is, there are few species moving in shoals due to the scattered nature of planktons, such that even the fish scatter in search for them. This fish occur very far from the shoreline and have a peculiar characteristic of moving very fast. It is therefore uneconomical to apply modern methods like trawling and seining.
9. Limited capital in many African countries and this limits the use of modern fishing vessels resulting into low fish catch. Still many countries cannot finance research on fish stock available which limits fisheries development further (to only a few countries like South Africa, Morocco). Many countries use poor crafts like canoes and boats.
10. Low levels of technology employed in many areas, resulting into low fish yields. Methods like basket trapping, beach seining, simple hooks are still noticed in several areas. Marine fishermen operate from small canoes and their activities limited to a few miles off the shoreline. More so poor preservation methods

such as smoking, salting and sun drying are common. This also limits the marketing of fish in distant markets.

11. Limited market for fish. Africa's population is still small and hence a small demand for fish and fish products. More so traditional customs/cultures prevent fish consumption; some African societies take eating fish as a taboo, hence limiting demand. Most areas along the coast are sparsely populated and people relatively poor.
12. Export of marine fish is difficult because of stiff competition from the developed countries, some of which already faced with the problem of over production of fish. This also discourages further investment in the fishing sector.
13. Political instability experienced in several areas such as Mozambique, Angola, Namibia, Liberia, Ivory Coast. This limits the investment in fishing industry by diverting funds to wars. It also limits the labourforce in the fishing sector.
14. Unfavourable government policies towards fishing. Many African governments have weak policies to control fisheries such as over fishing, indiscriminate fishing among other activities. Where the policies exist, there is weak or no enforcement. This for example results into depletion of fish stocks.
15. Invasion by foreign vessels which catch much of the fish in Africa's coastal waters for example Japanese and Korean vessels which have in recent years been catching fish off the coast of West Africa. This reduces the fish stocks.
16. Poorly developed infrastructure connecting the coast and the interior for example poor roads and this negatively affects the marketing of fish and fish products. This discourages further investment in the fishing sector.

FORESTRY

A forest is a large tract of land covered extensively by trees. It is a type of vegetation dominated by trees.

Forestry is a scientific process of planting, exploitation, and conservation of forests. It is concerned with managing forests on a sustainable basis, balancing exploitation and conservation.

In the world there are almost 40 million km^2 of forests with roughly half found in the tropics. Forests once covered about 60% of the earth's surface but have greatly reduced by clearance for settlement and farming or during the exploitation process. About 25% of the earth's surface is today covered with forests and the world demand for timber is increasing leading to over cutting of forests. On the other hand, some people are realizing the need of maintaining timber supplies and have planted forests / established forest farms.

MAJOR TYPES OF NATURAL FORESTS IN THE WORLD

The major forests of the world are found in the more humid temperate and tropical areas. The classification is based on climatic factors and the dominant type of trees / wood they produce. The major types include:

1) Tropical hard wood forests
    (a)Tropical evergreen forests / tropical rain forests/Equatorial forests
    (b) Tropical monsoon forests*
2) Temperate hard wood forests*
3) Coniferous forests/ temperate forests

TROPICAL HARDWOOD FORESTS

These are divided into two:

- Tropical evergreen forests/equatorial forests/ tropical rainforests.
- Tropical monsoon forests

TROPICAL EVER GREEN FORESTS/ TROPICAL RAIN FORESTS/ SELVA FORESTS/ EQUATORIAL FORESTS

These forests are located astride the equator extending approximately 10^0N and 10^0S of the equator. The largest expanse of tropical rain forests is in the Amazon basin of Brazil, extending from the Atlantic coast to the foothills of the Andes Mountains. These forests also occur on the pacific coast of Columbia and in Central America.

In Africa tropical rainforests occupy the Congo basin (former Zaire), Central African Republic, low lands of West Africa such as Nigeria, Ivory Coast, Sierra Leone, Ghana, Cameroon, and Gabon. They also occur on the coastal plain of tropical East Africa.

In south Asia, tropical rainforests are found in Malaysia, Indonesia, Papua New Guinea, and in the coastal low lands of south and South-East Asia countries.

Equatorial forests mainly cover lowlands with heavy rainfall and hot temperatures all the year round, between 24^0c and 32^0c, which rarely follow below 21^0c.

Characteristics of tropical rainforests

1. They are thick forests and with much luxuriant foliage/leaves. This is due to heavy rainfall and hot temperatures.
2. The majority of the trees have broad leaves to release excess water through transpiration.
3. The forests are heterogeneous in nature—the trees do not appear in pure stands of a single species but valuable tree species are widely scattered/ mixed up with other trees.
4. The forests have distinct layers called canopies –the top layer, middle layer, and bottom layer.
    - The top layer mainly consists of tall trees (giant trees) with buttress roots – generally over 46m in height.
    - The middle layer mainly consists of clinging plants which cling on strong trees, tree ferns, lianas (thick stemmed creepers) and trees between 19 and 34 m tall.

- The bottom layer consists of mainly under growth of ferns, herbaceous plants (herbs), with trees of upto17m tall.

5. The forests are dominated by hard wood trees and yield valuable hardwood timber(such as mahogany, rose wood, iron wood, ebony)
6. The tall trees are characterized by buttress roots extending for several metres above the ground (up to 10m) which support them and the trees have long straight trunks ideal for timber.
7. The forests have little or no under growth because the dense canopies shut out sunlight from the lower layers/ floor of the forests. The undergrowth becomes thick only in few areas where some trees have been destroyed.
8. There are a variety of climbers /lianas (rope-like climbing plants), creepers, and parasitic plants. Rain forests also have epiphytic plants (plants which grow on other plants but do not actually feed on them such as ferns, orchids, bromeliads).
9. Palm trees exist especially along shores or muddy coasts.
10. The trees are evergreen throughout the year because the areas receive rainfall throughout the year (shed at different times of the year/ never shed off all their leaves—most trees retain their leaves for most of the year so that the forest appears evergreen).
11. The trees have a long gestation/ maturity period; most trees take over 60 years to mature (Mvule takes over 70 years).

Examples of tree species in the tropical rain forests are: Mahogany, Iron wood, Red wood, Red heart, Green heart, Mvule, Ebony, Teak, African cedar among others.

TROPICAL MONSOON FORESTS

These mainly occur in south East Asia and the Indian sub-continent, with the major countries being India, Burma, Thailand and indo-china, northern Cambodia, northern Vietnam and northern Australia.

Characteristics of tropical monsoon forests

1. The monsoon forests are less luxuriant than equatorial forests because of seasonal drought (trees are not as close as in the evergreen forests).
2. They have thick under growth of shrubs and small trees and dense thickets of bamboo.

3. Forests shed their leaves during the dry season and do not grow new ones until the rains come (most trees are deciduous –shed their leaves seasonally).
4. Trees are not in pure stands (heterogeneous in nature).
5. Mainly hardwood species like iron wood, teak, sandal wood etc.
6. Some trees are associated with buttress roots and have broad leaves which are deciduous.

TEMPERATE HARDWOOD FORESTS

These forests are found between approximately 30^0 and 50^0 North and South where temperatures are moderate (but where the seasonality of the climate though marked is not as extreme as in the coniferous forest belt).

The major areas with temperate hardwood forests are: northern china (including Manchuria), Japan; west, south and central Europe; eastern North America. Some temperate hardwoods are also found in southern Australia, especially in Tasmania, and west Australia.

Characteristics of temperate hardwood forests

1. The trees are mostly deciduous, shedding off their leaves in autumn and remaining leafless throughout winter.
2. The trees yield a variety of hardwoods like oak, beech, camphor etc
3. Like the tropical forests, the temperate hardwood forests have a variety of species scattered irregularly through the forests.
4. The forests also contain many shrubs and small plants. But neither the tall trees nor the undergrowth are as luxuriant as those in the tropics.

Note: The hardwood while being very durable and strong is not usually as heavy or as difficult to work as are tropical hard woods. But it is more difficult to extract than softwoods.

The main commercial species are: Oak, Ash, Beech, Poplar, Mongol trees, Camphor, Walnut, and Elm.

TEMPERATE (soft wood) FORESTS/ BOREAL FORESTS/ CONIFEROUS

Coniferous forests cover a broad belt of land in both North America and Eurasia (to the north of the temperate hardwood forest belt). They extensively cover the high latitude areas and high altitude areas (uplands and mountains). Coniferous

forests are mainly located in the northern hemisphere in a belt between 50^0 and 70^0 N (though there are some conifers in the southern hemisphere)

The major regions with coniferous forests include:

- Western North America, including northern California, Washington and Oregon in USA; British Columbia in Canada and southwest Alaska.
- Central and Eastern North America. It extends southwards around the Great lakes and into the Appalachian mountains.
- Southern USA –from Virginia to Texas.
- Northern Europe. This includes Scandinavian countries –Norway, Sweden and Finland; northern Russia, many uplands further south such as Britain, Germany, parts of Italy.
- Asiatic USSR—northern Siberia extending to the pacific coast.

Characteristics of coniferous forests

1. The conifers have tall straight trunks/ stems and they grow to a height of 30m or more depending on soil and climatic conditions.
2. The coniferous forests have evergreen trees (due to high adaptation to severe winter conditions). They do not shed their at once and maintain a green foliage throughout the year.
3. The trees have narrow needle-like leaves with small surfaces to prevent excessive loss of water by transpiration/ to limit transpiration.
4. The leaves of the trees have tough and thick skins/ barks to protect them from winter cold.
5. The trees have a short growing / maturity period (about 14 to 20 years).
6. Most coniferous trees are softwood (like hemlock, firs) and are light in weight which makes them easy to cut and transport.
7. The forests are homogeneous in nature-the trees usually occur in pure stands of a single species (a particular species like spruce occurs in a given area), and hence easily exploited.
8. The trees are cone-shaped and flexible to allow snow to slide off without breaking branches.
9. The forests have no under growth because of frozen ground, and yet the trees grow close together producing a heavy shed.

10. Coniferous forests are moderately dense and they become thinner in colder or drier regions(the most dense , luxuriant coniferous forests are found in western north America).
11. The trees often grow to a height of 30m or more (but do not have the wide buttress roots of tropical rainforests).
12. The trees have wide spread shallow roots to collect water from the top frozen ground.
13. There are no creepers and lianas.
14. Conifers bear and carry their fruits in form of tough cones; hence the name conifers.
15. There are few species unlike the tropical rainforests.
16. Towards the poles the conifers become shorter, more dispersed, stunned and merge with the tundra vegetation.

The major commercial tree species include:

- The pines—such as white pine, Scots pine, Lodgepole pine, Norwegian pine, jack pine, pitch pine, slash pine, ponderosa pine.
- The firs—such as Douglas fir, Balsam fir, Joint fir, Noble fir, Silver fir.
- The spruces—such as Norway spruce, red spruce, Sitka spruce.
- Cedars—such as Red cedar, Cedar of Lebanon, Cyprus cedar, Deodar.

- ✓ Hemlock—such as eastern hemlock(N.E USA and eastern Canada); western hemlock(along pacific coast from Alaska to central California);Japanese hemlock etc.
- ✓ Larches – such as American larch (tamarack), subalpine larch, and European larch.
- ✓ Californian red woods (sequoias)

General importance of forests

1. Provision of industrial raw materials for example the major product timber which is used to produce many items such as used in the construction and boat making, furniture making, manufacture of synthetic textiles (like rayon), production of cellulose.

2. Provision of medicine for certain diseases such as quinine extracted from cinchona tree, cocaine got from the coca shrub, camphor –an oil distilled from the camphor tree and today used in making cosmetics, soaps and ointments.
3. Forests provide food and fruits collected from the tropical rain forests such as ivory nuts, Brazil nuts, and betel fruits. Many societies obtain gums from forests—used in the making of chewing gum. Also palm oil like in Brazil for extracting cooking oil and other products. There are also mushrooms and yams.
4. Water catchment function of forests / protection of water resources because the canopies break the force of rain making it percolate/infiltrate slowly into the soil causing long run water storage hence development of rivers and rivers. In fact, the world's major rivers are characteristic of forested areas such as Amazon River, and Congo River.
5. Modification of climate through the evapo-transpiration process, by recharging atmospheric moisture which condenses into rain. In fact, many dense forests have the heaviest rainfall world over such as Congo and Amazon basins. This supports economic activities such as farming in the surrounding areas.

   Rain forests also regulate climate by absorbing carbon dioxide and give off oxygen in the process of photosynthesis; hence lessening the impact of global warming.
6. Soil conservation since the forests reduce soil erosion frequency and intensity by facilitating infiltration/ percolation of rain water into the soil and therefore reduced runoff. The rainwater is intercepted by the tree branches and rolls off the trunks into the soil. The plant/tree roots also bind the soil particles together which factor also promotes slope stability.
7. Habitat for wild life in form of flora and fauna species. The animals and birds include: elephants, buffalo, chimpanzees, monkeys, gorillas, flamingos, falcons in tropical rain forests. In the temperate forests –bears, deer, gray owl, North American mink, lynx (wild cat), lemmings. There are also various plant and tree species in various forests. Eventually the forests act as laboratory for research and educational studies.
8. Promotion of the tourism sector because many forest areas have been gazetted as national parks and game reserves for example Okanda national park in Gabon, Amazonia Park in Brazil, and Galamba Park in Congo to conserve wild

life. These act as places for recreation, and other tourist activities such as picnics, forest walking, camping, and viewing forest animals. The tourists bring in valuable foreign exchange and also provide market for the local products and services.

9. Generates government revenue through the sale of forest products such as timber, rubber, and medicinal products brings in revenue to government. The government also licenses and taxes the forest exploitation companies, workers, timber exports and other forest-related activities to get revenue that is re-invested in other sectors of the economy such as health and, education.
10. Generates foreign exchange through the exportation of forest products such as timber, sawn wood, plywood, fibre boards, rubber, gums, to outside countries. The foreign currency generated is used to settle foreign debts and encourage importation of foreign capital and consumer goods.
11. Promotes development of urban centres since the sawmills, pulp and paper industries have attracted a large population as workers and in turn associated infrastructure such as roads, schools, banking, recreation centres—hence development of urban centres/towns.
12. Provision of many employment to the people such as lumber jacks, forest guards, fire fighters, supervisors, transporters, industrial workers. These earn incomes which they use to improve their standards of living.
13. Diversification of the economy since forestry industry acts as an alternative source of income for the respective countries instead of over depending on a few sectors like mining, agriculture. This expands the economic base and results into increased national income.
14. Forestry is an economic use of land where other activities are limited for example areas of little agricultural value –like the steep slopes, areas of thin soils, infertile stony or sandy soils, water logged areas, areas of a short growing season. Also very remote areas are more economically utilized for forests instead of farming.

Negative / shortcomings of forests

1. Occupation of land that would be used for other economic activities such as industry and agriculture. The forests are an obstacle by limiting land for arable farming especially with increased population pressure on land.

2. Harbor dangerous wild animals such as black mamba, cobras, python, chimpanzee, lions, buffalo etc which threaten human life and limit economic activities in the surrounding areas.
3. Forests harbor disease causing vectors such as mosquitoes and tsetse flies that are dangerous to the people living near them and their livestock, by causing malaria and sleeping sickness in people or nagana / trypanosomiasis in livestock and hence reduce the quality of life.
4. Forests hinder development of transport and communication networks. The vegetation grows so rapidly and associated with heavy rainfall that destroys the road networks. For example the Trans-African highway has problems in DRC due to high costs incurred to construct each kilometer of the road through the forest.
5. Some forests act as hiding places for rebels and other criminals, who disrupt peace/ bring about political instabilities and hence destroy social economic infrastructure.
6. Some forests have few valuable tree species and thus their exploitation is uneconomical. There are many trees with no present economic value.
7. Industrial –related problems such as pollution of the environment by the sawmills, pulp and paper industries due to the disposal of wastes into water sources and emitted gases into the atmosphere. This contributes to the environmental degradation.
8. Urban-related problems such as slums, alcoholism, and increased crime in the urban centres that have come up. These reduce the quality of life such as slums on the margins of the urban centres having poor structures and poor hygiene. The eradication of such problems is very to the government.
9. Forestry leads to regional imbalance in development especially where areas around processing centres are more developed in terms of infrastructure than the countryside /other areas.
10. Some forests act as social and economic barriers between people of the opposite sides. For example, it is difficult to connect the areas via transport routes since people have to move for longer distances outside the forest.

FORESTRY IN BRAZIL

Brazil is located in South America and it is the largest country in terms of area in South America (3.2m km ^{2}). The largest single area of tropical rain forests is in the Amazon basin. The westward extension of this forest is limited by the Andes Mountains. On the east coast of South America tropical forests extend as far south as 25^0s.

The tropical rain forests cover almost half of the country's total area mainly in the north and the area is called the Selvas/Amazon region. The forest has over 40,000 tree species such as Mahogany, Ebony, Rosewood, Green heart, Ironwood, Teak, Palm trees

The main districts covered by Amazon forests are: Acre, Mato Grosso, Amazonas, Para, Rondonia, Ceara, and parts of Bahia.

A sketch map of Brazil showing the major forested areas

Factors which have hindered the development of the forestry industry in the Amazon basin / Brazil

Despite the abundance of forest resources in Brazil, the forest industry is still under developed in the Amazon region and this is explained by a number o of factors:

1. Heterogeneous nature of forests/ the trees grow in impure stands.
2. Some densely forested areas are impenetrable.
3. Tropical hardwoods are bulky and too heavy to be floated on rivers like Amazon and its tributaries (such as Negro, Tapajos, Madeira)
4. The tropical forest trees have buttress roots
5. The long gestation / maturity period of most valuable tropical trees.
6. The harsh climatic conditions
7. The tropical rain forests harbor dangerous wild animals
8. Limited capital to invest in forest exploitation.
9. Low levels of technology
10. Shortage of labour both skilled and unskilled.
11. Political instability such as the military coup of 1964.
12. Unfavourable government policy
13. The government has also gazetted some areas as forest reserves like Amazonia, Raajon game parks.
14. Limited market for tropical hardwood.

15. Limited research and careless destruction of valuable tree species through charcoal burning, shifting cultivation, hunting and settlement.

DEMOCRATIC REPUBLIC OF CONGO

In Africa, the largest tropical rain forests occupy parts of the (Congo) Zaire basin, which covers the lowlands drained by the congo river and its tributaries(such as Kasai and Ubangi. Although the forests are not as luxuriant and extensive as those in the Amazon basin, it is one of the worlds thickest. The main tree species include: Mahogany, Ebony, Iron wood, Rose wood, Mvule, African cedar, Iroko, teak, Limba, Green heart

The main forested areas are: Kasai area in the south, Equatuer, Bandundu, and Orientale provinces. The main lumbering forests are: Ituri forests, Great Congo forests, pygmy forests, Stanley forest. The Coastal region was the major production area at first but after exhaustion lumbering moved to the interior. The simba forests have been replaced by Eucalyptus forests.

A sketch map of DRC showing the major forested areas

<u>Problems facing the exploitation of forest resources in the Congo basin</u>

1. Heterogeneous nature of forests/ the impure stands of the trees in that, the valuable tree species are widely scattered such as iron wood, mahogany as noted in Ituri forest, pygmy among others. These are mixed up with trees of no present economic value. This makes selection, felling and removal of logs from the forest difficult –hence limiting the exploitation of forest resources.
2. Some of the most densely forested areas are impenetrable making accessibility difficult since many trees are entangled by creepers and plants like lianas, saprophytes and epiphytes. Therefore the commercial tree species cannot easily be reached in the Congo basin—hence complicated exploitation.
3. Tropical hardwoods are bulky and too heavy –to be floated on rivers like Congo River and its tributaries (like Lomami, Lualaba, Kasai, Uele) from the forested areas to processing centres.
4. Most tropical trees (such as mahogany and iron wood) have buttress roots extending outwards from the base of the trunk, which also makes the process of felling difficult. It requires working from a platform built around the trunk of

the tree (at a height of 3-5 m from the ground) which is tedious and time consuming. affecting lumbering

5. Long maturity period of tropical hardwood trees such as Ebony, Green heart, Mvule and Mahogany which affects supply. They mature in a period ranging from 60 to 100 years, which does not match with the available demand. This complicates the process of exploitation and quickens depletion of forest species since the rate of cutting is far more than the rate of growth. It is there fire difficult to maintain production on a sustainable basis.
6. The harsh climatic conditions/ these tropical rain forests have hot humid weather throughout the year with temperatures ranging between 27 and 32^0c, which is too hot for the lumbermen. The areas also receive heavy rainfall between 3000 t0 4000mm per annum, which makes the ground damp and impassable / transport difficult. These conditions also favour the breeding of mosquitoes causing malaria –which reduces labour supply to exploit the forests.
7. The tropical rain forests harbor dangerous wild animals for example lions, chimpanzees, cobras, black mambas, which pose great danger to lumbermen and forest rangers in the forests of Ituri and Stanley among others.
8. Poor transport routes in the forested areas affecting marketing. Many areas in the Congo basin with the best timber are not accessible due to lack of good roads and railways. The roads are difficult to construct but still even when built they are difficult to maintain due to rapid re-growth of vegetation. The roads become impassable during heavy rains. The rugged relief in some areas also further limits the setting up of transport networks-hence limiting exploitation of forests.

   Besides some rivers/ streams are less navigable due to problems of waterfalls, rapids, shallowness and floating vegetation among others. They are therefore hard to use to float logs.
9. Inadequate/limited capital to exploit forests/ to invest in the forest sector such as to develop infrastructure, purchase modern machinery and set up processing centres. This has led to continued use of rudimentary tools (like axes handsaws) and dependence of poor infrastructure in many forested areas of the Congo.
10. Low levels of technology/ Rudimentary tools are still being used in the exploitation of forests in some parts of Ituri, Bunia, Lisala and Stanley forests.

This involves the use of handsaws, axes, and pangas among others. These are ineffective, time consuming and wasteful. These lead to low quantity and quality of timber and other products. Although the use of power driven saws is increasing, it is still on small scale.

11. Shortage of labour both skilled and unskilled since the densely forested areas such as Bunia, Ituri, Stanley, Great Congo and pygmy forests are sparsely populated, so that obtaining labour is a problem. The unskilled labour in such areas uses rudimentary tools which are wasteful. The inadequate skilled labor force also implies production of poor quality timber, which cannot compete favourably on the world market.
12. Political instability in many parts of the Congo forests for a long time such as a series of civil wars and unrests. For example the Katanga rebels from Angola in the period 1977-78, the Allied Democratic Front of Laurent Kabila in 1997 to over throw the government and others instabilities caused by invading forces from Rwanda and Uganda , in addition to the current Congo rebels. This has affected forest exploitation by scaring away workers and investors, since the forests are taken as war-zones.
13. Unfavourable government policy / limited government support since the government does not give priority to the forestry industry in favour of other important sectors such as mining of copper and gold in the Shaba province, and agriculture. This therefore undermines investment in the forest sector --hence limiting the purchase of modern machinery, developing necessary infrastructure and carrying out research among others.

    The government has also gazetted some forest areas for wild life conservation –national parks, such as Galamba national park, Salonga national park, okapi national park, and Maiko national park—hence limiting the area available for forest exploitation.
14. Limited market for tropical hardwood, both local and foreign. The local market is limited by the location of the forests in sparsely populated areas/ remote areas of the Congo. Basin. More so tropical hard woods compete with coniferous forests (softwoods) in other parts of the world such as British Columbia (Canada), Sweden, Russia, among other areas—with a variety of uses

of economic value. This further limits the market since lower prices are often offered for tropical hardwood; a factor which also discourages exploitation.

15. Limited research and careless destruction of valuable tree species through charcoal burning, shifting cultivation, hunting and settlement.
16. Many accidents occur during the felling and transportation of timber, leading to death of workers.
17. Over exploitation of forests for example the coastal region was the major production area at first but these forests were exhausted and lumbering moved to the interior –hence affecting future supplies. More so many areas cleared of their original forests have been replanted with other fast growing trees such as the simba forests replaced with eucalyptus trees, and this in the long run makes the forests less valuable.
18. Population encroachment on forest areas.
19. Limited power supply
20. Hostile tribes like pygmies
21. Competition from other wood producing countries like Sweden, Sweden, Norway, Finland, Ghana, Gabon.
22. Pests and diseases which damage the valuable timber and logs, by attacking the trees during their growth. The pests include: larvae of moths which feed on leaves and buds of young trees. Diseases such as rusts and rots caused by fungi. This reduces the quality and quantity of wood harvests.

FORESTRY IN GABON

Gabon is one country located in the equatorial region of Africa and its economy greatly depends on the exploitation of forests. Gabon is largely covered by dense tropical rain forests (equatorial forests). However, there are also planted forests.

The major tree species include: Okoume (a native softwood tree used for making plywood), Mahogany, Ebony, Kevazingo, Rose wood, Azobe, Ozigo, Iron wood, Kavaninga, and Green heart.

The main lumbering areas include: the coastal strip along the coast of the Atlantic ocean running from cocoa Beech north of Libreville to Sette-cama in the south (which is today exhausted) along Ogooue river, Owendo, Okonja, Moanda, Mekambo, Makokou, Koula -Moutou, and Kango.

In Gabon large companies were given concessions for systematic forest operations. Operations have necessitated the construction of a railway line (Trans-Gabon Railway) and a new port at Owendo. There are over 15 sawmills mainly located at the coast. The largest and one of the biggest exporters of plywood in the world lies at Port Gentil. Also a giant sawmill has been constructed at kango to process more wood before export.

Note: Lumbering especially along the coastal strip is almost ended due to exhaustion of forests and today most lumbering takes place in the interior and along the Ogooue River. The exhausted timber lands have been replanted with other trees such as Okuome.

A sketch map showing forest areas in Gabon

<u>Factors which have favoured commercial forest exploitation in Gabon</u>

1. The equatorial climate characterized by heavy rainfall of over 1500mm and which is well distributed throughout the year and hot temperatures of 26^0c and above—which conditions have encouraged the growth and maturity of trees species like Okoume, Ebony and Mahogany. This in turn promotes wood production.
2. Presence of many valuable tree species. Gabon has a virtual monopoly of Okoume in the world—which provides valuable plywood, and competes favourably with softwood of the temperate forests. Gabon also has valuable hardwood trees species like mahogany, ebony, Ozigo, red wood in the forest areas like parts of the coast, Lambarene, Makokou, Mekambo and Franceville. These provide more valuable timber for construction and furniture making.
3. The sparse population/ low population density which has favoured continued existence of forests. The population density is about 6 people per sq km and this means that vast areas of natural forests have not been encroached on by people for settlement, agriculture, fuel wood, and illegal timber harvesting. The country therefore has large reserves of forests especially in the interior and along Ogooue River for commercial exploitation.
4. Presence of various rivers like Ogowe/ Ogooue and its tributaries (Como, Nyanga, and Offoe). These have enabled the transportation of light logs using Tug-boats to factories at the coast and inland workshops. This increases the supply of wood and wood products.

5. The relatively flat nature of the landscape which facilitated the construction of transport routes particularly road network and railway—which connect lumbering centres to processing centres at the coast. This ensures continuous supply of wood and wood products likw timber.
6. The fairly fertile soils which have supported the growth of various tree species like Okoume, and Ebony—in turn favouring the supply of wood and thus encouraging lumbering in Gabon.
7. The presence of hydro-electric power generated from the rivers which helps to run machines in the saw mills and other factories. This increases efficiency in the wood processing factories and thus steady supply of wood products.
8. Availability of large sums of capital for commercial exploitation provided by large companies from Europe (particularly France), which the government has given concessions/ contracts to exploit tropical wood. These companies compliment government in providing the necessary capital to purchase modern machinery, setting up processing facilities, payment of labour and carrying out research. This increases forestry production.
9. The use of improved technology in the forest sector which involves selective felling of trees using powered saws for feeling trees, trimmed and hauled using tractors to collecting centres. The factory technology has also been improved to increase efficiency in the forestry industry.
10. Presence of skilled labour / highly skilled and specialized labour especially the French plus local people –used in tree selection, felling, trimming, hauling and timber processing. There is also division of labour where the forest area is sub-divided and each portion allocated to a team under a supervisor. This ensures that quality and quantity output is realized and thus more investment in the sector.
11. Cheap labour provided by the local people from the nearby area to work at certain stages of the forestry industry such as in tree felling, loading and unloading.
12. The improved transport network such as the Trans—Gabon railway (from Libreville at the coast to Franceville in the interior), and roads connecting the forested areas to the processing centres. The railway has opened up large areas

of the forests previously inaccessible. This also increases the supply of logs to the factories and thus more supply og wood products to the market.

13. Presence of a large market for the forest products both local and foreign. The Okoume tree commands a large market in Asia (like china, Japan), Israel, and the Rest of Africa especially Morocco. China is the largest importer of Gabonese timber products today like plywood, furniture, tanning materials. This has encouraged invesement in the forestry sector so as to satisfy the demand.
14. Favourable/supportive government policy towards the forest sector since 1960s to date. It signed concessions with large timber companies to carry out efficient forest exploitation. It constructed the transport infrastructure like the railway lines connecting lumbering areas and sawmills at the coast. The government has also invested in giant sawmills (such as at Kango). This in turn increases the quality and quantity of wood production.
15. The development of forest-based industries such as at port Gentil, Libreville, cocoa beach, Kango-including sawmills, plywood factories, furniture workshops and boat making factories. These add value to forest output and hence provide immediate market. This encourages wood production.

<u>Problems facing the forestry industry in Gabon</u>

1. Over exploitation leading to exhaustion of forests near the coast. Mismanagement has led to over exploitation without appropriate conservation efforts. Presently exploitation is further inland and has necessitated construction of a railway line. Besides the revenue from forestry has been declining due to exhaustion of valuable timber at the coast.
2. Transport problems to the interior/ poorly developed transport routes making some forest areas inaccessible. The transport network to the interior is not good, although the 320km railway was constructed to Pointre Noire and another 700km railway across the country to Mekambo. It was very expensive since many bridges had to be put up. It is also hard to maintain roads and railway due heavy rainfall, quick re-growth of forest vegetation.
3. Long maturity period of the hardwood trees such as Mahogany, Ebony, taking over 60 years to mature. The trees cut down are difficult to replace and this limits sustainable forest exploitation.

4. The heterogeneous nature of trees species / the trees do not occur in pure stands of a single species, but scattered and mixed up with other currently useless tree species. This makes selection and removal of valuable species difficult, hence discouraging exploitation.
5. Accidents occur during the felling of trees, leading to destruction of equipment and loss of lives of the workers.
6. The forests harbor dangerous wild animals such as cobra snakes, black mamba snakes, lions, which scare away the people working in the forestry sector, hence limiting effective commercial forest exploitation.
7. Pests and diseases which affect the trees and negatively affect the quality of timber.
8. Poor methods of exploitation in some parts of the forests / low levels of technology. The poor tools used waste wood such as pangas, axes, hand saws etc. this limits the production of high quality and quantity timber.
9. Competition for market from other forest product exporters mainly West African countries like Ghana, Cameroon, and Nigeria. This limits the market and discourages further investment in the forestry sector.
10. Limited market for hardwoods
11. Price fluctuations and marketing problems.
12. Profit repatriation by foreign –owned companies from Europe.
13. Limited capital affecting exploitation.
14. Limited skilled labour supply.
15. Buttress roots affecting lumbering.
16. Heavy rainfall affecting lumbering and transport.
17. Opposition from environmentalists/ conservation policies

<u>Steps taken to solve the above problems</u>

1. Exploitation of forests further inland due to exhaustion of forests near the coast.
2. Re-afforestation programmes in areas where forests have been depleted/exhausted.
3. Growing fast growing / maturing trees such as eucalyptus which have a gestation of 12--15 years.

4. Diversification of exports by the government and encouraging cash crop production like cocoa, coffee, ground nuts , rice to reduce over dependence on timber exports.

   The government has also emphasized mineral exploitation such as uranium, manganese, and iron ore, to reduce over dependence on timber exports.
5. Construction and rehabilitation of roads and railway lines to increase accessibility to forest/ lumbering areas.
6. Use of protective gear to guard against accidents when feeling trees
7. Spraying with chemicals to control pests and diseases.
8. Carrying market research to widen the external market for timber and timber products.
9. Attraction of foreign investors with enough capital and better technology.

Nigeria

Nigeria is one of the leading producers of logs , timber and other wood products in Africa. The country has various forms of forest cover ranging from tropical rain forests, savanna woodlands and planted forests; but the most valuable wood is extracted from the southern tropical rain forests. Nigeria has been exporting tropical hardwoods for a long period especially to UK, and other countries of western Europe.

Like other countries of tropical Africa, Nigeria has experienced massive exploitation of forests since the 1960s. this has been due to increased demand for logs, timber, pulp and other wood products.

Wood processing factories (such as pulp and paper mills) are located at Itu and Iwopin. The country has over 1300 sawmills, 7 plywood factories and 2 board mills. The wood products include: logs, timber, veneers, pulp, paper, plywood, furniture.

Forestry in Ghana

Ghana is also a major lumbering country (and ranks second among west African timber exporters). Timber is the second foreign exchange earner after cocoa. The

main tree species in Ghana include: makore, utile, edinam, mansonia, wawa, fuavea, ebony, mahogany.

Forest exploitation in Ghana is done using both local and modern methods. After cutting the logs are hauled by tractors or logging arch to the nearest road and railway, and moved to saw mills. The major sawmills are located at Sekondi, Accra, Tema, and Takoradi. More than half of Ghana's timber is shipped for export in log form and exported through Takoradi port. Other products from forestry include plywood, veneers, furniture.

FORESTRY IN CANADA

Canada is part of North America and forests cover about 60% of the land area. Canada is dominated by coniferous forests. Newsprint is the major timber product due to predominance of Spruce in the eastern forests and the country is also the largest newsprint producer in the world. The dominance of Douglas fir in the western forests also makes Canada a leading producer of sawn wood in the world, much of which is exported.

The major forested areas of Canada are:

- Eastern Canada
- Western Canada (British Columbia)

EASTERN CANADA

The forests stretch from the Rocky mountain slopes to the Atlantic Ocean. The major lumbering areas are in the Maritime Provinces and the St. Lawrence – Greatlakes region. But these forests in the east are not as valuable as those in the west since they are with smaller and less valuable trees due to harsher climate and poor soils. Main tree species are: Red spruce (good for pulp and paper), Balsam fir and a variety of pines.

Eastern Canada produces all types of Paper and also produces Sawn wood, Furniture and other timber products but still the most important is Newsprint. The Pulp industry is the major user of HEP in Canada. The main producing centres include: Quebec, Montreal and Toronto. Other are: Ottawa, Cornwall on st. Lawrence Seaway, st. John, Corner Brook, Nova Scotia, Grand-Falls and Newfoundland.

Market exits in N.E USA, Britain and the rest of Europe. There is a large British investment in Canadian forest industries. Pulp is also used in the st. Lawrence – Greatlakes industrial belt of Canada, northern USA and New England for making rayon (for textiles).

WESTERN CANADA (BRITISH COLUMBIA)

British Columbia is Canadian province found in the west. Its economy largely depends on the exploitation of natural resources. The province is largely covered by coniferous forests producing mainly softwood timber.

The major tree species in British Columbia include: Douglas fir (which is Canada's leading timber by value), Spruce (leading timber by volume), Western hemlock, Balsam fir, Red ceder, Pines. British Columbia produces Sawn wood, Plywood, Furniture, Pulp and Paper.

The main lumbering and processing centres include: Vancouver, Prince George, Kitmat, Prince Rupert, Kamloops, New Westminster, Chilliwack, Nelson, Alberni, and Gold River.

<u>Factors responsible for the development of forestry in British Columbia (Canada)</u>

Physical

1. Rugged /mountainous nature of the landscape consisting of the Coastal ranges and Rocky Mountains—which prevented other land uses like crop growing and settlement. Glaciation is also responsible for this rugged landscape and which removes fertile soils making the land less supportive to crop farming. All this created room for forests as an alternative land use, thus more forest cover and more wood production.
2. The temperate climate with warm summers and mild winters which is ideal for the growth of coniferous forests and which allows forestry to go on throughout the year. The heavy rains on the slopes of the Rocky Mountains also facilitate the rapid growth and maturity of the tree species like Sitka Spruce, Western Hemlock, and Douglas fir. This leads to increased production of forest resources.
3. The infertile and thin soils which prevent crop growing and are also responsible for the sparse population, and this allowed a large area of the province to be left for forest growth. Only about 3% of the total land area in British Columbia

is agricultural land, forcing many people to seek a livelihood from forests resources.

4. Availability of extensive forestland with over 60% of the British Columbia forested. This is partly explained by the low population density of about 4 people per square kilometer—which has left large land area to be left for forests. This in turn leads increased lumbering activities.
5. Presence of many valuable/commercial tree species commanding high demand on the world market due to a variety of uses. The most important species are Douglas fir –for plywood production, Spruce for pulp and paper production, western Hemlock, western Red ceder, Balsam fir, Pines (like Lodge pole pine). Softwood is also used to make furniture, paperboards, newsprint, and tiles. All these ensure a constant supply of mainly soft wood, hence encouraging forestry investors.
6. The homogeneous nature of the forests(the trees exist in pure stands of a single species) –that is a particular species like Douglas fir exists in a given area. This leads to easier location, selection, felling and hauling the logs out of the forests –hence facilitating easy exploitation of the coniferous forests. This leads to increased development and exploitation of the forests.
7. The coniferous logs are light in weight and therefore easy to transport. They are easy to float on water from the lumbering sites to the sawmills on rivers like Fraser, Skeena, Nass, Kootenay, Columbia, and Stikine River. The logs are moved to booming grounds on special boats (barges) on frozen rivers. This ensures ready supply of wood to processing centres and thus continuous production of timber products.
8. The short gestation / maturity period of the softwood tree species like Lodge pole pine, spruce, and red cedar which mature in a period of about 14 to 22 years which facilitates planned exploitation of the forests. This has enabled sustainable exploitation of forests in British Columbia (Canada).
9. Presence of many fast flowing rivers which help in transporting logs and yet rivers like Peace, Nechako, and Columbia have dams which are also used to generate hydro- electric power—which is used to run machinery in the saw mills, pulp and paper industries. Therefore power increases efficiency and effectiveness of exploitation of forest resources.

Human factors

1. Availability of adequate capital to invest in forestry sector and the initial capital was brought in by US and British farmers. They also brought in the technology and lumber jacks- to cut down, to collect and load on the trucks skillfully. The government and the private individuals also provided capital used in the purchase of power saws, helicopters, and payment of labour and carrying out research training –leading to effective and efficient exploitation of forest resources.
2. Presence of skilled labourforce which is relevant to modern forestry operations. It is easier and quicker to work with the telescopic observers, water bombers and chain wheeled trucks. There are experienced and specialized lumberjacks who use power saws to fell trees, firefighters use water bombers and helicopters, and professional botanists who research on fast maturing and high yielding timber. This increases the quality and quantity of forest produce especially timber.
3. Availability of modern technology which promotes extensive and intensive mechanization of the forestry sector, with use of tractors to haul logs, bull dozers for quick exploitation, power driven saws to fell trees, fire fighters (telescopic observers, binoculars and water bombers), and chain wheeled trucks to move up and down the steep slopes. The technology improves efficiency and reduces wastage when exploiting wood.
4. Presence of a large market for softwood products both local and foreign. It supplies Canadian demands for sawn wood and other timber products, and also a ready market in western USA, Britain and the rest of Europe. There is increased demand for paper in printing books, newsprint, magazines, and paper bags. In turn, there is increased investment in forest plantations and their exploitation in order to satisfy the large market.
5. Well developed transport system by road, railway and water connecting the forested areas to the sawmills , pulp and paper industries; and also connected to the coastal ports like Churchill, Vancouver, prince Rupert, and Victoria to facilitate the exportation of forest products . The railway system is largely electrified which increases efficiency in transportation. This leads to ready

supply of wood to factories and increase in the volume of wood products exported.

6. Favourable/Supportive government policy for example the Forests are under the control of the Canadian government which minimizes careless and wasteful exploitation the forests. The government also facilitates /encourages research, encourages private companies, construction of the required infrastructure (like railway), and opening international markets for timber and timber products. This facilitates further investment in forestry industry.
7. Intensive research carried out in the forest sector to develop fast maturing, high yielding and disease resistant tree species. The trees are planted at regular intervals, thinned, protected against pests and diseases, and with regular inspection. This practice ensures high quality and quantity output from the forestry sector, leading to increased production.
8. Political stability of the country/the continent for a very long period of time which has enabled long-term investment in the forestry sector . This is by increasing the area under forest cover, setting up modern wood processing facilities, and attracting more investors and professional workers. This explains the continuous forest planting, exploitation and conservation.

Problems facing the forestry industry in British Columbia (Canada)

1. Fire outbreak especially during summer destroying large areas of forests. It is caused by holidaymakers and people on picnics who often leave fires burning in the camps or careless smokers who drop cigarettes. (The fires are also caused by sparks from power saws and saw mills . conifers have a high pitch content and can easily be gutted by fire).
2. Over exploitation of forests such near Alberni Port and Vancouver areas. Trees are cut down without replacement, leading to depletion of forests in such areas. Rapid exploitation of forests has been due to the discovery of new uses of wood products in the recent years, hence reduced forest cover.
3. Rugged mountainous landscape which makes large forested areas not easily accessible as they are far beyond the reach of roads and railway. This increases the costs of exploitation.
4. Pests and diseases which attack the trees and destroy them, leads to poor quality timber.

5. Heavy rainfall which makes the roads muddy and transport complicated since some trucks stick in the mud. This also leads to inefficiency in production.
6. Fluctuations in labour force. The available labour is inadequate considering the fact that British Columbia is sparsely populated. During the dry months of the year, the population is engaged in other activities such as tourism-hence limiting the manpower available for the forestry industry. In winter because other sectors are not vibrant, then labour is easily available. This fluctuation in labour supply affects the supply of logs to saw mills.
7. Log jamming in rivers due to congestion, that is at certain points of the rivers the logs get stuck leading to inefficiency in production.
8. Accidents occur when felling trees leading to death of workers. The forests are sometimes faced with strong winds also causing accidents of falling trees. This discourages potential workers.
9. Lumbering is difficult during winter especially in the higher latitudes where snow is very common. The felling trees is difficult and it is equally difficult to keep the roads open. Likewise the rivers get frozen and movement of logs difficult. This limits winter lumbering.
10. Competition from other producing areas of timber products such as Sweden, Finland, Norway, USSR, and Gabon among others. This limits the available market for Canadian wood and wood products.
11. Government conservation policies / opposition from environmentalists.
12. Presence of dangerous wild animals such as bears, snakes, wild fox which scare away workers.
13. Competition from substitute items on the world market such as plastics, metals.

Solutions to the problems facing forestry in British Columbia

1. Forest fires are controlled using:
    a) Watch towers high above the trees where fireguards are able to see far and detect fire out breaks.
    b) Regular patrols using helicopters to detect fire outbreaks.
    c) Use of mobile fire fighters and water bombers which run very fast and spread water to stop fires.

2. Over exploitation is partly solved by forest farming, a long range harvesting programme, re-a forestation, selective cutting etc. This is to ensure sustainable forest exploitation.
3. Introduction of quick/fast maturing and disease-resistant tree species to increase the area under forest cover.
4. The government also restricts the cutting of trees by imposing high taxes on the forest exploiters and complicated licensing process.
5. Spraying with chemicals to control pests and diseases that attack the trees. This is to increase the quality of wood.
6. Use of chain- wheeled trucks which can move up and down the steep slopes which are slippery –these do not stick in the mud. This makes movement of logs to saw mills easier.
7. Intensive and extensive mechanization to minimize the problem of labour shortage.
8. The use of trained men to remove the jam logs across streams /rivers to ensure steady supply of logs to the factories.
9. To avoid accidents, the fellers carry out the work carefully by checking the positions of their colleagues before each tree falls. The workers also use brightly colored steel helmets.
10. To avoid problems of lumbering during winter, they are using "log high" and "log low" system. Areas of higher cooler latitudes are logged during summer when forests are free from ice and snow. Winter logging is carried out in the lower latitudes where roads can be kept open.
11. Competition is being controlled by producing high quality products.

[Note: Pulp—a soft wood used to make paper
Plywood –construction material consisting of thin sheets of wood glued together.
Sawn wood –wood in planks (long flat pieces of wood) or board from saw mills].

FORESTRY IN SWEDEN

Sweden is one of the Scandinavian countries together with Finland and Norway. In Sweden about 50% of the total land area is covered by forests especially in the central-northern parts of the country. Most of the trees are coniferous and the most important commercial species is Spruce (like Norway spruce, Red spruce).

Other species are: Pines (like Scots pine, Norwegian pine), Larch, Firs, birch --which can withstand the climatic conditions.

Silvi-culture is a practice taken on in Sweden for over 100 years. It involves trees of the same species, age, and quality that are planted, transplanted easier, sprayed against pests and diseases, thinned and harvested at regular intervals. It also involves regular inspection of the forests.

Today forests are a major source of wealth and make up a large percentage of Sweden's exports. Timber is transported to saw mills by road, railway and rivers (like Torne, Ume, Oster, Dal, Pite, Angerman, Trysileva, Skellefte, Lule, Ljungan, and Ljusman). The tree species in Sweden are exploited for the pulp industry (the most important), sawn wood, paper, among others.

The main wood processing centres in Sweden are Harnosand and Sundsvall. Other important centres include: Jonkoping (important for matches), Orebro (paper), Karlstad, Norrkoping, and Trollhattan.

A sketch map of Sweden showing forest distribution

<u>Factors which have favoured the development of the forestry industry in Sweden</u>

1. The rugged nature of relief partly explained by glaciation which affected the highland interior and the northern parts of the country ,making soils thin and infertile, and this limits the land for cultivation –hence forcing people to turn to other land uses especially forestry. In turn, there is a large area under forests, which increases softwood production. The limited arable farming has also released labour to forestry activities.
2. The cool temperate climate with rainfall received throughout the year and the heaviest rains in the late summers. The warm summer temperatures (12-22^{0}c) help in the faster growth / maturing of the trees species like pines, and spruce.— hence continuous supply of softwood. The cold winter with frozen ground favours trees felling and hauling of logs on the snow into the rivers to the saw mills.
3. Presence of many commercial/ valuable tree species that is coniferous tree species such as spruce (Norway spruce, Red spruce), pines (Scots pine, Norwegian pine), larch, birch. These tree species have a variety of uses such as for plywood, pulp, sawn wood, paper, paperboards, matches, furniture; hence

commanding a large market in Europe and other parts of the world. This has encouraged investment in forestry in Sweden.

4. The homogeneous nature of the forests, that is, a close nature of valuable single tree species like spruce in a given part of the forest. This makes exploitation easier and systematic due to easy selection /searching of tree species; yet even removal of logs from the forests is easier since there is clear-cutting in a given area. This favours continuous / sustainable supply of wood and timber products.
5. The coniferous logs/ wood are light in weight and this makes them easy to transport by floating on rivers like Oster, Dal, and Angerman. Remember that floatation is the cheapest way of transporting logs to sawmills and pulp factories. This ensures steady supply of wood, which increases production of wood products for both domestic and foreign market.
6. The short maturity period of softwood tree species like Scots pine, Norway spruce, firs, birch and larch. These trees take about 14-20 years to mature, and this enables planned/ sustainable exploitation of the forests, since the forest trees are easy to replace once cut down. This encourages forestry investment.
7. Presence of many fast flowing rivers for example such as Oster, Dal, Ljungan, Torne, Angerman, Lule, Ume, Pite, Ljusman; which are used as float ways carrying logs to pulp and paper industries or saw mills along the Baltic sea coast. Still many canals (such Gota Canal) have been constructed to link the forests to the processing centres. Sweden has more than 35,000km of public float ways. This leads to continuity in supply of logs and hence more timber and timber product production.

   Besides the rivers provide a ready source of hydro –electricity due to the dams constructed such as Angerman, Dal, Trysileva, Ume, and Torne; and the power is used in running machines in the saw mills , pulp and paper industries , ship building , and furniture workshops. This increases the quality and quantity of output.
8. The sparse population of the country/ availability of extensive forest land due to the low population density (of about 22 people per $km^{2)}$ and most people live in the urban areas of the south. In the forested north (Norrland and Lapland) the population density is much lower. There is limited encroachment on forests

for settlement, agriculture and infrastructure. Therefore, there is a large area under forest cover and hence increase in the quantity of wood production.

9. Availability of large sums of capital invested in the forestry industry provided by the government, private companies and individual forest growers. The capital is invested in purchase of modern machinery, setting up processing facilities, development of transport infrastructure like railway, carrying out forestry research, and payment of labour. This favours large scale management of forest resources.
10. Presence of a large market both local and foreign. For example in the urban areas of Sweden like Stockholm and Goteborg. There is great demand for timber, pulp and paper in the industrialized countries to the south such as Britain, Germany, France, Holland, and Denmark. Sweden produces pulp, plywood, furniture, cellulose, and matches are also exported to USA, and Japan. There is increased production in the forestry sector to satisfy the ready market.
11. Presence of highly skilled and specialized labourforce to work in the forest sector such as forest rangers, lumber jacks, fire fighters, industrial workers, transporters, and botanists. The lumberjacks cut trees with less timber wastage and destruction of young trees. The fire fighters work to stop fires from destroying forests, while the botanists carry out research to improve the quality of tree species. This leads to high quality and quantity of forest products.
12. Sweden has one of the most developed transport system in Scandinavia including road and railway networks. For example the Swedish railway running from the south to the north which provides accessibility processing centres like sawmills, pulp and paper industries, and to urban markets. This favours continued supply of wood to factories and ready supply of wood products to the markets.
13. Presence of modern technology employed in forestry such as the use of power driven saws for felling and logging , fire fighting technology (such as use of helicopters and water bombers),tractors for hauling logs, bulldozers for quick exploitation, industrial processing technology. The botanists also use modern laboratory equipment in experimenting trees species. This increases the quality and quantity of wood and wood products, thus increased investment in the forestry sector.

14. Highly developed research in the forestry sector promoted by the government and private companies. Silvi-culture is practiced and involves planting trees of the same species and quality, protecting them against pests and diseases, thinning, regular inspection, harvesting at regular intervals, and replanted at regular intervals. this ensures that fast maturing and disease resistant tree species are realized. This ensures high quality and quantity of forestry output; and ensures sustainable forest development.
15. Favourable / supportive government policy such as setting up the necessary infrastructure such the railway network and port facilities to transport wood products, encouraging private companies and individuals to invest in the forest sector since most of the land is not suitable for crop farming and encouraging forestry research to ensure quality output. The government also controls the forest sector to ensure sustainable forest development.
16. Political stability of the country for a long period of time which has enabled long-term investment in the forestry industry such as planting large areas of forests, extraction of wood, logging, transportation and setting processing facilities-since security of investments is assured. This has encouraged more investors and thus continued supply of softwood and associated products like pulp.

Contribution of forestry to the economy of Sweden

1. Promotion of industrial development by providing raw materials such wood used in sawn wood, pulp and paper, and plywood industries. The pulp industry remains the most important and the main processing centres are Sundsvall, Harnosand, Karlstad and Trollhattan. Paper production is greatly noted at Orebro; and the production of matches is especially at Jonkoping. Remember that Sweden is world's main producer of matches. This increases the national income of Sweden.
2. Promoted development of urban centres and ports along the Baltic coast and in the central lakes area. The major urban centres are Karlstad, Trollhattan, Stockholm, Sundsvall, Harnosand, Norrkoping, Jonkoping, Malmo, Uppsala, Linkoping, Orebro, and Halmstad. These are centres of saw mills , pulp and paper industries , furniture workshops which have attracted population concentration as workers and in turn associated infrastructure like banking, schools, health facilities and recreation facilities.

3. Generation of foreign exchange through the exportation of forest products such as sawn wood, pulp, paper, plywood, and furniture, cellulose, to other countries like Britain, Germany, Norway, France, Denmark, and USA. The foreign currency generated is used to obtain foreign technology, consumer goods and paying expatriates.
4. Generation of many employment opportunities such as lumber jacks /fellers who sort and cut trees, botanists who research on the tree species, forest rangers/ forest officers, engineers in pulp industries, transporters and export handling workers. The forest sector employs a large percentage of the total working population. These people earn incomes which helps to improve their standards of living.
5. Encouraged development of float ways to promote transportation of logs to factories. The forest regions are very accessible due to a large number of rivers, lakes and canals which provide float ways. Sweden has about 35,000km of float ways. Besides forestry has led to development of transport networks such as road network and the Swedish railway system. The transport system does not only facilitate forestry, but also several other activities such as industry, agriculture, tourism, trade and commerce—hence facilitating the general economic development.
6. Forestry promotes Soil conservation since the forests occur on the steep slopes of central to northern parts of the country. The forests have protected soils against soil erosion and the occurrence of landslides /avalanches by compact the soils together –hence promoting slope stability.
7. Habitat for wild life and promote development of tourism. The forests harbor wild animals like Reindeer (with branching horns), Roe deer (without b.h), Lemmings, Moose, Bears, Lynx (wild cat), Wolves; and many wild birds; and yet the pure stands of the trees also attract many tourists. Both flora and fauna act as items for research and educational studies for the tourists and picnic goers. Tourism also generates foreign exchange and provides market for other locally made products like foodstuffs.
8. Provision of other forest products for example fruits, nuts, spices, resin, tar, and tannin. Tannin is a substance found in the bark of certain trees used in conversion of raw hides to leather found in trees like hemlock, cedar, and oak.

There are also synthetic textiles known as rayon (from spruce wood), materials for paint making, and making medicines. All these products when made improve the quality of life /standards of living of the people.

9. Promoted international cooperation/ relationship between Sweden and the importing countries.
10. Diversification of the economy.
11. Generation of government revenue.
12. Forests act as catchment areas for rivers.
13. Modification of climate.
14. Forests used for research and educational studies.
15. Utilization of the land that would otherwise be lying idle.—it utilizes areas that would be wastelands.

Negative /shortcomings

1. Environmental pollution such as the water ways are polluted with wastes containing bleach, lignin and fibres. Also the processing industries emit gases and toxic substances which pollute the environment. This reduces the quality of life such as by causing deadly diseases.
2. Urban-related problems such as high crime rate and congestion.
3. Forests hinder transport and communication development.
4. Harbor dangerous wild animals such as wild fox, bear.
5. Occupation of land that would be used for other economic activities.
6. Straining the government budget due to the heavy investment in the forest sector which has meant that other sectors like agriculture have been largely underdeveloped.
7. Some forests act as social and economic barriers between people of the opposite sides.
8. *Results into regional imbalance in development because the areas where processing centres exist are more developed in terms of infrastructure than the countryside.

FORESTRY IN NORWAY

Norway is a less important lumbering country compared to Sweden and Finland. About 35% of the land area is under forest cover, and as in other Scandinavian

countries the forests are owned mostly by farmers. Approximately 80% of the forests are owned by families/farmers who manage their forests in combination with farming. The rest of the forests are owned by the state, community and private companies.

Silvi—culture and forest improvement are important and new species have been introduced from Alaska and British Columbia in a forestation schemes. The major species of commercial value are: Norway spruce, Scots pine, and birch. Others include: firs, larch, and other pines.

These softwoods have been used to produce soft boards, furniture, pulp, paper, paint, rayon, and cellulose.

The main centres are: Trondheim—an exporting centre as well as having timber industries, Honefoss—a saw milling centre, Kristiansand and Skien have pulp and paper mills, Drammen has a wide range of timber processing industries. Rivers like Glomma are used for floating logs.

Note: the factors for forestry development are similar to Sweden.

FORESTRY IN FINLAND

Finland is also a Scandinavian country. Like Sweden, much of the original forest cover remains and there is a practice of Silvi—culture which has been practiced for over 100 years. Forest production has been enhanced by the introduction of trees from other countries that give a higher yield of timber. Many farmers have been encouraged to turn their land over to forest to increase forest area and therefore boost timber output.

The major commercial tree species include: Scots pine, Norway spruce, Firs and larch—which are exploited for Sawn wood, Pulp and Paper, Rayon, Furniture among other products.

The main rivers for floating logs and producing HEP are: Oulu, Kemijoki, Muonio, and Tornio (Torne).

In Finland there are timber industries at the coastal ports of Vaasa, Oulu, and Pori—which also export timber and timber products. The main centre is Tampere. Sawn wood, pulp, paper, furniture and other wood working industries are all important. In addition Finland has important engineering industry manufacturing wood-processing machinery both for the local and foreign market.

Finland supplies about 4.5% of the world's pulp much of which is exported to Britain and other European countries with small local timber resources. Finland is also a major exporter of sawn wood.
Note: factors for the development of forestry are similar to Sweden.

Causes of forest depletion in Africa
Deforestation refers to the gradual removal / destruction of forested lands to be converted into other uses. There is continued decline of forest cover in Africa greatly by clearance for settlement, agriculture or during exploitation process. The causes of forest depletion in Africa include:

1. Rapid population growth which increases the need for settlement and cultivation land thereby encroaching on the forests. For example the population growth rate of Nigeria is 3%, Malawi- 2.8%, DRC-3.1%, and Cameroon-2.4%. In effort to divert land to farming, large areas of forests have been destroyed such as parts of Congo forests, southern Ghana and Cameroon where crop plantations have been established.
2. Increasing demand for timber and timber products such as making plywood, furniture, construction, boat-building among others. There is also increasing demand for fuel wood and charcoal for smoking fish (like in West Africa), curing tobacco (such as in Zimbabwe), and domestic cooking. This has also led to continued destruction of forests in Africa.
3. Careless felling of trees/ poor logging methods. As people cut down trees for timber, charcoal, firewood they cut even the young trees and yet there is limited or no reforestation of the trees. Therefore each time a tree is cut down there is no replacement and where it has been encouraged it is still limited. This in turn has reduced the forest cover.
4. Poor farming methods like shifting cultivation practiced by the Bemba in northern Zambia, Azande in the Congo basin forests. Many farmers also carry out bush burning before cultivation-which ends up destroying large areas of forests.
5. Need for infrastructural development and industrialization involving roads, railways, schools, hospitals, and recreation centres ,which have been set up after destroying part of the existing forests. More so, the process of

infrastructural development and industrialization requires large quantities of poles, timber and timber products. For example power transmission requires poles and timber—hence quickening forest destruction in Africa.

6. Effect of mining activities in large areas of forests which are destroyed to access the mineral ores especially with use of open cast mining such as copper mining in the Shaba province of Congo and the Zambian copper belt, diamond and gold mining in Ghana, and iron ore mining in Gabon. Many trees are destroyed and not replaced.
7. Low level of power and energy development in Africa/ lack of alternative sources of energy and this has led to continued cutting down of trees to get firewood and charcoal, since the people have limited or no alternative. This is compounded by the poverty in Africa with many people engaged in selling firewood and charcoal for survival.
8. Forest/wild fires especially during the dry season caused by careless smokers, hunters, or cultivators intentionally or accidentally-hence destroying large areas of forests.
9. Damage by wild animals such as elephants, giraffe in the national parks and reserves especially where many of such animals exist in a given area. For example in Tsavo park elephants destroyed the vegetation tending to create an "elephant desert".
10. Pests and diseases which also lead to continued destruction of forest trees such as aphids destroying soft wood trees. There is also cutting down of trees in order to control the pests and diseases. This in turn reduces the forest cover.
11. Political instabilities in many parts of Africa for example in the Congo basin forests where the rebel activities have existed for long, West African forests(like Nigeria, Togo, ivory coast, Liberia) where the forests have been bombed or cut down suspected to be hiding places for rebels. The continued violence makes the natural forests hard to maintain.
12. Government negligence to conserve forest resources such as lack of a comprehensive conservation policy and poor law enforcement against forest encroachers. There is also inadequate funding and high degree of corruption in the forest departments. This results into continued destruction of the forests.

13. Prolonged drought conditions for example the fact that the Sahara desert is extending southwards and thus declining forest cover. The northern parts of the Congo forests are turning into woodlands.

Effects of forest depletion in Africa

1. Brings changes in local climate. Forest depletion brings adverse effects on the climatic conditions by bringing low rainfall which is also irregular due to reduced evapo-transpiration. This leads to desert conditions.
2. Decline in agricultural productivity which leads to famine. Because most Africans are farmers they have been affected by increasing poverty due to declining crop and animal performance.
3. Decrease in timber products because of the long regeneration/ maturity period and the little reforestation. Therefore, Africa's future survival on timber products is not assured.
4. Causes severe lack of fuel resources especially in the areas of increasing populations such as southern Ghana and southern Nigeria. This is increasing difficulty in acquiring wood for fuel.
5. Destruction of habitats for wild animals and birds for example monkeys, buffalo, elephants, eagles, cranes—which also limits the tourist potentials in various parts of Africa.
6. Leads to soil erosion and mass wasting which affect the people in various areas. This leads to low crop yields due to reduce soil fertility and poverty due to reduced earnings from farming. Mass wasting (landslides) affect especially highland areas where forests have been cleared –leading to loss of life and property.
7. Leads to increased incidence of economic refugees since the areas facing environmental degradation are often struck by drought and famine making people to migrate to other areas that are productive. This strains the receiving areas.
8. Increased government expenditure due to the need to handle the situation when programs like reforestation and afforestation are put in place. There is also need to import food to feed the affected people, hence straining the government budget.

9. Decline in revenue in form of foreign exchange due to importation of forest products, which are some of the direct benefits from the forests. This in turn compromises other government activities like health and education service provision.
10. Decline in water table because forests would act as bases for water streams and rivers. The forests would allow water to infiltrate the soil hence increased water table, but the clearance of forests undermines this purpose.

Forest conservation

1. Afforestation which involves planting of trees in areas which have not been previously covered with forests. In some countries governments give incentives to farmers who turn their arable land to forest. It mostly involves panting quick maturing trees especially conifers—like pines.
2. Re-afforestation which involves replacing the trees which have been cut down. In some countries (such as Germany) every tree cut down must be replaced by law. The new trees may or may not be the same as those removed. Conifers are preferred due to shorter gestation period and more useful such as pines, Cyprus.
3. Silvi-culture which is a system where logged areas are planted with more trees and they are properly cared for. It involves planting of trees of the same quality, age, and grade; replanted at regular intervals, protected against pests and diseases, thinned and harvested at regular intervals. It involves planting the trees in line and quick maturing species that readily meet market demand.
4. Improved tree cutting practices such as selective cutting of trees, the forests stand a better chance of regeneration and survival. It involves removing the mature trees or the diseased ones.
5. Forest protection for both the natural and planted forests from hazards such as pests or fires. This can involve a close system of inspection using towers and air patrols as can be seen in Scandinavia and North America.
6. Reducing wastage at the industrial level for example use of pulp which is not suitable for paper to make fibre and particle boards for the building industry. Also the re-use of waste paper in the production of newsprint and other inferior paper products. The greater use of plastics rather than paper for packaging purposes. It can also involve using trees more intensively to reduce cutting down of more trees.

7. Gazetting areas into forest reserves to reduce on the encroachment of people on forests for other activities like farming. There should also be eviction of encroachers by the forest department. This in turn increases the forest cover.
8. Encouraging use of alternative sources of energy such as biogas, agricultural wastes(coffee husks, sugarcane husks, banana peelings) , and the use of HEP. This in turn reduces the cutting down of forests.
9. Use of energy saving stoves which reduce on the demand for firewood and charcoal; and hence reduction in forest destruction.
10. Training labour force as forest rangers, and supervisors to manage the forests in various departments such as fighting against forest encroachers.
11. Government legislation against forest encroachment, regulating the issuing of licenses /permits to reduce careless cutting down of trees. It also calls for serious enforcement of the conservation laws.
12. Emphasizing Population control measures to reduce the cutting down of forests for settlement and cultivation in various areas.
13. Ensuring peace and stability in all areas to reduce forest destruction. This can be through peacetalks and promotion of international relationship with neighboring countries.
14. Education/sensitization of the masses about the value of forests and the need to conserve nature.

PLANTED/ ARTIFICIAL FORESTS

These are forests planted by man and not indigenous to an area. They are also called man-made forests. The world's hope in global wood requirements lies in planted forests. They are often of a singletree species.

Man –made forests Swaziland

Swaziland is a small country found in Southern Africa. Most of the forests are man-made / artificial coniferous forests which have been planted since the 1940s. Many years ago, Swaziland had many great forests which were unfortunately greatly destroyed for fuel and to create more farmland. Over grazing and heavy rainfall of the Drakensburg caused severe soil erosion.

However, since the 1940s much reafforestation and afforestation has taken place. Planted forests play a great role in the economy of Swaziland. There are now vast/ large coniferous forests in the hilly and mountainous region.

The major forested areas include:

a) Sappi Usutu (formerly Great Usutu forest)—further South near Mbabane exceeding 70,000ha. It is the largest man-made forest and covers about 4% of Swaziland's total area. It is situated at Bhunya near Mbabane, on either side of the great Usutu River. It was started in 1949 when 40,000 hectares were planted with exotic tree species such as Pinus Patula from Mexico and Pinus Taeda from USA. Today this forest covers over 70,000 hectares. It was financed by the common wealth development corporation.
b) Mondi peak (formerly Piggs peak forest)—North West of Swaziland covering about 32,000ha. This is the second major forest area and it is managed by the pigs timber company.
c) Shiselweni (formerly Nhlangano forest)—in the South West (which is the most recent).

Organization

The country has carefully planned a rotational system of afforestation to ensure that timber is maintained to support the economy. The forests mainly consist of pines, eucalyptus. The forests are scientifically managed with well-maintained access roads crossing from all directions. It has many divisions planted on a rotational basis to ensure steady and regular supply of wood to the processing factories. The trees mature within 15 to 20 years. Trees are cut using mechanical saws and tractors are used to drag the logs to the main service roads where they are loaded on to huge trucks for transport to the sawmills.

Forests such as the Great Usutu and Mondi peak have their own processing factories and saw mills. They produce pulp, sawn timber/wood, pit props, and telegraph poles, telephone poles, tanning materials, plywood, furniture, Paper etc

Many companies are involved in forests such as the Usutu pulp company produces pulp and the spring wood cellulose company does the marketing in Great Usutu. The Piggs timber company manages the Piggs peak forests.

Sketch map showing the major forests of Swaziland

Advantages of planted forests in Swaziland

1. They grow and mature very fast, taking about 15 years.
2. The trees occur in pure stands, which makes their exploitation easy.
3. They produce softwood, which has a variety of uses.
4. They lead to effective use of land that otherwise would be lying idle due to being rugged.
5. The forests conserve the environment by controlling soil erosion and protecting water catchment areas.
6. They yield valuable softwood products which have a variety of uses, hence generating revenue.
7. They modify the climate through evapo-transportation which favours rainfall formation.
8. The planted forests are used for research and educational purposes.

Factors/ conditions which have favoured forestry in Swaziland

1. The sub-tropical climate characterized by moderate to heavy rainfall ranging from 1000mm to 2200mm (tropical to sub-tropical climate) for quick maturing of softwood forests. This in turn favours extensive forest cover and thus increased supply of timber and timber products.
2. Cool temperatures due to high altitude of over 1000m above sea level which favours the growth of softwood species. This in turn encourages the establishment of more tree plantations and thus increasing the supply of softwood and softwood products in Swaziland.
3. The mountainous/hilly and rugged nature of the landscape in the western part of the country which cannot support settlement and crop cultivation, hence availability of extensive areas occupied by forests. This explains why most of the forests are located in the western parts of the country such as the Great Usutu forests in Bhunya. The extensive forests encourage wood production in Swaziland.
4. The need to preserve hilly slopes especially the Drakensburg Mountains from erosion and protect the water catchment areas by planting trees. This has resulted into large areas of forest cover and in therefore sustainable forest

exploitation since there is always need to replace the trees cut down to protect the environment.

5. Presence of valuable/ commercial tree species which grow and mature very fast in a period of 15—20 years such as pines (like Pinus Patula , Pinus Taeda) favouring steady supply of softwood by planting the trees in intervals (rotational system) and hence sustainable forest exploitation. The soft wood trees also have a variety of uses such as furniture, sawn wood, pulp, paperboards, pit props, telegraph poles; which encourages production.
6. The tree also occur in pure stands which makes their exploitation/ harvesting easy. A single species exists in a given area making it easy to locate and cut down the trees. Clear cutting is majorly done in which all the trees are removed and replaced at once. Easy exploitation increases the supply of timber and timber products.
7. Availability of adequate/ large sums of capital provided by Swaziland government, local and foreign investors (the Common Wealth Development Corporation) to invest in the forestry industry such as; establishment of large plantations (like the Great Usutu and Piggs peak), financing the pulp mills (like at Bhunya) , constructing transport routes, carrying out forest research to develop more fast maturing and disease resistant trees. This increases the forest area, the production and supply of wood.
8. Presence of skilled labour to work in the forestry industry such as carrying out research on tree species, careful selection and felling trees, transportation of logs to saw mills, timber processing in the factories, grading and exportation of wood products. This in turn increases the quality and quantity of timber production.
9. Presence of a ready/ large local and foreign market for the soft wood forest products such as pulp, plywood, sawn wood, and furniture. There is a large demand forest products in united kingdom, Switzerland, south Africa , Botswana, Namibia, Lesotho. This therefore encourages the establishment of more tree plantations to satisfy the large market.
10. Developed / improved transport network by road, railway and water linking to processing centres and markets. The planted forests such as the great Usutu have a network of roads linking to the main roads and railway leading to the

factories and sawmills which encourages the supply of wood. The railroads are also connected to the ports like Maputo and Durban which increases the exportation of timber products.

11. Advanced/ Improved technology used in the forestry sector which has simplified the forestry activities such as in felling trees using mechanical saws, use of tractors to haul logs to the main service roads, also industrial processing machinery which increases the quality and quantity of output. This in turn encourages further investment in the forestry sector.
16. The development of timber processing factories such as at Mbabane that produce sawn timber, boards, pit props, furniture, pulp, telegraph poles. These provide immediate market for wood, and add value to forest output which commands high prices and in turn increasing the income from the forest sector.
12. Favourable / positive government policy of afforestation and reafforestation to ensure sustainable forest utilization. There was a government policy of attempting to use the land available in the most economical way because of being rugged and hence establishment of large tree plantations, leading increased timber production.
13. Presence of ready supply of hydro-electric power which is used in the processing of wood / timber in the factories, and hence encouraging further forestry investment.
14. Increased scientific research and management of the forests. The forests have a carefully planned rotation system of reafforestation that ensures continued existence of the large forest cover. The introduction of tree species especially pines, and also wattle, eucalyptus which have a short maturity period of about 15 –20 years and disease resistant is also based on research in other countries. This ensures steady supply of wood and thus sustainable exploitation.

Problems facing the forestry sector in Swaziland

1. Fire outbreaks destroying forests and thus limiting production.
2. Pests and diseases which destroy the trees and thus limit production.
3. Poor transport network due to the rugged nature of the landscape which limits accessibility to some forested areas.
4. Competition for market with other soft wood producing countries which limits export earnings.

5. Over dependence on foreign companies which repatriate the profits to their home countries.
6. Limited capital to invest in the forestry industry such as purchasing modern equipment and funding research.
7. Long distance to markets abroad, which increases the costs of production.
8. Shortage of skilled labour due to the small population in most areas which limits production.
9. Price fluctuations on the world market which discourages production/ leads to fluctuation in export earnings.
10. Competition from alternative raw materials in the industrialized countries such as plastics, metals; which reduces the demand for timber.
11. Rapid population increase which creates more land for settlement and farming, hence encroachment on forestland.

Guiding questions

1) Assess the role of the forestry sector to the economy of either Canada or Swaziland.
2) Examine the economic significance of the forestry industry to either British Columbia or Norway.
3) With reference to either British Columbia province of Canada or Gabon
   (a)Discuss the problems facing the forestry industry.
   (b)What steps are being taken to solve the above problems?
4) Account for the development and importance of the forest sector in either Scandinavia or North America.
5) With reference to a specific country in either North America or tropical Africa, discuss the problems involved in the exploitation of the forestry industry.
6) Describe the characteristics of tropical rain forests and discuss the problems associated with their exploitation.
7) Compare the characteristic features of equatorial forests with those of coniferous forests, and describe the strategies taken to improve the forestry industry in either a developing or a developed country.
8) (a) Compare the forests in the higher latitudes with those in the lower latitudes.
   (b)How are the forests in the lower latitudes an obstacle to their exploitation?
9) Explain the importance of forests to the economy of either Sweden or Ghana.

10) Account for the development of forestry in either Gabon or Norway.

11) To what extent have physical factors favoured the development of forestry in either Finland or Swaziland?

12) The effective utilization of equatorial forests/ tropical evergreen forests has been mainly limited by human factors. Discuss.

13) Examine the problems facing the utilization of forest resources in either the Amazon basin or Congo basin.

14) With reference to either west Africa or Scandinavia,

(a) Outline the factors that have favoured the existence of natural forests.

(b) Discuss the problems encountered in the utilization of natural forests.

15) (a) explain the following:

(i) Agro-forestry

(ii) Natural forests

(b) Examine the problems faced in harvesting forests in either Amazon basin or Canada

16) For either south America or topical Africa,

(a) Account for the disappearance of the rainforests

(b) Suggest ways how the forest resources of the region you have chosen can be conserved

17) With reference to either Sweden or Swaziland,

(a) Account for the development of forestry

(b) Discuss the role played by forestry in the country's development

MINING

Mining refers to the process of exploitation of minerals from the earth's crust. The mining industry involves all activities related to the extraction, processing and trade in minerals. In the industrial sector, minerals are used as raw materials, as a source of power and contribute to the generation of capital when exported.

Minerals are classified into two categories: the metallic and the non-metallic minerals. The metallic minerals are the most important and valuable because they are hard and have a wide range of uses. These include iron ore, tin, copper, aluminium, chromium, gold, silver, platinum, uranium, manganese, cobalt etc. The non-metallic minerals are relatively soft and weaker such as salt, potash, nitrates, sulphur, asbestos, certain precision stones e.g. diamonds. Minerals fuels are non-metallic minerals (derived from vegetation remains). These include coal, oil and natural gas.

Methods of mining

The methods used to remove mineral ores from the ground depend on the nature of mineral, the depth at which it occurs and its marketing value. The most common methods include:

- Open cast mining

  This method is used when the mineral ore is near the surface. The top soil (over burden) is removed and the mineral ore is blasted using explosives. The ore is then crushed to reduce the size. It is then loaded into trucks and taken to the processing plants.

- Shaft/ Adit/ underground mining

  This is used when the mineral ores lie deep below the surface (the over burden is too thick to be removed by mechanical shovels). Vertical shafts are dug into the ground to appropriate levels. From these, horizontal tunnels leading to the ore body are constructed. Supporters are provided from the roof to the floor of the tunnels. The ore is then blasted using explosives causing shattering. The ores are crushed and loaded on small wagons and taken to the vertical shaft, and lifted to the surface, and taken to processing plants.

- Placer or Alluvial mining.

  This is used when minerals occur in alluvial deposits. In this method a steel dredge or a gravel pump is used to dig up the alluvial deposits (waterlogged alluvium). The alluvium is mixed with a great deal of water. The mixture is rotated and in the process the lighter particles (sand, mud, dust) are washed off, leaving the heavier ores (diamonds settled down.
- Drilling methods such as for petroleum/oil.

  Process of oil drilling

  The basic equipment for oil drilling is a derrick—which is a steel tower about 40m high. Exploration /prospecting/survey of the oil is done and installing of the derricks/oil rigs follows. The derrick carries a drill stem on which steel drilling pipes are screwed /attached, having a drilling bit. The drilling bit is used to drill into/cut through the rock strata/layers to reach the oil well below. Lubricating mud is pumped into drilling pipe to lubricate the bit and to bring up rock samples. Once the bit reaches the oil stratum/layer, crude oil rushes out by natural pressure or pumped out to the surface using oil pumps if natural pressure is weak. The oil is then transported through pipes, fuel tankers, trucks to the refinery.

Factors limiting exploitation and use of tropical minerals

1) The small size of some mineral deposits that is, very small quantities not economically viable to exploit. A small deposit which can run out in a few years is uneconomical to exploit/ to install expensive machinery such as iron ore in Zimbabwe, Kenya, CAR; and Gold in Uganda, Kenya, Zimbabwe and Liberia. This discourages many investors in the mining industry.
2) The low grade of some minerals/ low value for example copper which looses almost over half of the ores to become viable for productive value; yet it is deeply underlain/ occurs in deep layers such as in Zambia, and DRC (Shaba province). Because a large percentage of the mineral ore becomes waste material, copper mining attracts less investment. In Tanzania the quality of diamonds vary and some are of low grade, hence more uneconomical to mine.
3) The great depth of the mineral ores. Most minerals exist at great depth underground and hence very expensive to exploit. They are subjected to a thick overlying burden (over burden) such as coal, diamonds, ironore and copper. This

increases the cost of exploitation since it requires sophisticated technology such as the shaft/underground mining method and involves a lot of risks.

4) There are many risks involved in the mining sector. The mining conditions are not appealing partly attributed to the deep overlying burden which can burry the miners/exploiters, high pollution levels involved (noise and air) which causes deadly diseases. All these scare away workers and investors from tropical mining.
5) Most tropical countries export their minerals as crude ores and this earns them less than if they had processed ores. As a result the high costs of production are not compensated by high value in terms of exported ores, which weakens and undermines tropical mining especially in tropical Africa. For example copper in democratic republic of Congo (DRC).
6) Remoteness of some mineral deposits, referring to the distance from the coast. The deposits occur in remote areas such as iron ore and coal in southern Tanzania, copper inland locked Zambia. Therefore the long distance travelled and the absence of viable transport infrastructure has limited mineral production and trade in tropical countries despite having enormous mineral potential. Also the dense tropical rain forests such as in Congo basin make the development of transport systems more difficult.
7) Low level of technology used in extracting the mineral resources especially the underground minerals. This is the case with Africa and Latin America. More the small operations make mineral exploitation using modern technology unprofitable and very expensive. Yet even most countries cannot afford purchasing the modern equipment.
8) Inadequate capital to invest in the mining sector. Capital is inadequate for economic exploitation of minerals such as bauxite which needs large amounts of electricity for the final production of aluminium itself (such as in Ghana, guinea and Sierra Leone). Also the delayed exploitation of oil in Lake Albert in Uganda has been mainly due to inadequate capital. The purchase of mining equipment, building smelting/processing plants and associated infrastructure are all expensive.
9) Limited skilled labour to work in the mining sector. Tropical countries do not have many competent engineers, geologists, and other scientists to develop and

manage mineral exploitation economically. This is also attributed to the poorly developed training in mineral exploitation and the general education system in tropical countries. This also explains why these countries continue relying on foreign expatriate personnel.

10) Price fluctuations on the world market. The prices of some tropical minerals have fluctuated more in the recent past, leading to uncertain incomes. For example the prices of copper declined more in the 1980s such that even earnings from it reduced tremendously such as for Zambia, and former Zaire causing unfavourable terms of trade, hence limiting further investment in mining.

11) Limited market for tropical minerals. Many other countries that would import tropical minerals have large deposits of their own minerals/Reserves with better mining cost reducing technology for example copper greatly exists in USA, USSR, Canada; yet coal occurs in USSR, USA, china, Germany; which further reduces the market for tropical minerals. Still some tropical minerals have low market value such as lead and zinc.

12) Political instability in many tropical countries which also limits the success of mining. Countries like DRC, Liberia, Sierra Leone, CAR, Angola, Venezuela, Zambia, Gabon, Nigeria, Venezuela etc have for a long time been locked up in wars and civil strifes which negatively affects the mining activities. The mineral wealth in Angola (e.g. diamonds and uranium, iron ore, copper and manganese) has not brought maximum benefit to the country because rebels have been selling the minerals cheaply to American and European companies in order to get many to buy arms.

13) Unfavourable government policy towards the mining sector. In many countries government efforts are directed to many other sectors and providing social services but limited investment done in the mining sector, after all some countries have less economic potential currently in terms of minerals or their known reserves. Some governments also discourage foreign investors through high taxes and failure to maintain transport and other infrastructure.

14) Power and energy problems in many tropical countries. The exploitation and processing of some minerals requires colossal/large amounts of electricity. However many potential power generation plants have not been established

and the existing ones have low voltage; which further undermines the performance of the mining sector in tropical countries.

15) Low level of research in the mining sector. There is inadequate mineral exploration to discover new mineral potentials, partly attributed to inadequate funding and limited expert manpower. Therefore many minerals are not known to exist and thus low level of mineral development.

16) Exhaustion of some mineral deposits due to high rate of exploitation, and thus many mineral deposits are exhausted or threatening exhaustion. For example some of the Zambian copper deposits are already exhausted. The copper deposits in Kilembe in Uganda are also exhausted. This also discourages many investors in the mining sector.

MINING IN SOUTH AFRICA

South Africa is gifted /blessed with plenty of mineral resources and the country has the most developed mining sector in Africa.

Gold mining

South Africa has the world's largest known reserves of gold. Gold mining takes place on the Rand (Witwatersrand) covering parts of the Orange Free State and Transvaal. The main gold fields of the Rand include Johannesburg, Springs, Krugersdorp, Klerksdorp, Vierfontein, and Odendalsrus.

Diamond mining

South Africa is also a major producer of diamonds. In South Africa diamond has the greatest deposits in Kimberley and Hope town in the Rand. Other mines include the Premier mine near Pretoria, Bultfontein, Jagersfontein, Koffiefontein, Rustenburg and Bloemfontein.

Most industries connected with diamonds are found in Johannesburg—with most of the diamond cutting factories plus diamond research centre.

Note: Diamonds are formed beneath the ground by great heat of volcanic activity and occur in rocks called kimberlite.

Coal mining

South Africa has large reserves of coal and produces about 6% of the world's output. Coal is also used to generate electricity alongside other sources of power].

Southern Transvaal is the leading coal producing state in South Africa. Huge deposits occur at Witbank, Vereeniging and Middleburg.

Iron ore mining

The most important African iron ore producer is South Africa and the country has its own iron and steel industry. In South Africa, large deposits occur in Pretoria, Middleburg, Waterburg and northwestern Cape.

Other important minerals in South Africa include platinum (world's leading producer), tin, manganese, chromium, asbestos, copper, nickel, zinc, and limestone.

Factors which have favoured the development of the mining industry in South Africa

1) Presence of a wide range of minerals and large deposits, which encourages investment in the mining sector due to being economically viable. The country has the largest known reserves of gold concentrated in the Witwatersrand. It has large reserves of coal such as in Middleburg and Vereeniging; and it is a major producer of diamonds such as in Kimberley. These large deposits have attracted government funding and various local and foreign mining companies.
2) High quality/value of the minerals produced such as gold and diamonds. Gold commands high demand since it is a very precious metal used as international currency and used for decoration. Diamonds are used in industry for cutting and polishing, and making jewellery. The high grade of most of South Africa's deposits attracts many companies /encourages mining investment.
3) Presence of labour both skilled and unskilled employed in the mining sector. Cheap labour to work in the mines is provided by the black local people and migrants from neighboring countries like Lesotho, Namibia, Botswana, Mozambique and Malawi. South Africa pays better wages than other countries. The foreign companies brought in many skilled workers and trained local people to acquire the necessary skills such as geologists who carry out mineral exploration, mining engineers, and supervisors.
4) Presence of adequate capital to invest in the mining sector provided by the government, foreign and local companies. These are investing in the exploration/ survey, exploitation and processing of minerals such as coal, gold,

diamonds and platinum. For example the Anglo-American corporation is engaged in gold mining. This promotes the growth of the mining sector.

5) Availability of large quantities of power/energy supply such as coal used for smelting and refining gold, platinum, and chromium. There is also hydro electricity generated at Vaal dam and Handrick Verwoed dam on River Orange. Uranium near Johannesburg generates nuclear power. This in turn attracts various mining companies.
6) High level of technology used partly due to foreign companies. This involves the use of earthmovers, caterpillars, bulldozers, and cranes. Most mines began as open cast mines but of today underground mining is also used by deep-level miners. There is also alluvial /placer mining such as for alluvial diamond deposits. Modern mineral processing technology is used and all this turn increases quality and quantity of mineral production.
7) Presence of a large market both internally and internationally. Gold as an international currency has a ready market especially in industrialized countries in Europe, Asia and North America. South Africa also exports mineral and mineral products to African countries. Besides the Rand is the major industrial region of South Africa and yet the minerals are concentrated there, hence offering immediate market. This promotes more investment in the mining sector.
8) South Africa has the most developed transport system in Africa and directly comparable with those in North America and Europe. This includes road and railway network such as the Cape—St. Lucia via Johannesburg and the Pretoria rand –Kimberley Railway lines. These facilitate the movement of mineral ores to processing centres, and minerals and mineral products to the export ports like Cape Town and Durban. This increases mining investment.
9) Large water supply, from both underground and surface sources such as Vaal and orange rivers; necessary for refining some minerals such as diamonds. The water is also used for domestic use in the labour camps. This also encourages further investment in the mining industry.
10) The development of the industrial sector such as in Witwatersrand using the minerals as raw materials. For example the iron and steel industries using iron ore as a raw material in Pretoria, Witbank and Vereeniging. Other industries are

engineering and electronics. This enhances mineral exploitation and processing due to the available immediate market in the various industries.

11) Favourable/supportive government policy towards the mining sector. Due to apartheid in the past, South Africa was isolated by economic sanctions and this gave the country a chance to develop most sectors of the economy to promote self-reliance including the mining sector. The government has set up the necessary transport infrastructure, creation of markets and economic liberalization, which has allowed many private companies into the mining industry (since the end of apartheid).

12) Increased research and discovery of more valuable mineral deposits in South Africa. Research is undertaken by geologists, engineers in areas of mineral exploration, exploitation and processing. This also in turn promotes the quality and quantity of mineral production.

13) Political stability of South Africa. Since the end of apartheid the country has remained stable which has encouraged many local and foreign investors in mineral exploration, extraction and processing as well as encouraging trade in minerals and mineral products since security of investment is assured.

Contribution of mining to the economy of South Africa

1. Generation of foreign exchange because South Africa is the world's leading producer of gold, the world's largest exporter of platinum, a major exporter of coal, diamond. All these minerals and mineral products are exported to Europe (UK, Germany, Belgium); North America, South America, Asia, and the rest of Africa. The foreign currency generated helps to import foreign goods not produced locally, and foreign technology.
2. Promotion of industrial development such as gold refining and diamond cutting industries in the Rand region. The large deposits of iron ore are responsible for iron and steel industries in Pretoria, Johannesburg, Witbank, and Vereeniging. These industries have led to development of secondary industries (such as electronics, machinery, jewelry) and provide jobs to many people.
3. Generation of many employment opportunities to many people at various stages such as mineral extraction, processing, refining, transportation, and exportation. Many people are employed by the gold mining, diamond mining, and coal mining companies. This improves the standards of living of the people

such as through building better houses, accessing better education and health services.

4. Source of power/ energy supply such as the mining of coal in the Rand has supplied power for domestic and industrial use. Remember that South Africa is the leading producer of coal producer in Africa. This helps to supplement other sources of power like HEP and thermal power, hence contributing to the general development of the country.
5. Promotion of urbanization/ development of urban centres especially in the Rand such as Johannesburg, Pretoria, Germiston, springs, Witbank, and Kimberley. As population increases in these urban centres, a number of facilities come up such as banking, insurance, education, hospitals, recreation, entertainment, and research facilities.
6. The mining sector facilitates capital accumulation such as gold mining which boosts the GNP of South Africa. Also the strong linkage between mining and industry has increased the export earnings –hence raising valuable capital to invest in various sectors of the economy like industry, sugarcane growing and tourism.
7. Generation of government revenue from the taxation of gold, platinum, uranium, iron ore and coal mining companies. The government also taxes the incomes of workers employed in the mining sector and the related industry. The revenue realized is invested in various sectors like fisheries, manufacturing industry, and vine growing.
8. Promotion of international relationship/cooperation between South Africa and other countries such as the countries where the mining companies originate, countries importing the minerals and associated industrial products-and they include: UK, USA, Canada, Japan, other Asian countries, South America, and the Rest of Africa. This has increased trade and economic contacts with those countries—hence more capital inflow.
9. Promoted development of transport infrastructure for example today South Africa has the most advanced road and railway network in Africa comparable to that of Europe and North America. These routes were initially established to connect mining, processing centres and the export ports such as Cape town-Johannesburg—St.Lucia railway and Pretoria—Kimberley railway. These

networks have not only supported the mining sector, but also other activities such as industry, farming, service sector.

10. Diversification of the economy due to the development of the mining sector and related industry which supplements on the number of economic activities. It has therefore reduced over dependence on few sectors like agriculture; thereby expanding the economic base and national income.
11. Facilitation of technological development and research in the country through the use of modern mining methods—like underground mining, and standardizing of the industrial processing technology to improve the quality of products like chemicals, electronics, jewelry, and diamonds.
12. Promoted development of other sectors like agriculture, trade and commerce, tourism—given the linkage with such sectors. For example, the mining sector provides market for the agricultural sector through buying food for the mining workers. This in turn increases the national income.

Negative effects/ short comings

1. Disfiguring of the landscape/ destruction of the landscape. The abandoned mines, ditches/ quarries and heaps of soil have created an ugly landscape and large areas of wasteland such as soil heaps from the gold mine near Johannesburg.
2. Mining leads to pollution of the environment, that is, air, water and noise pollution. For example coal mining destroys underground water and lakes. In addition, the dust from the various mines pollutes the air hence causing deadly diseases.
3. Mining accidents are associated within the sector for example the sinking of soils, patches of soil covering miners, collapsing roofs—leading to loss of life.
4. Neglect of the agricultural sector due to the movement of able-bodied people from the rural areas to get better paying jobs in the mining sector. This undermines food production.
5. Displacement of people from areas where mineral deposits occur (especially due to large open cast mining). Many people lose their areas with less or no compensation.

6. Emergence of ghost towns where minerals have been exhausted and this has forced people to move to other areas. Modern planned settlements at high cost have been abandoned such as in Johannesburg.
7. Urban-related problems in the mining towns such as slum growth, high crime rate, and poor structures. It is very costly for government to eradicate such problems.
8. Discovery of minerals increased foreign influence. Earlier the British and the Boers after discovering minerals displaced the blacks from their land. Today there are more whites in South Africa engaged in the exploitation and trade in minerals.
9. Profit repatriation by the foreign—owned companies such as those involved in gold and coal mining. This reduces the rate of re-investment in the economy.
10. Leads to regional imbalance in development since the mining zones have experienced more progress in terms of infrastructure than other areas. This in turn has led to rural—urban migration, hence creating more problems in the urban areas.

Problems facing the mining sector in South Africa

1. Shortage of labour to work in the mines and related industries, and this undermines production.
2. Shortage of water needed in processing of minerals especially in the Rand.
3. Price fluctuations of minerals on the world market leading to uncertain incomes.
4. Competition with other mineral producing countries like Ghana, DRC producing gold.
5. Long routes to the coast which increases the transport costs.
6. Labour unrest which often leads to strikes and hence affecting production. This is due to poor working conditions and racial segregation.
7. Accidents occur during mining leading to loss of life such as due to falling rocks.
8. Suffocation due to lack of fresh air and flooding of the mines.
9. High costs of mining due to increasing depth of the mines.
10. Exhaustion of some high grade mineral deposits due to over exploitation.

MINING IN NIGERIA

Nigeria is the largest producer of oil south of the Sahara. Large deposits of petroleum /oil occur under sedimentary rocks of the Niger delta and the neighbouring coastal plains/ off shore in the ocean.

Commercial oil production started in 1956. The first commercial oil well was at Oloibiri west of Port Harcourt and soon after others around Port Harcourt started production. Other oil reserves are found at Ughelli in Bendel state. Refineries exist at Port Harcourt, Warri, and Kaduna.

In Nigeria many companies both domestic and foreign are engaged in the oil industry such as shell—BP, Gulf, Mobil, Texaco, Elf, Nigerian national oil corporation. Most foreign companies originate from Britain, USA, France, Italy, Japan, and Germany.

Apart from oil/ petroleum, Nigeria produces natural gas, a cheap clean industrial fuel (exploited together with oil). Other important minerals in Nigeria include Iron ore at Enugu and Itakpe near Lakoja, Coal mined at Lafia and Enugu supplying power, Tin in Baunchi on Jos plateau.

A sketch map showing the distribution of minerals in Nigeria

Factors which have favoured the development of the mining sector in Nigeria

1) Presence of large reserves of minerals in the country for example large reserves of oil at Oloibiri, Port Harcourt and offshore deposits. Nigeria has got the largest oil reserves south of Sahara, making it economical to exploit the oil and this has encouraged many oil companies to invest in the oil industry.
2) Presence of adequate capital to invest in the mining sector provided by local and foreign companies such as shell BP, Texaco, Gulf, which were attracted by the large oil reserves in the country. Capital is also raised by the Nigerian national oil corporation. This has enabled the installation of oil derricks to drill the oil and building of oil refineries such as at Port Harcourt; hence expansion of the mining sector.
3) Presence of skilled manpower to work in the mining sector. Nigeria is one of the African countries with high functional literacy levels and has trained many people as engineers, technicians, geologists, and managers. Workers are trained on the job to acquire the skills in oil drilling and processing. The skilled workers

are also brought in by the foreign companies from their home countries. This increases the quality and quantity of oil production.

4) High level/improved technology employed in mining. Since 1956 mining and processing has been progressing with advancing technology such as the drilling pipe technology attributed to the mining companies. Previously natural gas was simply lost but today it is extracted as oil is being refined. One method to increase production has been the construction and operation of offshore drilling rigs.
5) Presence of a large market, both domestic and foreign. Nigeria has a big population over 130 million providing a big home market for oil and oil products. Nigeria mainly exports oil to USA, United Kingdom, Italy, France, and the rest of Africa to be used in a number of ways such as making chemical products and in the transport sector. Given the high grade of oil, the country supplies about half of its oil to USA and most of the other half to Europe. This has encouraged investment in Nigerian oil mining.
6) Efficient transport system since Nigeria is not landlocked and is lucky to have oil reserves at the coast which minimizes the transport costs to export markets. There is also an extensive system of pipelines laid down to transport oil from the fields to oil collecting terminals such as the pipeline from Oloibiri to port Harcourt, pipelines to Escravos terminal, Forcados terminal, Brass terminal, and Bonny terminal. Port Harcourt handles most of Nigeria's oil exports while other facilities for export are at Bonny and Burutu.
7) Large quantities of power in form of hydro-electric power at Kainji dam on Niger River, oil and natural gas to support the mining industry such as oil drilling and refining. This promotes efficiency and hence large-scale oil mining.
8) The setting up of various processing industries such as the completion of the Port Harcourt refinery owned jointly by the Nigerian government and shell BP made it possible to process total output in part. Other oil refineries are at Warri, and Kaduna; to increase the quality of output, instead of exporting crude oil. In turn, this has increased the export earnings from oil mining.
9) Positive/ supportive government policy towards the mining sector such as the liberal policy since it has allowed many companies to invest in the mining sector. The government has encouraged many companies by granting them tax

holidays and protecting them against competition. This in turn expands the mining sector.

10) Nigeria is also strategically located reasonably close to the markets in Western Europe, USA and South America. This enables easy access to the markets. Nigeria became a member of OPEC (Organization of petroleum exporting countries) in the late 1970s. Easy marketing encourages further investment in the mining sector.
11) Relative political stability.
12) Increased /intensive research in the mining sector.

MINING IN GERMANY

Germany is a country greatly endowed with mineral resources and has the second largest coal reserves in Western Europe after UK and its rapid industrial development was greatly based on the exploitation of coal. Today however other forms of energy are taking over from coal.

The most important /largest coalfield is the Ruhr coalfield which accounts for ¾ of Germany's output and about 90% of its reserves. The coalfield is divided into two; the exposed coalfields to the south in the Ruhr valley and the concealed coalfields in the north in areas of the areas of the Lippe valley and Emscher valley.

The exposed coalfields have the coal bearing rocks on the surface while the concealed coalfields have them buried underground. Open cast methods are used for exposed coal while Shaft or underground methods are used for concealed coal.

Note: The exposed coalfields are getting exhausted and work now is deep in the concealed coal fields which are difficult and expensive.

Other coalfields in Germany include Aachen coalfields (not very important today); and the Saar coalfields near the Germany—French border with good coking coal and easy to mine. There are also lignite coal deposits at cologne and in Bavaria which are mined to provide fuel for thermal electricity generation.

There are other important minerals in Germany such as potash, salt, iron ore, phosphates, copper, lead and zinc. [The presence of certain minerals in large quantities such as potash and salt led to the development of chemical industry, including fertilizers and pharmaceuticals].

Factors which favoured the development of coal mining in Germany

1. Availability of large mineral deposits/ reserves for example the country has the second largest reserves in Western Europe after UK which meant that mining was cost effective. The largest coalfield is the Ruhr region which accounts for about ¾ of Germany's output. Other deposits are the Aachen and Saar coalfields. This has attracted large-scale investment in the coal mining industry.
2. Presence of different types of coal for example Anthracite coal containing a high percentage of carbon and burning with great heat—making it an important source of energy. Gas coal for domestic and industrial purposes. Coking coal especially valuable for the iron and steel industries and chemical industries. Mining was therefore necessary since the coal acted as a raw material and energy for industrial development.
3. Some coal deposits are near the surface and thus easy to mine. At the beginning mining was concentrated in the exposed coal fields of the south and these could be mined by open cast method especially in the Ruhr valley. Still most of the deposits were in close proximity to one another, allowing convenient use of coal as fuel first to process the iron into steel and manufacture products from steel.
4. Presence of other forms of energy such as petroleum, natural gas and hydroelectric power has also supported mineral exploitation and processing. In the recent years, nuclear energy and hard coal which burn more cleanly than brown coal are gaining importance.
5. Well developed and cheap transport system provided by the Rhine River and its tributaries such as Ruhr, Lippe and Emscher. The Rhine water way is linked with a system of canals such as Dortmund Ems and Lippeseite canals, which improves its transportation capacity; to transport coal to industries and markets. The Ruhr region has railway and road networks to transport coal, iron ore and mineral products. This leads to expansion of the mining sector.
6. Large sums of capital to invest in coal mining which was first provided by the government but later private financiers joined, to provide the necessary capital for mineral exploration, extraction, setting up processing plants and related industries.
7. Development in technology in the mining sector such as open-cast mining for deposists near the surface. Large machines are used such as shovel wheels which can do a lot of work. There is intensive research in mining technology such

as the use of cranes, and excavators to support exploitation. This increases the quality and quantity of mineral production.

8. Presence of skilled labour employed in mining because a body of skilled labour labour has been developed right from the time of the industrial revolution in mining sector such as geologists specializing in mineral exploration/research, mining engineers, machine operators, managers, and drivers. This has increased efficiency in the mining industry.
9. Presence of large market for minerals and mineral products. Coal is used in the coking of iron, as a catalyst in blast furnaces and as a source of power. Of all the coal produced in the Ruhr , 40% is used there, 30% to other Germany areas and 30% exported to Scandinavia , France , Belgium ,Italy Switzerland and The Netherlands. Germany's potash industry ranks as one of the largest exporters of potash based on fertilizers in the world.
10. Political stability of the country since the Second World War. Germany has remained a peaceful country providing the necessary conditions for the rehabilitation of the mines that were destroyed during the war in the Ruhr, Saar and cologne areas. Political stability has increased the confidence of investors and hence enabled the establishment and maintenance of mineral processing plants.
11. Positive /supportive government policy towards the mining sector such as originally investing in the mining sector with powerful industries. Today the government has provided enabling policies and subsidies such that mining continues in the rather uneconomical concealed mines. This has attracted foreign investors from countries like USA and Britain.
12. High level of research in the mining sector which leads to the discovery of more mineral deposits, improve their quantity and quality. There is also research into mining technology and new uses of the minerals. This in turn expands the mining sector.

Importance of coal mining in Germany

1. Promotion of industrialization for example the iron and steel industries which use coal as a source of energy and as an ingredient in the refining process. Iron

and steel producing areas include Hamburg, Bremen, Hannover, Wolfsburg, and Brunswick. Chemical industries use coal as a raw material centred at Bochum, Dortmund and Essen. This has increased national income.

2. Has promoted urbanization in Germany. Many towns started as mining areas but have grown into great cities such as Dortmund, Duisburg, Essen, and Bochum. The Ruhr conurbation has a number of towns which developed mainly due to the presence of coal which was used as power. Most of the industries of the Ruhr are linked together/ depend on each other. The concentration of population in the Ruhr region has attracted many urban facilities such as banking, insurance, and education facilities.
3. Generation of foreign exchange
4. Generation of many employment opportunities.
5. Promoted development of transport infrastructure.
6. Generation of government revenue.
7. Promotion of international relationships.
8. Diversification of the economy.
9. Modernization of other sectors of the economy.
10. Development of modern technology.

Negatives/ short comings

1. Pollution of the environment.
2. Urban-related problems.
3. The closing of some mines due to exhaustion of coal is leading to the under utilization of infrastructure put in the mining areas. This is especially in areas of exposed coal which is now exhausted like in Essen.
4. The use of open cast methods in the Ruhr, Aachen and Saar mines has led to destruction of the landscape, which has affected the otherwise viable agricultural land.
5. etc

Problems facing the mining sector in Germany

1) Exhaustion of coal in some areas because coal has been mined for many years especially in the exposed fields. These areas have redundant infrastructure.

2) Increasing costs of mining with increasing depth of the mines especially in the concealed coal deposits. It requires experts and a lot of facilities such as construction of shafts, lamps—hence costly.
3) The closing of mines has resulted into unemployment and pre-mature retirement of skilled manpower.
4) Coal is facing stiff competition from other sources of energy especially petroleum/ oil which is a less pollutant and today the Ruhr region receives a large quantity of petroleum moved in by pipeline and ocean-going vessels , which has seriously replaced coal as a major source of power.
5) Competition from other countries whose coal deposits are continuously being discovered and low cost producing countries such as Saudi Arabia, china, USSR, and Australia.
6) Decline in demand for coal in relation to other minerals due to improved technology which requires less inputs and costs. For example in the iron and steel industry the technological progress results into less and less coal demanded.
7) Price fluctuations on the world market.
8) The shared location of some mineral deposits such as coal with France.
9) The uneconomical deposits of some minerals in some areas.
10) Destruction of landscape and mining accidents.
11) Shortage of labour to work in mining activities.
12) Remoteness of some areas of mineral occurrence.

MINING IN USA

USA is endowed/ blessed with a variety of minerals. The most important minerals are iron ore, coal, gold, copper, petroleum/ oil and natural gas. Others are aluminium, lead and zinc, manganese, cobalt, and silver

IRON ORE

Iron ore is mined in four (4) major regions:

- Lake Superior region—the most important of which is the Mesabi Range. Other deposits occur in the vermillion Range, Cuyuna, Gogebic, Menominee and Marquette Range.

- The northeastern region. Mainly ores are mined in the Adirondacks region of Newyork and the Cornwall area of Pennsylvania. Here they have the advantage of location near the industrial cities of Newyork and Pittsburgh.
- The southeastern region. This region is centred at Birmingham –Alabama. It is favourably located near the coalfields of the southern Appalachians and serves the iron and steel industry at Birmingham.
- The western region. This includes many scattered fields in western USA in the states of Utah, Nevada, Wyoming, and California. The ores are transported to the steel works at San Francisco, Los Angeles, Puelo, Colorado and Provo, Utah.

COAL MINING IN USA

USA is the world's leading coal producer and it became the leading producer in the 20th century. However, the USSR has the largest coal reserves in the world.

The major coal areas of USA are:

- The Eastern province. This is the most productive region and has the greatest reserves. This includes four leading coal states: Pennsylvania, West Virginia, Kentucky and Ohio.
- The Interior province. This is the 2nd major producing region and it covers the shores of Lake Huron, Indiana, Illinois, Iowa, Missouri, Kansas, Oklahoma, and Arkansas.
- The Gulf province. It is a minor coal region including Texas, Alabama and Arkansas.
- The Rocky mountain province. This is America's greatest coal reserve but yet little exploited due to inaccessibility and distance from major markets. The major deposits are located in Utah, Colorado, Wyoming, Montana, and New Mexico.
- The Pacific province. This includes small coal deposits close to the pacific coast. The fields include Washington, Oregon, California and Alaska.

Factors which have favoured the success of coal mining in USA

1) The existence of large coal deposits spread over the Eastern, Interior, the Gulf, Rocky Mountains and the Pacific provinces. These large deposits have promoted

exploitation and processing of coal for now over two (2) centuries. The remaining deposits will last for over several decades to support the industries in USA and the international market.

2) Presence of high quality coal and of all types such as anthracite, bituminous coal, lignite (brown) coal and graphite coal. Coking coal is a grade of bituminous coal used in the iron and steel smelting in blast furnaces. Anthracite coal is of the best quality usable for heating, boilers as well as in the manufacture of batteries. About 50% of the world's anthracite coal is found in USA and this has given USA dominance in its supply to countries like Canada, china, Russia, and India.
3) The country's coal deposits are easy to mine and transport because the coal is found in horizontal layers and many deposits are found near the surface. The extraction of coal is done at low cost sometimes-using open cast methods. Even in mountainous regions such as Appalachians, the coal seams/ layers are not very deep and thus easy to access and extract.
4) Strong capital base to invest in mining provided by rich coal mining companies and private individuals. The corporations which operate in the Eastern and Gulf provinces are some of the richest in the world of coal mining business. More so USA has a high GNP per capita therefore capital mobilized for the purchase of modern machinery, setting up processing industries, training manpower, and carrying out mining research.
5) Influence of many large foreign companies from Britain and Germany due to the liberal economy of the US. These have brought in more capital, high technology and find it easy to market the coal abroad using their international reputation. The companies include the Peagody coal company and Kennecott company from Britain. Such companies have contacts in Europe and Asia which guarantees market for US coal.
6) Presence of a large market both domestic and abroad. Within USA the end user sectors for coal include electric utilities, coastal shipping, transcontinental railways and residential facilities. US coal is also exported to Canada, Japan, Italy, Netherlands, France, china and southeast Asia (like Malaysia, Indonesia). The economies of the newly industrialized countries continue to provide a large market for US coal. This promotes investment in the mining sector.

7) Presence of efficient transport systems in USA such as the country's highway system which is integrated with the railway system. The railway system is connected to almost all ports enabling easy transportation of machinery, manpower, the coal and coal products. The railway system if further integrated with the Canadian and Mexican railway systems. For purposes of export the US depends on the Atlantic and Pacific Ocean routes, which implies lower transportation costs compared to other coal producing countries.
8) Availability of skilled/ hilghy trained labour to support coal mining such as geologists, managers, engineers, marketeers, and accountants. The migrant workers from South America, Asia and Africa are also trained to acquire the needed skills. The coming of the multinational companies has increased the skilled labour and thus high quantity and quality of production.
9) Advancement in technology which facilitates easy extraction and processing of the coal. The extraction technology includes open cast methods (for seams near the surface), underground/ shaft mining (for deeper coal seams), and slope mining. The technology further has enabled the Americans to manufacture a wide range of products from coal greater than other nations.
10) The growth of the industrial sector also explains the success of coal mining. Previously coal was a major source of power for many industries (such as chemical, engineering). Today coal is used in the smelting of iron and steel and used to make metallurgical coke used in the blast furnaces. Coal provides a number of raw materials for the chemical industry (such as the making of organic chemicals, plastics, detergents, disinfectants, synthetic fibres, explosives). This attracts more investment in coal mining.
11) Political stability of the US for a long period which has attracted foreign investors from Europe and Asia due to guaranteed security of investment. The financial, insurance and securities subsectors have been attracted to the US mining industry for a long time. This has boosted further the stock of capital invested in the coal mining industry.
12) Availability of large quantities of power required for Coal mining, processing and the making of coal-related products. This includes hydroelectric power and the leading dams are Hoover dam, Grand Coulee dam, Shasta dam, and the many dams in the Tennessee Valley Authority scheme. These together with

thermal facilities produce large quantities of power to run the coalmines and processing factories.

13) Favourable/ supportive government policy towards coal mining industry such as creating a stable political and economic environment, encouraging local and foreign investors and financing large hydro electricity projects. There has also been economic liberalization policy aimed at boosting coal mining as well as giving preferential treatment to investors when securing loans.

14) Intensive/ developed research in the mining sector done by physicists, chemists, engineers, geologist—to explore the available quantity and quality of coal in a given area and extract it using the most appropriate technology. There is also research aimed at improving the mineral processing technology.

Impact of coal mining on the economy of USA

Positive impact

1. Promotion of industrial development for example iron and steel industry since it is used in smelting. Coal and oil have also led to the growth of chemical industries since they are used as raw materials to make various products like organic chemicals, plastics, detergents, perfumes, disinfectants, insecticides, fungicides, and pharmaceutical drugs.
2. Generation of employment opportunities to the people.
3. Generation of foreign exchange to USA.
4. Diversification of the economy of USA.
5. Mining has promoted the development of transport infrastructure.
6. Promotion of urban development.
7. It has led to further technological advancement.
8. Coal miners have acquired more skills due to constant training.
9. Generation of government revenue.
10. The country's international relations have been strengthened.
11. Promotion of research and scientific studies.

Negative impact

1. Exhaustion of minerals causes dereliction of the landscape.
2. The decline of mining and closure of mines is associated with problems of unemployment and declining industry.
3. Pollution and health hazards.

4. Mining accidents
5. Profits by the foreign owned companies
6. Displacement of people
7. Destruction of natural vegetation
8. Urban—related problems
9. Underdevelopment of some rural areas
10. Displacement of other economic activities like farming and industry and tourism.

Problems facing the mining sector in USA

1) Exhaustion of some high-grade minerals in some areas because coal has been mined for many years. For example the exhaustion of coking coal/ high grade bituminous coal in the Appalachians. In addition, many old oil fields are being exhausted which has made USA a major importer of oil/ petroleum and hence greatly affected by oil price rises since the 1970s.
2) Increasing/high costs of mining with increasing depth of the mines especially in the concealed coal deposits. This requires experts and a lot of facilities such as construction of shafts, miners' lamps—hence costly/ very expensive.
3) The closure of some mines has resulted into unemployment and pre-mature retirement of skilled manpower. It has also resulted into redundant infrastructure and unproductive land in terms of other activities such as agriculture.
4) Stiff competition between oil and coal as sources of energy. Today oil is a major source of industrial power. Oil has largely replaced coal in the boilers and furnaces. For example the presence of major oil fields in the interior has negatively affected coal production and trade, since oil is mined more cheaply and is a more effluent fuel.

   On the other hand, coal is very bulky, which makes it difficult and costly to transport than either liquid petroleum carried by pipelines or tankers or electricity which is simply transmitted by wires and has no bulk at all.

   Note: Oil has also become a raw material in a wide range of chemical industries and in fact dominates the chemical industry. It is used in making synthetic textiles, dyes, solvents, detergents, plastics which have a wide range of industrial and domestic uses. Synthetic rubber is also extracted from oil.

5) Competition from other mineral producing countries whose deposits are continuously being discovered and which are low cost producing countries such as Saudi Arabia, china, USSR, and Australia which produce oil. Also USSR, china, UK, South Africa which produce coal. This in turn limits the export market of US minerals.
6) Remoteness of some areas of mineral occurrence for example in the Rocky Mountain region mining of oil is more difficult, more expensive and thus potential oil districts are inaccessible due to rugged terrain. There are high costs of transporting minerals from the interior to the coastal processing centres and export ports. The Alaskan region also has large reserves of oil and natural gas but it is expensive to produce and transport because of the cold tundra climate (the severe winter conditions) make mining difficult throughout the year.
7) The shared location of some mineral deposits such as coal and iron ore with Canada. For example iron ore mining in the Lake Superior region which at times causes conflicts as regards the control of certain deposits of minerals. This undermines the expansion of mining investment.
8) The uneconomical deposits of some minerals such as the many scattered fields of iron ore in the states of Utah, Nevada and California. The pacific province has very small deposits of coal only for local significance close to the pacific coast. North America in general is markedly lacking in tin deposits, has limited deposits of zinc, chromium, and diamonds. This makes it rather uneconomical to exploit such minerals, hence discouraging investors.
9) Fluctuation of prices of some minerals on the world market such as for coal, oil and copper. For example, copper prices fluctuated more in the 1970s and 1980s which also negatively affected US production by discouraging some potential investors.
10) Destruction of the landscape and many mining accidents. The exhaustion of some deposits has left a derelicted landscape—since mining operators are unwilling to spend money on rehabilitation, which will not give them direct financial return. This leads to waste of agricultural and industrial land; causes ugliness, health and accident hazards. Therefore, there is strong opposition from environmentalists on further expansion of mining.

11) Pollution of the environment for example by the oil industry through unintentional oil spillage from tankers and pipeline leaks as well as through dumping of oil processing waste. This negatively affects the habitats of birds and aquatic life. This also leads to strong opposition from the Authorities and especially environmentalists.
12) Shortage of labour to work in mining activities since many are attracted to other better paying and/ or less risky jobs in the country or outside. This limits the productivity of the mining sector.
13) Congestion at the ports which leads to delays in the exportation of the minerals and thus leading to inefficiency in the mining sector.

Guiding questions

1) To what extent have natural resources influenced the development of the mining sector in either Ruhr region of Germany or Zambia?
   Natural resources to the development of the mining sector

- Large deposits of minerals
- High grade of the minerals
- Relatively flat landscape
- Nearness of some ores to the surface
- Availability of land/ sparse population
- *Aridity of the area—alternative land use
- *Water supply

Other factors

- Cheap labour and skilled labour
- Developed transport system
- Adequate capital
- Etc

2) Account for the development of the mining sector in either Nigeria or USA.
3) Assess the role of the mining industry in the economy of either Zambia or Germany.
4) Examine the problems facing the mining sector in either Zambia/Ghana or USA

5) Using specific examples assess the significance of mineral resources as a basis for industrial development in either a developed or a developing country.
6) To what extent have mineral deposits led to the growth of towns in either republic of South Africa or France?
7) Assess the impact of mining on the environment in USA.
8) With reference to either DRC or Germany, discuss the problems facing the mining industry and suggest possible solutions to the problems.
9) Assess the contribution of the mining industry to the development of either Greatlakes region of North America or the Witwatersrand (Rand) region of the republic of South Africa.

POPULATION

Population refers to the number of people living in a given area at a particular time/ over a specific period of time.

The study of population characteristics like growth, density, distribution, and movement is known as demography.

To achieve development, proper national / international planning is seriously based on proper population statistics. The world population today is over 7 billion people.

Population concepts

1. Population growth

   Refers to the increase in the number of people in a given country/ region in a given period of time.

   This population growth is affected by:

   - birth rate and death rate
   - age structure
   - migrations

2. Birth rate

   Refers to the total number of children born alive per year per 1000 of the total population in a country / region.

$$\frac{\text{Total number of live births}}{\text{Total population}} \text{ X } 1000$$

Birth rate = ———————————

3. Death rate

   Refers to the number of people who die per year per 1000 of the total population.

$$\text{Death rate} = \frac{\text{Number of deaths}}{\text{Total population}} \times 1000$$

4. Population growth rate

   Refers to the percentage ratio of the death rate to birth rate per 1000 of the population per year.

   Or Refers to the rate at which the population of a country increases over a given period of time usually a year, expressed as a percentage.

$$\text{Population growth rate} = \frac{\text{Birth rate} — \text{Death rate}}{1000} \times 100$$

   Examples: Kenya (2.9%), Uganda (3.5%), Somalia (3.0%), Nigeria (2.8%), Sweden (0.16%), USA (0.9%), Switzerland (0.4%).

5. Fertility rate

   Refers to the average number of children a woman is capable of producing / bearing throughout her reproductive life (15-49 years).

   High fertility rates of over 6 children per woman are experienced in many parts of Latin America, Africa and South East Asia.

6. Infant mortality rate

   Refers to the number of children who die before they are one year old per 1000 of the population in a given year.

$$\frac{\text{Number of deaths of children under 1 year}}{\text{Total number of live births}} \times 1000$$

IMR=

7. Dependency ratio
   Refers to the proportion of economically unproductive population (0-14 yrs) and (65+ yrs) to the economically productive population (15-64 yrs).

$$\text{Dependence ratio} = \frac{\text{Children (0-14 yrs) and Elderly (over 65 yrs)}}{\text{Economically productive (15-64 yrs)}}$$

8. Rapid population growth
   This is a situation where the rate of population growth is higher than the rate of economic growth to meet the demands of the increasing population.
9. Population census
   Refers to the actual counting of the number of people living in the country at a given time.
10. Population pressure
    Refers to the human weight exerted on the available resources of an area in a given period of time. It is a situation where the existing resources can no longer sustain the increasing population.
11. Life expectancy
    Refers to the average number of years which people live from birth to death.
    Or average number of years a new born infant is expected to live (length of life).
    Examples: Uganda -52 years, Malawi 43 years, Zimbabwe—40 years, Sweden—80 years, japan—81 years, germany—79 years, Switzerland—81 years, USA—78 years, Canada—80 years.
12. Population density
    Refers to the average measure of the total number of people per unit area of land.

Total Population

$$\text{Population density} = \frac{\text{Total Land Area}}{\text{Total Land Area}}$$

13. Migration

    Refers to the movement of people from one place (origin) to another (destination). Population migration takes a longer span than say population mobility or tourism although they are interrelated. It is also sometimes temporary or permanent, internal or international.

14. Emigration

    Refers to the movement of people out of a country. The people involved are called emigrants.

15. Immigrations

    Refers to the movement of people into a country. The people involved are called immigrants.

16. Net migration

    Refers to the difference between emigration and immigration.

17. Net migration gain

    This is where the number of people coming into a country (immigrants) is more than the number of people leaving the country (emigrants).

18. Net migration loss

    This is where the number of people leaving the country (emigrants) is more than the number of people coming into the country (immigrants).

Optimum population

Optimum population refers to the population size that provides labour force that is sufficient to combine with the existing co-operant factors of production leading to maximum output per worker/highest income per capita.

It is the population size that is just enough to fully exploit the available resources, resulting into highest aggregate demand and standard of living. Below this population size there is under utilization of resources while above it there is over utilization of resources.

Under population

This refers to the population size that provides insufficient labour force to combine with the existing co-operant factors/resources, resulting into under utilization of resources and low per capita income/low average output.

A situation where a country's population is less than enough required to fully exploit the available resources, leading to low average product and low standards of living. (This is noticed in countries like DRC, Gabon, Sudan, Venezuela, and Australia)

To increase output per capita, there is need to increase the size of the population.

Effects of under population

Positive

1. Resources are not over exploited.
2. There is a high potential for employment opportunities.
3. Reduced government expenditure especially on social services due to limited number of people.
4. The standards of living are easily increased by increasing resource exploitation.
5. Inflationary tendencies due to excess demand do not occur.
6. There are less social costs such as pollution.
7. Political and social instabilities are minimized.

Negative

1. Results into wastage/underutilization of resources such as mineral, forest, water due to the small population. DRC has rich deposits of gold and diamond , extensive tropical rain forests etc all of which remaining underutilized.
2. Results into limited market size for goods and services due to small population. This undermines agricultural and industrial development.
3. Leads to labour shortages due to the small population, hence low level of a development and industrial development.
4. High/increased social over head costs per head. It is very expensive for the government to develop infrastructure and other social facilities.
5. Results into low tax revenue due to the low tax base/ small population. This undermines the development of social and economic facilities.
6. Encourages rural-urban migration leading to under development of rural areas. Many people leave the remote countryside attracted to the few urban areas.

7. Leads to regional imbalance in development due to uneven population distribution. People tend to stay in the most favoured areas and hence infrastructure is also concentrated in those areas.
8. Results into dependence on other countries, in terms of labour supply, market, capital, and the supply of essential goods.

Possible solutions to the problems of under population

1. Providing incentives for large families such as free housing, free education.
2. Encourage people to settle in less populated areas such as by developing the necessary infrastructure.
3. Encourage foreign investors to finance development projects in various regions.
4. Gazette under populated areas into national parks and reserves as an alternative landuse.
5. etc

Over population

Over population refers to the population size that provides more than sufficient labour force to combine with the existing co-operant factors, leading to low out/income per capita/worker and therefore low standards of living.

A situation where the country's population is more than enough required to fully utilize the available resources, leading to low average product and low standards of living. (This is seen in countries like India, Bangladesh, Indonesia, China, Rwanda, and Burundi)

The output per worker can be increased by reducing the size of the population.

Effects of over population

(Refer to rapid population growth)

Possible solutions to the problems of over population

1. Birth control practices to cut down the rate of population growth.
2. Development of more natural resources such as soils, power, forests to support the bigger numbers of people.
3. Ensure higher foods supplies /yields from the existing farmland such as through agricultural research, farm technology, swamp reclamation , desert irrigation etc

4. Encourage out-migration to relieve population pressure. However today fewer governments are prepared to accept immigrants.
5. Strengthen education to change traditional attitudes to reduce birthrates.
6. Exportation of labour force such as expatriates to other countries (export skilled labour which is unemployed).
7. Addressing poverty so as to improve income and general standards of living. This involves encouraging organizations with anti-poverty programmes.
8. Population control policies / legislations should be undertaken such as one child per family policy, marriage age legislation.
9. Women empowerment programmes should be undertaken such as enhancing their education, political and economic opportunities.

Population structure/ composition

Emphasis is placed on the age and sex structure. The population structure helps to show the effects of migration, age and sex of migrants , impacts of large scale wars, and major disease epidemics.

The population structure of developing countries greatly differs from that of developed countries because developed countries have a high life expectancy and a low rate of natural increase while the opposite is true for developing countries. The best way to describe the population structure is the use of an age –sex graph / population pyramid.

There are mainly/ majorly four (4) characteristic stages:

Stage I

Most developing countries fall in this stage such as Kenya , Malawi , Uganda , Mozambique. This stage is characterized by the following:

- High birth rates due to a large number of people under 15 years of age (having a broad base)
- High death rates due to rapid fall in age-groups upwards
- A short life expectancy since the top is very narrow , implying very people living beyond 65 years.
- High infant mortality rate –evidenced by a rapid fall from the broad base
- Generally females are moe than the males in all age groups

Reasons for the broad base

- Limited use of birth control measures suvh as fmiliy planning devices
- Most cultures encourage polygamy
- Influence of religion such as Catholicism and islam encouraging large families
- Social and cultural attachment to many children such as providing field labour.
- Low levels of education especially among women , making them to prefer large families
- Low desire for savings and investment among most people

Reasons for the narrow apex

- Rampant disease epidemics killing many people
- Poor medical services in many areas such as limited essential drugs, few doctors leading to high mortality
- Famine due to insufficient food supply in many areas
- Low life expectancy due to poor hygiene and malnutrition, with few people living beyond 50 years

Stage II

- This stage has a broad base due to high birth rates
- Relatively straight adged pyramid due to fall in death and increase in life expectancy.
- Due to reduced death rate/ moratality , a large useful population enters the production process to become economically active.

- India is seemingly at this stage , with 39% under 15 years, 3% over 65 years, and thus the remaining majority in the middle working age bracket.

Stage III

This stage is characterized by:

- Declining birth rate, young ones equal to those in the productive age bracket.
- As the death rate is much lower , more people are expected to live at an older age (top is convex shaped)
- Birth rates tend to be equal to death rates, and the population is said to be stagnant.
- Countries like argentina are at this stage and has about % 26 % under 15 years and 8% over 65 years.

Stage IV

Many developed countries are at this stage and the population structure is characterized by:

- Narrow base due to low birth rates i.e a small number in the pre-productive age groups
- Wider top/apex –a large population in the post-productive age groups due to increased life expectancy
- Low infant mortality and low death rates
- Wider productive age bracket (16-64 years)

Causes of the population structure of developed countries

- Increased family planning through the use of contraceptives
- Increased industrialization and mechanization implying limited need for labour
- Increased desire for savings and investment among the people, hence less demand for large families.
- Increased government prohibition of large families through legislation.
- Emancipation of women, enabling them to follow their professional careers rather than being child bearers.

Implications of the population structure in developing countries

Positive

1. Creates a big market potential for industrial and agricultural output, a large percentage of the population is below 60 years.
2. Increases the potential labour force since many people engage in productive activities.
3. Leads to optimal utilization of social and economic infrastructure in the country such as roads, railway, schools, hospitals, due to the rapidly increasing population.
4. Encourages hard work in order to sustain the predominantly dependant population. This implies that many young people become innovative leading to increased enterprise.
5. Leads to increase in tax potential, and thus increase in government revenue. This results from the increasing number of people and taxable activities in the country.
6. The government is awakened to its responsibility of providing necessary infrastructure and other social services. This leads to increased output in the long run.
7. Increases occupational and geographical mobility of the working population caused by the challenges facing them since they have to support a large number of dependants. Labour in turn becomes more productive.
8. Facilitates the utilization of natural resources such as water resources and minerals in order to support the rapidly growing population.

Negative

1. Leads to increase in dependence burden on the working population. This is due to a big percentage of dependants and this results into low savings and low investment.
2. Results into a high level of unemployment and under employment. This is due to increased number of people looking for jobs as the population grows rapidly yet the jobs are limited.
3. Leads to external resource dependence such as on foreign man power and other forms of aid. This is because the population is dominated by the semi-skilled and unskilled people.

4. The available infrastructure is overstrained such as roads, schools, hospitals. This results into depreciation of such infrastructure and lowers the quality of service delivery.
5. Results into increase in social costs in form of pollution, congestion especially in the urban areas. This has negative health implications such as diseases.
6. Limits effective government planning to support the population, because of the rapidly increasing number of people against inadequate resources.
7. There is increase in government expenditure on provision of social services such as education, medical services.
8. Leads to high rates of rural-urban migration and its negative implications such as congestion, unemployment. This is because the young and the youth tend to move to urban areas in big numbers.
9. Results into brain drain i.e skilled/professional manpower leaving the country to look for better opportunities in other countries, and this limits domestic production.
10. Leads to low taxable capacity and low tax base resulting into low tax revenue due to small working population.
11. Over exploitation of natural resources such as through over fishing, deforestation to sustain the rapidly increasing population leading to quick depletion.
12. Increases income inequality, since many people cannot access resources to engage in economically productive activity.
13. etc

Implications of the population structure in developed countries

Positive

1. There is a large population of old people who act as a store of wisdom and advice on political , social and economic issues due to a high life expectancy
2. A large working population which facilitates industrial and agricultural development.
3. leads to geographical and occupational mobility of labour due to a high population in the productive age group
4. high spirit of enterprise and innovation due to a high population above 15 years

5. leads to high effective demand for goods and services since a large population is within the working age bracket.
6. Low government expenditure on social services due to a low rate of natural population increase.
7. Reduced dependence ratio and thus increase in savings due a small number of young dependants
8. Increases labour supply for economic development due to a large number in the productive/ working age group.

Negative

1. There is some dependence burden on the working population, due to a large number of ageing people who are unable to work.
2. As the population continues to be ageing , many people get out of the taxable age bracket.
3. Leads to a shift in the consumption patterns, since the old people create demand for different commodities which are not greatly demanded by the young or middle age.
4. Under utilization of social and economic infrastructure such as schools, hospitals.
5. Increase in government expenditure on pensions and health services plus homes of the elderly due to high life expectancy.
6. With small families and better opportunities in urban areas, the young are being attracted to urban areas , hence making rural areas depopulated.

Population pyramid

(Refer to statistics)

GENERAL CAUSES OF RAPID POPULATION GROWTH

Population growth refers to the change/ increase in the number of people in a given period of time. It is a result of natural population growth and net migration.

Rapid population growth is a situation where the rate of population growth is higher than the rate of economic growth to meet the demands of the increasing population.

The causes of rapid population growth include:

1. High fertility rates among women in developing countries, in that, many women produce more children in their child bearing years, yet on the other hand there is a decline in the death rate due to improved healthcare, causing high population growth rate.
2. Low levels of education. The less educated people prefer big families causing high birth rates. In developing countries there is a large number of school drop-outs leading to a long child-bearing period for girls.
3. Strong belief in traditions and culture (that prefer large families)/ social benefits attached to many children. Many people see children as a source of wealth and prestige or insurance in old age—, a source of labour in the field, dowry from girls –hence producing more children.
4. Early marriages in many developing countries. Many people marry before the age of 20 years and therefore a long child bearing period / which increases the incidence of teenage pregnancies causing a high population growth rate.
5. The prevalence of polygamy in many societies. This is also rooted in culture and promotes competition among the women who produce more children to please the husbands –leading to a high population growth rate.
6. Low levels of income/high level of poverty. Most people lack productive economic activities to occupy them and resort to producing many children— causing a high population growth rate. Studies show that the poorest people have low ambitions in life unlike the middle class who have great material aspirations in life and find large families as a burden to their achievement.
7. Low status of women in developing countries. Many women are poor, illiterate and many are full-time house wives lacking viable economic roles outside home, which causes high birth rates.
8. Strong influence/effect of religion. Some religions work against population control measures like family planning using contraceptives. This position is in line with the holly books. Still some religions encourage polygamy.
9. Limited use of family planning methods in developing countries. There is limited access to birth control devices partly due to being relatively expensive / unaffordable, limited sensitization and being urban-based. This explains why the family planning methods are mostly restricted to urban women and thus the high population growth rate.

10. Increasing rate of immigration. This is in form of increased number of refugees from neighboring countries attributed to wars, displacements and famine among other factors. This leads to high population growth rate in the recipient country.

IMPACT OF RAPID POPULATION GROWTH

Population as an asset / positive effects

1. Results into increase in market potential/demand for goods and services. The size of the market increases as the population increases.
2. Increases/ widens the labour force of the country. As the population increases more people enter the productive age bracket to enhance the production process.
3. Increases pressure on government to undertake development programmes. The government is encouraged to provide social and economic infrastructure like roads, schools, and hospitals to cater for the increasing population.
4. Encourages geographical and occupational labour mobility. Increasing population results into a big number of youths who are energetic and willing to move from one geographical area or occupation to another since they have to support many dependants, hence increased exposure and labour supply.
5. Increase in population stimulates investment/setting up of more production units to cater for the requirements of the population. This in turn increases national income.
6. Promotes hard work among the population in the country. The individuals in the labour force are awakened to work harder in order to provide for the increasing population –hence more innovations and inventions such as through agricultural modernization—intensive farming methods
7. Results into increase in resource utilization especially natural resources such as minerals, water resources, forest resources in order to sustain the increasing population.
8. Reduces the social over head costs per person in the country. It becomes more economically viable/cheaper to provide social services since they are utilized by many

9. Increases the tax potential and thus increasing government revenue for development purposes such as providing health and education services. Due to population increase many people are engaged in productive activities which government taxes.
10. Encourages urbanization / development of towns as population increases. There is population concentration in some areas leading to the setting up of transport networks, medical facilities, banking facilities, recreation centres etc ; hence growth of towns.

Population as a liability/ Negative effects

1. It increases the dependence burden. Increase in population results into increased proportion of unproductive people to the small productive labour force hence straining them. There is increased expenditure on education, food, housing, medical care, clothing etc
2. Rapid population growth limits the rate of investment. As population increases the rate of savings also reduces and this reduces capital accumulation –hence reduced investment.
3. Strains the government budget due to increasing expenditure to cater for the growing population. There is increasing demand for social services such as education , medical care ;as the population is increasing, and this results into dependence on external donations and loans.
4. Increases income inequality/ disparities. Increasing population enlarges the economic gap between the rich and the poor. People with resources become richer while those without become poorer; which causes social, political and economic discontent.
5. Increases unemployment and under employment; because the rate at which the population increases is higher than the rate of job creation/rate of investment. This leads to increased poverty and represents a wastage of human resources.
6. Results into over exploitation of natural resources especially the non-renewable resources like minerals. This leads to quick exhaustion and reduces the potential benefits of the future generations from the resources.
7. Reducing the per capita income. Increasing population reduces the average income per person and hence low standards of living.

8. It increases rural-urban migration of the landless people. Surplus labourforce moves to the urban areas in search for jobs and hence associated problems like increased crime, social unrest among others. This also reduces the importance of agriculture leading to food shortages.
9. Results into inflation due to excessive demand. Increasing population results into shortage of goods and services due to increasing demand causing persistent increase in the general price level. This leads to increase in cost of living.
10. Worsens the balance of payment problems of the country because the internally produced goods and services become insufficient to meet the growing demand. This increases the demand for imports, hence increasing foreign exchange expenditure.
11. Leads to excessive reliance on foreign aid/ assistance in form of food, medical services, grants, loans in order to support the rapidly growing population. This aid comes with many strings attached which increases external dependence.
12. Leads to increase in brain drain since many qualified professionals /highly skilled workers continue leaving the country to look for better opportunities in other countries. This causes a skilled manpower gap and negatively affects the development process.
13. Rapid population growth increases pressure on land and reduces land productivity. A growing population reduces available land for various activities such as agriculture in rural areas. This leads to land conflicts and land fragmentation. (Or which leads to slow economic growth and unbalanced development). There is also over-use of land for cultivation leading to a decline in its productive value and thus lower yields realized.
14. Facilitates the growth of slums associated with immorality and increased crime rate, low standards of living in form of inadequate and poor housing, poor health facilities, poor hygiene among others. There is robbery, alcoholism, drug abuse in the slum areas due to growing population.
15. Leads to overcrowding which results into easy spread of diseases. There is crowding of social public services such as schools, health centres, piped water among others. This leads to quick depreciation of the service facilities.

Measures to control population growth

1. The government is encouraging education of children especially girls. For example through universal primary education to allow children to spend more years in school to reduce early marriages.
2. Sensitization of the public about the dangers of large families.
3. Promoting the status of women/women emancipation. This is through recognizing their rights including rights to decide on when to produce children, providing them with public obligations/responsibilities.
4. Encouraging the use of contraceptives and other methods of family planning. This is intended to reduce unnecessary pregnancies.
5. Setting/enforcing laws regarding child care and responsibility over children. For example every parent must educate his/her children and provide essentials of life as provided by the constitution—such that parents produce children they are able to look after.
6. Marriage age legislation. The age limit in Uganda is 18 years for both boys and girls which is trying to reduce early marriages (raising the age of consent / fight early marriages).
7. Sex education is being emphasized in schools, though with mixed feelings. This is intended to reduce teenage pregnancies and improve the quality of life among school-going children.
8. Encouraging investment /income—generating activities.
9. Controlling immigration rate using laws and a clearing system

WORLD POPULATION DISTRIBUTION

Population distribution refers to the way people are spread out in a given area on the earth's surface. The world population is unevenly distributed . Asia alone has more people than other continents combined yet it is 1/3 of the world's total area. Within the continents the population is still unevenly distributed for example in Asia, china alone has a population of more than 1.4 billion accounting for almost ½ of the population on the continent. In Africa and Latin America which are sparsely populated, there are fewer people in areas like Sahara desert and Amazon basin.

The world's population distribution is categorized as follows:

1. Densely populated areas
   - Western and central Europe especially Britain, France, Germany

- East –central North America including the St. Lawrence –Great lakes region and the Atlantic seaboard.
- Indian sub-continent –India, Pakistan, Bangladesh etc
- Eastern Asia including china, Japan, Koreas.
- The Nile valley and the delta region.

2. Moderately populated areas
   - South and eastern Europe –including the Mediterranean Europe, Balkan peninsula, southern Scandinavia, alpine Europe and European Asia.
   - Foot hills of mountains, plateaus and grasslands for example the Rockies, Andes, Asia Minor, Mexico, Ethiopian highlands, some tropical and Mediterranean grasslands such as New Zealand.
3. Sparsely populated areas
   - Hot deserts like Sahara, Atacama, Kalahari and the Australian desert.
   - Cold deserts –Tundra and ice carp regions of Antarctica, Greenland, Siberia, northern Canada.
   - High mountain ranges such as Himalayas, high alps
   - Hot-wet forests i.e. the dense equatorial jangles of Congo, Amazon among others.

POPULATION DISTRIBUTION IN AFRICA

The population is unevenly distributed and the densely populated areas include the Nile valley, Nile delta, Niger delta, Maghreb of north west Africa, Johannesburg industrial area of south Africa, East and west African coastal regions

The moderately populated regions are Ethiopian highlands, and Margins of the densely populated areas

The sparsely populated areas include Sahara desert areas, Namib and Kalahari desert areas, Hot-wet forests (such as the Congo basin areas, Gabon)

Factors influencing population distribution in Africa

Physical factors

1. Climate. Areas which receive heavy and reliable rainfall ,and hot temperatures favour arable farming/ crop growing hence attracting dense population such as south east Nigeria, Lake Victoria, and Kenya highlands. However, areas which receive low and unreliable rainfall of less than 500mm per annum and very hot

temperatures discourage crop farming leading to sparse population such as Kalahari desert areas.

2. Soils. Areas with deep / well-drained fertile soils promote crop growing hence attracting dense population such as the fertile alluvial soils of river valleys and deltas such as South West and South East Nigeria, Nile valley and Nile delta. The volcanic rich soils of the Kenya highlands and Ethiopian highlands also support crop growing and hence attract moderate to dense population.
   However, areas with thin /infertile soils such as Sahara desert areas with sandy soils limit crop growing hence leading to low population density.
3. Altitude. Population decreases with increase in altitude in response to environmental conditions such as reduced atmospheric pressure, low oxygen content, dampness and cold temperatures. This explains why there are very few settlements above 2700m above sea level on the highlands of Africa like Mt. Kilimanjaro. However, areas of low altitude have warm conditions which attract dense settlement such as the coastal regions of West and East Africa.
4. Relief. In the high mountain areas such as Rwenzori, Mt. Cameroon, the rugged relief/ steep slopes limit construction of structures and mechanization of farming leading to low population settlement. However areas of relatively flat relief/ gentle slopes or the foothills of the mountains encourage construction of structures and mechanization of farming hence leading to dense settlement.
5. Vegetation. The dense /thick forest vegetation such as tropical rain forests of the Congo basin and West African coastlands hinder the construction of transport routes/ are not easy to clear, and thus have sparse population. These areas also favour the breeding of mosquitoes that cause malaria. However savanna grasslands of Africa are easy to clear for various activities such as farming and thus have dense settlement.
6. Biotic factors. Areas infested with diseases causing vectors such as tsetse flies— like the Miombo woodlands of Tanzania and the Fulani areas of Nigeria scare away people leading to sparse population settlement. However, areas free from disease causing vectors attract more people to settle and carry out various activities leading to dense settlement.
7. Drainage. Water logged areas/ areas with periodic flooding have low population density due to problems in cultivation and construction. Such as the East coast

swamps of Somalia. However well-drained areas encourage growing of various crops and construction leading to dense population such as plateau areas of central Uganda.

- Presence of water bodies such as rivers, lakes, oases, springs. Desert oases like in the Sahara desert favour some settlement due to provision of water and some little crop farming. Areas with large water bodies such as the Lake Victoria region favour various activities like farming, industry due to provision of water. However, areas without large water bodies such as Kalahari and Sahara desert are sparsely populated due to limited water supply.

Human factors

8. Economic activities such as industry, trade and commerce. Presence of many economic activities such as industrialized centres of Africa provide more employment opportunities to the people and hence attract dense population such as in Johannesburg and Pretoria in south Africa, Lagos and port Harcourt in Nigeria, Cairo and Alexandria in Egypt. However areas with limited economic activities such as mining, industry have less chances of employment, hence have low population density.
9. Level of urbanization. The development of towns/ urban centers attracts a large population such as cape town and springs in south Africa, Mombasa and Nairobi in Kenya, Accra and Port Tema in Ghana, Free town in Sierra Leone, Yaoundé in Cameroon. These urban centres have developed banking facilities, insurance, entertainment, education, port facilities and thus offering more opportunities to the people. However, areas without developed urban centers offer less opportunities to the people and hence are sparsely populated.
10. Level of development of transport routes. Areas with developed transport system such as along main roads, railways, rivers and coastal areas are easily accessible and thus promote economic activities like trade, farming hence attracting dense population as seen in the Mediterranean city of Alexandria and Cairo in Egypt. However, areas which are remote / far from main roads such as the Southern highlands of Tanzania are less accessible / limit economic activities leading to sparse population settlement.

11. Culture. In some parts of Africa where people depend on primitive cultural ways of life such as shifting cultivation and fruit gathering there is sparse population such as parts of the Congo basin. areas where is nomadic pastoralism dominant until today areas, there is sparse population since the system requires large land area for grazing such as the Fulani areas of West Africa and Maasai regions of Southern Kenya and Northern Tanzania. However in areas where there are cultural changes and activities like modern dairy farming, trade and commerce—(like central Uganda, central Kenya) have developed there is a moderate to dense population.
12. Historical factor
    (a) Slave trade. There was compulsory transfer of people from some areas in the past. Slave trade depopulated some parts of Africa like the middle belt of West Africa, Southern Tanzania and Northern Zambia. Upto today these areas sparsely populated.
    (b) Duration of settlement. Areas of ancient kingdoms / with long history of settlement and with strong kingdoms attract more opportunities upto today such as trade, jobs; and thus densely populated like Nile valley and delta of Egypt, Mombasa on the coast of Kenya , Ibo land and Yoruba land in Nigeria, Buganda in Uganda . While areas of relatively recent settlement or those with weak kingdoms have fewer opportunities for development leading to sparse population.
13. Government policy. Governments deliberately direct people to migrate and settle in certain parts of the country for strategic, economic or social reasons. Government policy of forest conservation (such as national parks, forest reserves) discourages settlement in such areas leading to sparse population. Government policy of resettlement schemes, infrastructural development attract settlement leading to moderate to dense population.
14. Political climate/situation. Areas which are politically stable encourage productive activities such as trade, farming leading to dense population. Examples are Kano region of Nigeria and western DRC. However areas which are insecure / unstable such as Eastern DRC, Southern Sudan and Somalia discourage productive activities like trade leading to sparse population.

Population distribution in Kenya

The population of Kenya is unevenly distributed. Since most of the country is arid or semi-arid, over 70% of the population is concentrated in a belt of about 10% of the total land area (which has high agricultural potential from the Ugandan border to Nairobi)

The densely populated areas include: the lake Victoria region (Nyanza , Kericho, Trans-Nzoia,, and Nandi region); Kenya highlands (Kikuyu land, Embu, Nyeri, Kiambu); the coastal plain (stretching from Mombasa to Malindi). The highly populated towns are: Nairobi, Kisumu and Nakuru.

The moderately populated areas include: Mt.Elgon region, Kitale, Nyahururu, Naivasha, higher areas of Machakos, Kwale district, Taita hills and higher areas of central Kitui district.

The lowly populated areas include: parts of the Rift valley, Maasai land, Nyika plateau, North and North Eastern Kenya(Lodwar, wajir, Marsabit, and Moyale).

A sketch map showing population distribution in Kenya

Factors influencing population distribution in Kenya

Physical factors

1. Climate. Areas which receive heavy and reliable rainfall which is over 1500 mm per year and hot temperatures favour crop growing hence attracting dense population such as lake Victoria region, and Kenya highlands. However, Areas which receive low and unreliable rainfall of less than 500mm per annum and very hot temperatures discourage crop farming leading to sparse population such as North and North Eastern Kenya.
2. Soil types/ Edaphic factor. Areas with fertile soils promote crop growing hence attracting dense population such as the fertile volcanic soils of the Kenya highlands which support coffee, pyrethrum and wheat growing.However areas with infertile soils such as Northern Kenya with sandy, thin and stony soils limit crop growing since they retain very little moisture, hence leading to low population density.
3. Altitude. Population decreases with increase in altitude in response to environmental conditions such as reduced atmospheric pressure, low oxygen content, dampness and cold temperatures. This explains why there are very few

settlements above 2700m above sea level on the highlands of Africa like Mt. Kenya, Aberdares, and Mt. Elgon. However, areas of low altitude have warm conditions which attract dense settlement such as the coastal regions of Kenya.

4. Relief. In the high mountain areas such as Mt. Kenya, the rugged relief/ steep slopes limit construction of structures and mechanization of farming leading to low population settlement. However, areas of relatively flat relief/ gentle slopes or the foothills of the mountains encourage construction of structures and mechanization of farming hence leading to dense settlement.
5. Vegetation. The dense forest vegetation such as tropical rain forests of the Eldoret, Kisii, Mt.Kenya and coastal mangrove forests hinder the construction of transport routes/ are not easy to clear, and thus have low population settlement. These areas also favour the breeding of mosquitoes that cause malaria. The desert vegetation also discourages settlement. However savanna grasslands of Kenya are easy to clear for various activities such as farming and thus have dense settlement.
6. Biotic factors/ pests and diseases. Areas infested with tsetse flies—like the Lambwe valley in western Kenya scare away people leading to sparse population. The mosquitoes have also limited settlement in areas of hot temperatures and low-lying areas with stagnant water and river valleys. However areas free from disease causing vectors attract more people to settle and carry out various activities leading to dense settlement.
7. Drainage. Water logged areas/ areas with periodic flooding have low population density due to problems in cultivation and construction such as the swampy areas. However well-drained areas encourage growing of various crops and construction leading to a moderate to dense population such as plateau areas of Kenya.

   Presence of water bodies such as rivers and lakes. Areas with water bodies such as the Lake Victoria region favour various water-related activities like farming, industry, fishing. Rivers like Tana, Athi, and Turkwel flow through large arid areas and have settlement along them to utilize the rivers for small-scale irrigation and domestic use. Areas without large water bodies such as Northern Kenya are sparsely populated due to limited water supply.

   Human factors

8. Economic activities such as industry, trade and commerce. Presence of many economic activities such as industrialized centres provide more employment opportunities to the people and hence attract dense population such as in Nairobi (general engineering, printing, brewing), Mombasa (oil refining, ship building , food processing), and Nakuru. However areas with limited economic activities such as northern Kenya have less chances of employment, hence have low population density.
9. Level of urbanization. The major urban centers such as Nairobi, Nakuru, Mombasa and Malindi attract a large population to enjoy the urban facilities such as banking facilities, insurance, entertainment, education, port facilities which offer more opportunities to the people. However, areas without developed urban centers such as Northern Kenya offer less opportunities to the people and hence are sparsely populated.
10. Level of development of transport infrastructure. Areas with developed transport system such as Nairobi and Nakuru urban areas, along main roads, railways, and coastal areas are easily accessible and thus promote economic activities like trade, farming hence attracting dense population. However, areas which are remote / far from main roads such as the northern interior are less accessible / limit economic activities leading to sparse population settlement.
11. Culture. In areas where people depend on primitive cultural activities such as nomadic pastoralism, there is sparse population since the system requires large land area for grazing such as the Turkana areas of north west Kenya and Maasai regions of Southern Kenya. However in areas where there are cultural changes and activities like modern dairy farming, trade and commerce-(like central Kenya) have developed there is a moderate to dense population.
12. Historical factor

    (a)Slave trade. There was compulsory transfer of people from some areas in the past. Slave trade depopulated some parts of interior Kenya and Up to today these areas sparsely populated although slave trade ended many years ago.

    (b) Coastal settlement and governance. The British colonial government divided Kenya into 'white lands' and 'African lands'. The African lands became densely populated due to limited land for expanding population (such as the districts of

the central province). Also the setting up of irrigation schemes such as Ahero and Mwea attracted settlement.

13. Government policy. Government policy of setting and expansion of national parks, and reserves such as Tsavo national park, Nairobi national park, Aberdare national park which are 'no settlement zones' by law has limited settlement. Government policy of infrastructural development such as roads, piped water, power supply in particular areas of central Kenya attracts settlement leading to moderate to dense population.
14. Political situation. Areas which are politically stable such as Nairobi and Nakuru encourage productive activities such as trade, farming leading to dense population. However areas which are insecure / unstable such as northern areas bordering Somalia discourage productive activities like trade, farming leading to sparse population.

Population distribution in Nigeria

Nigeria is located in West Africa and it is the most populated country in Africa with a population of over 140 million.

The densely populated areas include the southern parts along the coast, urban centres and the extreme north. High population is in the delta states , ibo land and in north Kaduna. Cities which have more than 3 million people are lagos, Benin, Port Harcourt.

The moderately populated areas include: located in the northern part of the country particularly around Sokoto, Kano, and Katsina. Also the margins of the densely populated areas.

The lowly populated areas include the middle belt, desert margins of the north and the forested areas of the south.

A sketch map showing population distribution in Nigeria

Factors influencing population distribution in Nigeria

Physical factors

1. Climate. Areas which receive heavy and well distributed rainfall which is over 1500 mm per year and hot temperatures favour crop growing hence attracting

dense population such as south east and south west Nigeria where oil palm , cocoa, maize and other crops are grown. However, areas which receive low and unreliable rainfall of less than 500mm per annum and very hot temperatures discourage crop farming leading to sparse population such as the middle belt region of Nigeria.

2. Soil types/ Edaphic factor. Areas with fertile soils promote crop growing hence attracting dense population such as the Southeast and South West Nigeria where a wide variety of food and cash crops are grown such as cocoa, rubber, maize. However, areas with infertile soils such as the middle belt with sandy, thin and stony soils limit crop growing since they retain very little moisture, hence leading to sparse population.
3. Altitude. Population decreases with increase in altitude in response to environmental conditions such as reduced atmospheric pressure, low oxygen content, dampness and cold temperatures. This explains why there are very few settlements above 2000m above sea level. However areas of low altitude have warm conditions which attract dense settlement such as the coastal regions of Nigeria (delta states).
4. Relief. Rugged relief/ steep slopes limit construction of transport routes , housing structures and mechanization of farming such as in the Yoruba highlands bordering Cameroon leading to low population settlement. However relatively flat landscape of South East and South West Nigeria encourage construction of structures and mechanization of farming hence leading to dense settlement.
5. Vegetation. The dense forest vegetation such as tropical rain forests and mangrove forests of the South hinder the construction of transport routes/ are not easy to clear, and thus have low population settlement. These areas also favour the breeding of mosquitoes that cause malaria. More so the government has put up restrictions on settlement in such areas by gazeting some of them as reserves. However savanna grasslands are easy to clear for various activities such as farming and thus have dense settlement.
6. Biotic factors/ pests and diseases. Areas infested with tsetse flies—like the Fulani areas of Nigeria scare away people leading to sparse population settlement. The mosquitoes have also limited settlement in areas of hot

temperatures and low-lying areas with stagnant water and river valleys. However areas free from disease causing vectors attract more people to settle and carry out various activities leading to dense settlement.

7. Drainage. Water logged areas/ areas with periodic flooding have low population density due to problems in cultivation and construction such as the mangrove swamps along the coast. However well-drained areas encourage growing of various crops and construction leading to a moderate to dense population such as South East Nigeria .

   Presence of water bodies such as rivers and lakes. Areas with water bodies such as the Niger river and the Atlantic ocean favour various water-related activities like farming, industry, fishing, transport; and thus they have moderate to dense population. Areas without large water bodies such as the middle belt and the northeastern part of Nigeria are sparsely populated due to limited water supply.

   Human factors

8. Economic activities such as industry, trade and commerce. Presence of many economic activities such as industrialization provide more employment opportunities to the people and hence attract dense population such as port Harcourt with oil refinery, machinery , automobile assembly and food processing, Benin city and Ibadan . However areas with limited economic activities such as the North Eastern region have less chances of employment, hence have low population density.
9. Level of urbanization/ the growth of major urban centers such as port Harcourt , Lagos, Ibadan, Abuja (capital) attracts a large population to enjoy the urban facilities such as banking facilities, insurance, entertainment, education, recreation facilities which offer more opportunities to the people. However, areas without developed urban centers such as North Western Nigeria offer less opportunities to the people and hence are sparsely populated.
10. Level of development of transport infrastructure. Areas with developed transport system such as Lagos, Ibadan, Enugu, along main roads, railways, and coastal areas are easily accessible and thus promote economic activities like trade, farming , mining hence attracting dense population. However, areas which are remote / far from main roads such as the northern interior are less accessible / limit economic activities leading to sparse population settlement.

11. Culture. In areas where people depend on primitive cultural activities such as nomadic pastoralism, there is sparse population since the system requires large land area for grazing such as the Fulani areas of northern Nigeria. Still many moderately settled areas on the margins of the densely settled areas could also support far more people but people have not moved into them due to traditional social attitudes and the need to stay near friends and existing cultural centres.
12. Historical factor

    (a) Historical background. Each of the three main centres of population is the chief area of settlement of one of the three main ethnic groups in Nigeria. The Ibo are concentrated in the South East, the Yoruba are in the South West, and the Muslim Hausa in the north. These are the most successful and powerful groups and their populations have grown rapidly than the smaller groups that were for long subjected to wars , slave raiding.

    (b)Slave trade. There was compulsory transfer of people from some areas in the past. Slave trade by the more powerful tribes depopulated the middle belt and the western parts of Kwara state of S.W. Nigeria and upto today these areas sparsely populated although slave trade ended many years ago.
13. Government policy. Government policy of setting and expansion of national parks, and reserves which are 'no settlement zones' by law has limited settlement. Government has also encouraged a wider spread settlement by developing transport routes , mineral resources, power supplies and agriculture in the regions which are capable of supporting a larger population.
14. Political situation. Areas which are politically stable such as Kano region and most urban areas (like Lagos, Abuja) encourage productive activities such as trade, farming leading to dense population. However, areas which are insecure / unstable due to religious and ethnic groups discourage productive activities like trade, farming leading to sparse population.

Population distribution in china

China is located in Asia and is the most populated country in the world with over 1.4 billion people. About 1/5 of the world's population live in china. About 26% of the population lives in the urban areas and 74% live in rural areas.

The most densely populated areas include the north china plain, Yangtze basin (Chiang Jiang basin), the Sichuan basin and Xi-Jiang (Si-Kiang) basin. The densely populated states are in the East including Shanghai, Zhejiang, Jilin, Hunan, and Duardong. The highly populated towns are shanghai, Beijing, Tianjin, Shenyang, Hongkong, Guangzhou, Wuhan etc

The moderately populated areas are found on the margins/ fringes of the densely populated regions.

The sparsely populated regions are in the interior provinces of the west such as Xin Jiang (sin kiang), Gansu, Qinghai (Tsinghai), Tibet, Inner Mongolia. The population density is generally less than 10 people per km^2.

Generally over 90% of the population occupies the land in the East while the remaining 10% occupy the Western states.

A sketch map of china showing population distribution

Factors influencing population distribution in china

Physical factors

1. Climate. Areas which receive heavy and well distributed rainfall which is over 1500 mm per year and hot temperatures(average 24^0c) and this favours crop growing hence attracting dense population such as tropical south china , sub-tropical east-central china and temperate north east where crops like rice (most important), wheat, maize and tea are grown. However, areas which receive low and unreliable rainfall of less than 500mm per annum and very cold temperatures discourage crop farming leading to sparse population such as most western states. The Gobi desert ranks as one of the coldest deserts in the world and this discourages population settlement.
2. Soil types influencing farming. Areas with fertile alluvial soils promote crop growing hence attracting dense population such as river valleys and coastal areas (Yangtze valley, Sin Kiang delta) where a wide variety of food and cash crops are grown such as rice, maize, soybean, cotton, and tea. However areas with infertile soils/ dry , rocky and sandy soils of western china limit crop growing since they retain very little moisture, hence leading to sparse population.

3. Altitude. Population decreases with increase in altitude in response to environmental conditions such as reduced atmospheric pressure, low oxygen content, dampness and cold temperatures. This explains why there are very few settlements in upper slopes of the Himalayas in the west. However areas of low altitude have warm conditions which attract dense settlement such as the coastal regions of Eastern China.
4. Relief. Rugged relief/ steep slopes limit construction of transport routes, housing structures and mechanization of farming such as in western china characterized by the Tibet ranges and Himalayas leading to low population settlement. However relatively flat landscape of encourage construction of structures and mechanization of farming hence leading to dense settlement especially the plateaus, plains and basins of Eastern China.
5. Drainage. Water logged areas/ areas with periodic flooding have low population density due to problems in cultivation and construction such as the swamps along the coast. However well-drained areas encourage growing of various crops and construction leading to a moderate to dense population such as the plateaus and plains of Eastern China like North China plain and Sichuan.

   Presence of water bodies such as rivers and lakes. Areas with large water bodies such as Yangtze river, Huang He river, the Yellow sea and East China sea favour various water-related activities like farming, industry, fishing, transport; and thus they have a dense population. Areas without large water bodies are sparsely populated due to limited water supply especially in western china.
6. Natural calamities /hazards. Areas which are prone to natural calamities discourage population settlement such as the highland areas of the west (e.g Gansu) which are at times affected by landslides that destroy property and lead to loss of life. Also some valley areas of Yangtze and Huang He rivers are prone to flooding that destroys crops , life and other property. However areas which are safer like the gentle slopes attract dense settlement like large areas of Shanghai and Beijing.

   Human factors
7. Presence of economic activities for employment such as mining and industry. The states industrialized states of china like shanghai, Beijing, and Manchuria provide more employment opportunities to the people as industrial workers

and into other associated activities and hence attract dense population. Beijing industries include iron and steel, motor vehicle, machinery, petro-chemical etc However areas with limited economic activities such as the western states of Qinghai and Inner Mongolia have less chances of employment, hence have low population density.

8. Level of urbanization/ the growth of major urban centers such as shanghai (china's largest port and industrial centre), Beijing (capital), Tianjin, Shenyang, Guangzhou, and Tongtu attracts a large population to enjoy the urban facilities such as banking facilities, insurance, entertainment, education, recreation facilities which offer more opportunities to the people. However, the western areas without developed urban centers such offer less opportunities to the people and hence are sparsely populated.
9. Level of development of transport infrastructure. Areas with developed transport system such as Guangzhou-Beijing-Shanghai, along main roads, railways, and coastal areas are easily accessible and thus promote economic activities like mining, industry, trade, farming, tourism hence attracting dense population. The region also has developed canals such as the Grand canal— which is the world's longest artificial waterway. However, areas which are remote / far from main roads such as the western provinces of Gansu, Tibet and Inner Mongolia are less accessible / limit economic activities leading to sparse population.
10. Historical factor. The development of the early dynasties such as Qing dynasty of Manchus (1644-1912) in East China which organized china into a large society with developed social and economic and political organization created a high population in the east and central china. However western china lacked such organized dynasties explaining the sparse population there.
11. Cultural factor. The physical conditions of the west have limited intensive crop growing and the best form of land use is some form of nomadic herding practiced by the Tibetans, Kazaks, Mongols and Kirgiz who stay in the area, rearing goats, sheep, horses and camels etc. this partly explains the sparse population in such areas.

    Ethnic differences. Most Chinese are very reluctant to move to the western territories (which are not 'china proper'). The people of china proper are the

true Chinese (especially the Han race) while the outer territories are populated by the smaller ethnic groups such as the Mongols , Zhuang , Miao, Yi among others.

12. Government policy. Government has influenced population distribution by developing transport routes, encouraging investors, importation of advanced technology, creating special investment zones, development of the required transport routes and power supplies in Eastern China. However, a large western part of china has received less government attention and hence less opportunities which explains the sparse population.

13. Political situation. Areas which have been politically stable for a long period and most urban areas encourage productive activities such as trade, farming leading to dense population since the security of property and life is assured. However, areas which have some unrest discourage productive activities like trade, farming leading to sparse population such as the north western areas bordering Mongolia and Kazakhstan.

POPULATION MIGRATIONS

(There is no agreed definition of migration). However generally migration refers to the movement of people from one place (origin) to another (destination). Population migration takes a longer span than population mobility or tourism although they are interrelated. Migration may be short term, long term or seasonally.

The movement of people is called migration and the people involved are called migrants. Migrations can either be voluntary or forced/ compulsory migrations. Generally, the voluntary migrations are associated with the search for better economic opportunities / conditions existing in other regions. People move willingly and it mainly occurs due to economic push and pull factors while compulsory migration may be legislation by government, slave trade or even wars etc

Population migrations affect growth by either decreasing population of the source area (origin) or increasing the population of the receiving area.

Classification of migrations

The meaning of migration is best understood based on the different types / forms of migration. Migration involves changing location and involves some degree of permanence. The classification id based on three (3) aspects namely; distance, time, and origin.

According to time

1. Permanent migrations. This involves the movement of people who leave their homes having no intentions of returning home. Permanent migrations should be the movement from one place to another place which lasts for at least more than one year.
2. Temporary migrations. This involves movement of people who leave their homes for a short period of time.

According to distance

1. Internal migrations. This involves movement of people from one part of the country to another part of the same country without crossing international borders. People who move out of an area are called out-migrants where as those people who move into an area are called in-migrants.

Internal migration is further subdivided into the following forms:

(a) Rural-urban migration
(b) Urban-rural migration
(c) Rural-rural migration
(d) Urban-urban migration
(e) Intra-rural and intra-urban migration

Rural-urban migration is the most common type of migration in the developing countries. It refers to the movement of people away from the countryside to towns or cities. Over the last 50 years in Africa and South America a large proportion of people, especially the young move from rural areas to urban areas. This is mainly a result of economic pull and push factors. This stems from the unequal distribution of facilities between the rural areas and the urban areas. Rural-urban migration tends to lead to rural under development because the young ones move leaving

only the aged and children; but also causing urban problems (resulting from urbanization).

Urban-rural migration

This is not very common in the developing world and takes place on small scale. People migrate from towns to the countryside and in the developed world, it takes place as a result of overcrowding, pollution etc in towns. People probably move outside the towns to enjoy bigger space where they can have bigger compounds and clean environment.

Rural-rural migration is the migration from one rural area to another. It mainly occurs when they have anticipated opportunities in the new location. It is a result of push-pull factors where there is population pressure on land such as people in Kigezi migrating to other areas.

Urban-urban migration is the movement of people from one town to another mainly because people are seeking for better opportunities in business, social and economic facilities. It has got to do with perceived opportunities.

Stepwise migration is the movement of people in stages i.e. step by step. For example in 1950s people in kabala were advised to move to other areas for enough land such as Kabale-Rukungiri-Bushenyi etc

2. International migrations/ external migrations. This involves the migration from one country to another .i.e. crossing international borders/ boundaries. This type of migration is today facing a lot of restrictions via controlled permission in form of visa.

International migration has two major forms:

(a) Emigrations

(b) Immigrations

Emigration refers to the movement of people out of a country. The people involved are called emigrants.

While

Immigrations refers to the movement of people into a country. The people involved are called immigrants.

The difference between emigration and immigration is called net migration. Depending on the source or destination the main source of emigration and immigration is the search for better employment opportunities.

Factors that influence population migrations

The factors for migration can be grouped as pull factors and push factors. The factors are usually categorized as political, social, economic and ecological factors. Pull factors are the favourable factors which attract people to migrate to an area such as better social services or these are the advantages /opportunities at a destination that attract to that area.

Push factors are the unfavourable factors which force people out of a given area and therefore migrate to other areas such as high level of unemployment, poor infrastructures or these are the disadvantages at the source area that make people to move to other areas.

1. Political factors
   - Difference in political belief/ party. People are sometimes forced to migrate because of being threatened since they belong to a particular party /system or political thinking.
   - Political insecurity in some areas / war or civil strife which make people vacate the insecure areas such as people in Rwanda during the 1994 genocide , people in DRC due to rebel activities , people in southern Sudan during the struggle for power in 2013-2014, northern Uganda due to Kony rebel activities, etc. such people migrate as refugees or internally displaced people.
   - The attaining of independence in some countries, which caused many migrations such as in India 1947 and people were forced to move especially non-Moslems to Pakistan. The same applied to many African countries on attaining independence—when many whites went back to Europe in the mid-20th century.
   - Shift in ideology (capitalism versus socialism). For example, Germany after the Second World War, East Germany became a socialist state while West Germany remained capitalistic in ideology. Thus, people who were capitalistic in ideology migrated from east to West Germany and vice versa.
   - The effect of slave trade. During slave trade era people were forced to migrate i.e. were captured and carried away against their will. Slave trade affected especially African countries such as west Africa, Rhodesia

(Zimbabwe) , east Africa etc. Today people may be abducted, kidnapped, and taken to other areas or countries to work as 'slaves'.

- Government schemes lead to forced migration of people such as settlement schemes, gazetting of national parks and wildlife reserves to displace people. Many people are displaced from the gazetted areas by law and they are taken to resettlement schemes prepared by the government or forced to go elsewhere.

2. Economic factors
   - Economic factors are often taken as the major reasons for migration, with the search for employment being the major reason for this type of motive. Labour migration is selective in nature and may be long or short term. The major destinations of labour migrants since 1945 are Western Europe and the Gulf States. Most migrants come from the Mediterranean countries and the ex-colonial territories among others.
   - Search for employment opportunities. South Africa is known for its reliance on migrant labour for the exploitation of its natural resources such as mineral resources. These migrants come from Britain, USA and Japan. Many workers also migrate from the neighbouring countries such as Lesotho, Swaziland, Botswana, Mozambique, and Namibia.
   - Shortage of land. Land in some rural areas is in short supply. The rural community heavily depends on land for production of food for home consumption and for sale. However, the available land in many areas is inadequate to produce sufficient food for the population. This causes migration to buy land from other areas and increase food supply.
   - The declining productivity of land in some areas which makes people to migrate to other more productive zones agriculturally. Use of soils in some areas for long leads to exhaustion and forces farmers to look for fertile lands elsewhere.
   - Uneven distribution of economic opportunities between areas especially industrial concentration in the urban areas, meaning that meaningful employment is mainly found in urban areas. Hence, the major cause of migration is the search for employment which is better paid, in a bid to improve the standards of living.

3. Social factors
    - Social pressures also force people to migrate such as evidenced by refugees (according to the UNHCR-United Nations High Commission for Refugees). These are related to social oppression, political control, housing, health and education facilities. Today the greatest concentration of refugees are in the developing countries.
    - The presence of better social services in some areas like medical facilities, schools of better standards. For example, much of the quality education can be attained in the urban areas where most of the cities always want to stay. Other social facilities include health facilities, recreation facilities, entertainment facilities which generally missing in the rural areas.
    - Cultural practices also force many people to run away from the rural areas such as rituals, compulsory circumcision by some societies. They migrate and take advantage of the urban areas. There are also social obligations of marriage especially in the rural areas which may not fit in people's priorities in life.
    - Population pressure in some areas causes migrations to other areas which are less populated. For example some parts of Kigezi, Kabale are highly populated, leading to shortage of land and land fragmentation. This limits settlement and cultivation land, forcing many people to migrate other areas.
    - Religious factors especially religious discrimination in particular areas. For example in Northern Nigeria, the Muslims discriminate against Christians, in Sudan the Muslims also do not want to stay in the same areas with Christians. Many times, there is conflict/ fighting between the different religious groups and this forces many people to migrate to other safer areas.
    - Racial discrimination is also common in particular areas, resulting into social conflicts and at times loss of life. This forces some people to migrate to other accommodative areas.
    - Migration for leisure such as pilgrimages—journeys to certain places under religious devotion. For example, pilgrimage to Mecca and Madina by Muslims. Many people do not come back to their home countries, but find new places in other areas. In addition, tourism involves traveling of people

abroad for holidays, which may be short term or long term. However many tourists end up becoming migrants.

- Love for adventure and prestige
- The desire for change and a better life

4. Ecological factors/ environmental factors
   - Many people move because of environmental pressures such as drought, desertification, floods, landslides, volcanic eruptions, pests and diseases, earthquakes.
   - For example, many people move to areas which receive heavy and reliable rainfall, which ensures increased food production for consumption and for sale. They migrate away from areas which experience frequent drought or desertification.
   - Landslides and earthquakes lead to great loss of life and property. Therefore, many people move away from vulnerable areas to safer zones.
   - Many people move away from areas infested by pests and diseases such as tsetse flies, and epidemics outbreak. For example, the outbreak of Ebola in the West African countries in 2014 forced many people to migrate.
   - Fertile soils induce people to migrate and settle in such areas especially near river valleys with alluvial soils yet the infertile soils in the semi-arid areas push people to migrate away.
   - Drainage. Most people migrate and settle near water bodies especially coastal areas to access water supply, water transport and other advantages.
5. Behavioural factors
   - Migration also has a basis on individual perception. This explains why certain categories of people choose to migrate to new areas while other people facing the same pressures do not migrate.
   - Minor issues like criminal tendencies—where criminals run away from their regions to go to other areas where their life may be a bit safe. Also misunderstandings such as between family members, law and order maintenance by authorities, AIDS scourge especially if patients are stigmatized.

CONSEQUENCES / IMPACT OF MIGRATIONS

A. The impact of migration on the source areas

- The migrants remit money to their home country and this increases the national income of the respective country. In addition they also remit money/ property to their relatives which improves the standards of living.
- Decline in labour supply because the able-bodied men move to the urban areas or other countries and this reduces economic prosperity in the place of origin such as retarded agricultural production since only the old and very young children remain in the rural areas.
- Accelerates poverty and insecurity especially in the countryside since the able bodied men are moving to urbanities.
- Results into social disintegration of cultural settings. This is because the indigenous people adopt the values of the migrants such in Africa many people have taken on norms and values of Arabs, British, and Indians.
- Permanent migration reduces the total population and slows down the population growth rate in the source area. This relieves the problem of unemployment in the formerly over crowded areas. It also relieves pressure on land in the origin / source areas.
- Creates imbalance in the age-sex structure in the source area. This is because the migrants are usually young adults and mainly the male sex, leaving majorly the old folk and females.

B. Impact of migration on the receiving areas/ destinations

- Causes strain on the existing services and facilities in the receiving areas especially urban areas which may have been meant for a smaller community. For example road network are congested, education facilities are over strained. Many times there is less expansion of the facilities.
- Permanent and temporary migration increases the population of the receiving areas. This leads to rapid urbanization with associated problems such as unemployment, prostitution, high crime rate, and political strife. The growth of slums characterized by congestion, poor sanitation, poor housing , stagnant water etc
- External migration brings together people of different origins, races, language, and religion. This integrates them into a new dynamic society; but may also lead to plural societies associated with continuous underground conflicts which eventually may become violent.

- Migration leads to easy spread of diseases in the destination areas such as Ebola, SARS, Cholera, AIDS scourge, airborne diseases due to mixing of people from
- Population migration also changes the age-sex structure of the destination areas. The number of young adults is raised and men may outnumber the women. This affects the birth rate and increases the incidence of prostitution and rape cases.
- Migrants often face prejudice and even violence in the destination area. This in the longrun sparks off return migrations back to the areas of origin or migration to other areas to seek a better life.
- Loss of social morals and cultural values due to mixing up of different groups of people.

Positives

- Adventure through tourism and movement to ne areas by the migrants.
- There is increased industrial growth due to the increase in the market size in the destination area and availability of land for expansion in the source area.
- Increase in labour supply and expansion of the tax base in the destination area.
- Increases human relations both economic and social influence. Leads to the spread of new ideas.
- Restrains people from the vulnerable / risky areas such as war-torn areas, landslide areas, dry areas.
- Migrants acquire improved standards of living and chances of employment.
- Eradicates violence when the misunderstanding people separate to different areas/ locations.
- Migrations also avail government with land for national parks, wildlife reserves, and other projects.
- Improvement in infrastructure in the destination area.
- Reduces pressure on land in the rural areas
- Environmental protection as forests and bushes grow freely with less disturbance.
- Land consolidation is encouraged in the source areas which favours extensive farming.

Negatives

- It is a source of brain drain and repatriation of resources.
- Shortage of land in the destination areas such as urban areas leading to conflicts and death.
- Resettlement problems on part of government.
- Refugee problems. Refugees are people who are forced to leave their homes due to several reasons such as wars, drought, floods and political persecution. Therefore refugees usually leave their homes in a desperate condition. In Africa many refugees in Somalia, Ethiopia, south Sudan, DRC, where people have been displaced by wars. This strains the economy of the receiving country as well as misery on the refugees themselves.
- Regional imbalances in development
- Increase in government expenditure in the urban areas
- Environmental degradation
- Etc

Case study: Africa

Arabs and Semites entered North Africa in great numbers in the 7th and 8th centuries. Such people spread their religion, language and culture as well as intermarriage with the Berbers. About ¼ of Africa's population is of Arab blood.

From the 16th century, many Europeans entered Africa from all directions starting with the Dutch at cape region of South Africa. Today Africa has about 4 million whites. The 19th century so the French occupation of Algeria, Tunisia, and Morocco. The major initial reasons were colonialism and the exploitation of minerals. Lastly the Asians also came to east and south Africa initially working on sugar plantations in natal and the East African railways.

In general, migration inn Africa can be analyzed in terms of pre-colonial era, colonial era and post-colonial eras. At the beginning of the 16th slave trade started to depopulate Africa. Many African slaves were shipped /moved to America, the Middle East and India. West Africa was the most affected by slave trade since it lost about 20 million people. Still many examples of internal migrations can be cited in Africa –with more emphasis on rural-urban migration.

Guiding questions:

1. Discuss the advantages and disadvantages of population migrations in Africa.

2. Using specific examples from Africa, explain the economic and environmental effects of migration.
3. Discuss the push and pull factors responsible for population migrations in sub-Saharan Africa
4. Discuss the causes and effects of rural urban migration in either DRC or India.
5. Examine the impact of migrations on the source areas and destination areas using specific examples in Africa
6. Assess the causes and effects of international migrations in tropical Africa.

INDUSTRIALIZATION

Industrialization is the process whereby countries increasingly become involved in the production of manufactured goods. Industrialization has formed a major criteria of classifying developed and developing countries in the world.

Industries are classified as:

a) Heavy industries. These are major industrial enterprises that process large amounts of bulky raw materials, involves heavy investment and large-scale

production such as iron and steel industry, shipbuilding, rail engineering, mineral refinery, petrochemical, aluminum smelting, automobile, and Aircraft industry. These are often located close to the supplies of raw materials.

b) Light industries. These are industries that use relatively less raw materials and lower capital investment. Examples include textiles, printing and publishing, furniture, pharmaceuticals, optical instruments, agricultural processing.

INDUSTRIALIZATION IN TROPICAL COUNTRIES

Industry is still underdeveloped in tropical countries with many people engaged in agriculture and obtaining most industrial products from export of agricultural raw materials and certain mineral resources. It should however be recognized that today a number of tropical countries (Africa, Asia, Latin America) are paying good attention to industrial development so as to realize its benefits.

<u>An account for the low level of industrial development in tropical countries</u>

1. Power and energy problems.

- Tropical countries have the major world's H.E.P potential, given the many waterfalls along rivers, old and firm rocks for dam construction, high rainfall facilitating rivers, and high temperatures which prevents water freezing with rivers always flowing. Despite this however, tropical countries account for a very small part of the world's H.E.P supply and this is a big limiting factor to industrial development, yet industries require large quantities of power.
- Power supply is limited /absent in many parts of tropical countries with particular reference to hydroelectric power. Generally, there is low voltage and hence supplied to only few places-which limits industrial development.
- The power supply is intermittent characterized by frequent load shedding in some countries which hinders industrial development. The operational costs for HEP are very high, and this limits the quantity of power produced for industrial use.
- Limitedness of other significant power sources such as coal deposits, oil/petroleum inmost tropical countries, which cannot sustain big industrial establishments. Still some deposits of sources like coal are of poor quality, and thus not harnessed for power supply.

- Most of these countries import petroleum/oil to use as power, which is unreliable and very expensive; and this limits industrial development.

2. Low quality and quantity of basic mineral resources such as petroleum, coal, iron ore, diamond, uranium. High mineral potential is a vital engine for industrial growth as evidenced in Western Europe and North America. As such in tropical countries heavy industries cannot be established due to inadequate basic minerals/ raw materials since even most of them are uneconomical to exploit.

   The grade of the minerals is also low for many mineral types such as copper losing over half of the ores to be of productive value. This undermines exploitation and hence limited industrial development.

3. Shortage of capital to invest in industry. Basic industrial machinery is very costly to acquire and service and yet large amounts of capital are needed to build industries. However in most tropical countries most people are generally poor and hence capital is limited. This is due to the low level of domestic savings and yet it is difficult to acquire loans from financial institutions due high interest rates.

   Still many tropical countries have limited incentives to attract foreign investors (capital inflow) and yet over dependence on foreign countries for capital and loans is also problematic such as loans failing to be given as promised.

4. Shortage of skilled labour.

- This is partly attributed to poor education and training, and this leads to very low productivity of labour. For example, there are few tropical engineers and technicians.
- Most tropical countries have to use imported expatriates to run the industries and this raises management costs of manufactured goods higher than in Europe and North America.
- Still due to inadequate skills, there are limited entrepreneurial skills, with the majority engaged in rural activities. This is worsened by the continuous brain drain.

5. Small size of the markets/limited market.

- Most tropical countries have generally small populations which limit the available domestic market for manufactured goods and this makes many potential investors reluctant.
- In addition, most people in tropical counties earn very low incomes and hence low per capita income. This implies low purchasing power of most people. This limits the development of large-scale manufacturing industries.
- External markets are also difficult to access, since most manufactured goods in the tropical countries cannot readily compete with goods manufactured by the already established developed/industrial countries, given the lower quality and higher price. More so, the developed countries protect their home industries by imposing high tariffs on imported manufactured goods from tropical countries.
- Weak regional cooperation/ integration among tropical countries. Many tropical countries violate the terms of integration by trading more with outside countries.

6. Underdeveloped transport and communication networks for example poor roads (main and feeder roads), poor railway network and poor water transport facilities. This limits access to the necessary raw materials and distribution of manufactured goods. As such, transport becomes expensive and it is rarely trusted by both local and foreign industrialists. The railway system has not been upgraded since the colonial days in most tropical countries.
7. Political instabilities in many parts of tropical countries since independence such as Uganda, DRC, CAR, Liberia, Ivory Coast, and Sudan. This discourages many potential local and foreign investors /industrialists, as the safety of their industrial establishments is not assured. In addition, the governments of many tropical countries end up diverting the funds from industry to military warfare.
8. Low levels of technology partly evidenced by depreciated machinery in many existing industries. The tropical countries often consult developed countries when they intend to develop industries, since they rarely invent their own machinery, and the modern technologies are too costly to acquire.
9. Long distance from the sea/ landlockedness of most tropical countries such as Uganda, Malawi, Zambia, and Chad and this means that they cannot favorably compete with the neighbors with sea ports. They incur high costs in transport

of imported raw materials and to export manufactured goods. There are also unnecessary delays in getting raw materials, machinery spare parts.

10. Under developed industrial research which limits product development, innovation and invention, and adoption of appropriate technology. More so most industries in tropical countries suffer from dependence on depreciated machinery. There is also limited proper prospecting and research in the natural resource potential such as minerals.
11. Foreign sabotage (colonial policies). Colonial countries over exploited the tropical countries during the colonial era by tapping some of the strategic resources such as mineral. The colonial governments restricted tropical countries to the supply of primary products such as agricultural raw materials for their home industries. It is for this reason that processing rather than manufacturing industries were encouraged in the tropical countries. This colonial legacy persists up to today and some tropical countries still export raw materials to UK, France, and Germany.
12. Unfavourable government policy towards industrialization evidenced in delays/bureaucracy in licensing of industrialists. There also other hindrances such as short tax holidays, high taxation.
13. Corruption and embezzlement limiting the funds for investment in the industrial sector.
14. Weak linkage between the industrial sector and other sectors of the economy in tropical countries.
15. Competition with other sectors for government funding. In most tropical countries, many sectors exist and given greater importance ahead of industry, most especially agriculture which is taken to be a backbone of most economies.
16. Over dependence on the primary sectors like agriculture, fishing and lumbering also hinders industrialization since most people do not have the desire to add value to produced output apart from satisfying immediate cash needs.

<u>Assignment</u>

Qn. Suggest the measures that should be taken in order to attain high levels of industrialization in tropical Africa

Guiding questions

1) To what extent is power responsible for low level of industrial development in tropical Africa?
2) Discuss the view that it is not lack of power that is responsible for low development of industry in tropical Africa.
3) To what is limited market responsible for the low level of industrial development in developing countries?
4) "In developing countries it is not lack physical resources which is primarily responsible for the low level of industrial development." Discuss.
5) Discuss the problems hindering industrial development in any one developing country.

SOUTH AFRICA

South Africa is the industrial giant of Africa. Before 1930, South Africa was a major raw material supplier and a major importer of manufactured goods. However after the 2nd world war the situation changed and many industries were established in South Africa. Today industries contribute a large percentage of South Africa's national income and employ millions of people.

Distribution of industries in South Africa

1. The Rand (Witwatersrand)

The heart of South African industry today lies on the Rand (Witwatersrand) –a gold strip in southern Transvaal. This is the most important region having over half of South Africa's industries and about half of the manufactured output. The major manufacturing centres of the rand include:

a) Johannesburg

The main industries here include iron and steel industry, manufacture of railway wagons, mining machinery, farm machinery, electrical, chemicals, furniture, textiles, paper and printing, and food processing.

b) Pretoria

This is the administrative capital of South Africa. The major industries include iron and steel industry; railway wagon manufacture, glass, cement, metal working, chemical, engineering, and food processing

c) Vereeniging

This is a major coal mining, engineering and iron and steel centre. There is a tinplate industry, manufacture of alloys.

d) Germiston

This is a home of the Rand's gold refinery. It produces metal goods/machinery, chemicals, railroad equipment, textiles.

e) Springs

This is a major gold and coal-mining centre. It has steel industry, mining machinery, electricals, bicycles, printing machinery, paper, glassware, and canned foods

f) Other centres on the rand are Kimberley, Bloemfontein, Benoni, Krugersdorp, and Vanderbijl Park.

2. Cape town

The major industries include oil refining, shipbuilding, and repair, diamond cutting, printing, chemicals, leather goods, textiles, paper, food processing, and vehicle assembly.

3. Port Elizabeth

The major industries are vehicle assembly, tyre manufacture, metal and wood products, chemical, and food processing.

4. East London

Industries include soft drinks, furniture, building materials, textiles, vehicle assembly.

5. Durban

This port is a major importer of raw materials and manufactured goods. The industries include machinery, railroad repair workshops, oil refinery, soap, paint, fertilizer, textile, light engineering, and vehicle assembly.

A sketch map showing industrial distribution in South Africa

Factors which have influenced the location/ distribution of industries in South Africa

1. Presence of various mineral resources such as large deposits of coal, iron ore, gold, and copper which are the major industrial minerals. Industries are located

near the mining centres due to cheap mineral supply. For example Johannesburg has a variety of steel and cement manufacturing industries, machinery and chemical industries due to iron ore, coal and cement in the surrounding area. Germiston is also a major centre of gold refinery due to the large deposits of gold on the Rand.

2. Presence of various sources of power such as coal which is a major source of power for industries in South Africa. The biggest coal-burning power station in the southern hemisphere is the Klip power station at Vereeniging. Industries are therefore concentrated in the main coal producing regions such as machinery, electricals, and steel works in Vereeniging, and springs. There is also hydroelectric power generated from the Vaal and orange rivers; nuclear power from uranium, and imported oil/ petroleum for power supply.
3. Availability of a variety of other raw materials. Industries have been distributed following the distribution of raw materials. In Natal, the sugarcane mills are located within the sugarcane belt (such as Durban and Huletts). In SouthWestern cape, the fruit canning industries are within the fruit belt. Industries using imported raw materials are located at the coast such as oil refinery, shipbuilding, chemical, vehicle assembly and textiles industries at Cape Town, Port Elizabeth, East London, and Durban.
4. Presence of a ready/ large market for industrial output. Many industries are concentrated in the major cities and ports for example Johannesburg, Durban, and Cape Town, which have over 3 million people each—hence offering a large market and the industries include oil refinery, chemical, textile and food processing. Still many industries are located at the coast to easily access foreign markets such as industries in Cape Town, Durban, East London and Port Elizabeth. South Africa has obtained a large market in the Far East (Japan, Taiwan, and Singapore) in addition to Europe.

   Note: South Africa has got trade links with the rest of Africa, given that it is nearer to the African states than other significant industrial countries.
5. Availability of large supply of skilled and unskilled labour. Most industries have been set up in highly populated areas such as Johannesburg (with over 3 million people). Also the large black towns of Soweto and Alexandria lie within the Johannesburg metropolitan area providing cheap labour for the industries in the

region (such as iron and steel, mining machinery, chemical and food processing). Although some skilled labourers have fled the country, more skilled workers have immigrated to South Africa than they do emigrate.

Still South Africa competes with major industrial countries due to careful training of local workers to make them efficient especially in the main industrial centres of Pretoria, Germiston, Vereeniging and Kimberley.

6. Presence of efficient transport system such as water, railway, and road to move finished goods to markets and easily access to raw materials. For example, Southern Transvaal area (the Rand) is well favoured for the gold mines which have roads and railways. This partly explains the presence of many industries in the Rand (such as Johannesburg, Pretoria, springs, Germiston). Some industries are located along the coast to take advantage of the cheap sea transport such as oil refineries and vehicle assembly at Cape Town and Durban.
7. Ready water supply. Increased industrialization has taken place strategically near water sources, since water is required as a raw material, cooling and cleaning machines. Witwatersrand which is the main industrial area draws water from Vaal River to support the iron and steel industries in Vereeniging and Johannesburg. Durban and East London are fairly supplied with water from rivers and the ocean. Water supply greatly determines the location and expansion of big future industries in South Africa.
8. Availability of adequate capital. Much of South Africa's industry is concentrated on the Witwatersrand and this is greatly because of the capital generated from the gold sales. Gold accounts for a large percentage of South Africa's exports and with a variety of other minerals when exported, more capital has been generated which is used to invest in industry especially in the Rand. Still many industrialists/investors have settled in the major industrial zones of the country such as the Rand, Cape Town, east London, Port Elizabeth and Durban.
9. Industrial inertia where by old industries fail to move from an area to another when the location advantages change. This is explained by the 'momentum of early start' and results into the concentration of both primary and secondary industries in an area. For example the supplies of iron and steel in Vereeniging have attracted other manufacturing industries like agricultural machinery, pipes, wind mills, chains, cables, bicycles on the Rand.

10. High level of technology and research. South African industrialists in the main industrial regions (such as Rand, cape town, Durban) have emulated/adopted certain technologies from the East (especially Japan), Europe and North America; and also continuously undertake research in industrial products especially in the secondary industries such engineering, agricultural machinery, food processing.
11. Political stability is a major factor attracting the location of industries in areas such as the Witwatersrand. The stability has boosted the confidence of both local and foreign investors and hence enabled long-term investment in the industrial sector in such areas like Pretoria, Vereeniging, Germiston and Kimberley.
12. The strategic location of industrial centres for example Vereeniging has an advantage of a central position in relation to the three provinces of Transvaal, Orange Free State and Durban which means easy access market in all directions. It is also about 150km from Orange Free State gold fields. Also the industries located at the coast have a strategic advantage of easily accessing markets overseas and also imported raw materials.
13. Availability of vast/ extensive land to set up industries. Industries which require vast land are located in sparsely populated areas where land is readily available and cheap. More so, South Africa has many unrestricted sites for industrial development in the zones of Rand, Durban among others –which has encouraged both local and foreign investors to such area/zones.
14. Favourable /supportive government policy of industrialization such earmarking several industrial sites in certain areas, hence influencing industrial location/ distribution. The industrialists have further benefited from import control and the imposition of certain taxes to cut down the stiff competition from overseas industries. The government also promotes quality control and finances basic industries such as iron and steel industry, electricity generation. It also greatly spends on improving and extending the communication routes in various parts of the country, a factor that attracts industrial location.

Contribution of industrialization to development

1. Generation of foreign exchange through the exportation of the industrial goods such as textiles, chemicals, and machinery to other countries. The foreign currency generated helps to import foreign goods not produced locally, and foreign technology.
2. Generation of many employment opportunities at various stages directly and indirectly such as the supply of industrial raw materials, industrial processing, grading and packing industrial goods, transportation, and exportation of industrial output. This has helped to improve the standards of living of the people such as through building better houses, accessing better education and health services.
3. Promotion of urbanization/ development of urban centres for example in the Rand of south Africa –Johannesburg, Pretoria, Germiston, springs, Witbank, and Kimberley. As population increases in these urban centres, a number of associated facilities come up such as banking, insurance, education, hospitals, recreation, entertainment, and research facilities.
4. The industrial sector facilitates capital accumulation from the sale of the industrial goods. It also attracts many private investors hence raising valuable capital to invest in various sectors of the economy like mining, farming and tourism.
5. Generation of government revenue from the taxation of the industrial companies, the incomes of people employed in the sector and the related activities. The revenue realized is invested in various sectors like fisheries, education sector, and farming.
6. Promotion of international relationship/cooperation with other countries such as the countries where the foreign industrial companies originate, countries importing the industrial products. This has increased trade and economic contacts with those countries—hence more capital inflow.
7. Promoted development of transport infrastructure for example today South Africa has the most advanced road and railway network in Africa comparable to that of Europe and North America. Various railway lines were developed to connect industrial centres to raw material sources and the export ports such as Cape town-Johannesburg—St.Lucia railway and Pretoria—Kimberley railway in

South Africa . These networks also support other economic activities such as tourism and farming.

8. Diversification of the economy due to the development industries which supplement on the number of economic activities in the country. It has therefore reduced over dependence on few sectors like agriculture; and yet industry is not badly affected by price fluctuations of primary products. This therefore expands the export earnings and national income.
9. Facilitation of technological development and research in the country, through using modern industrial processing technology to improve the quality of products like chemicals, electronics, and textiles. There is improvement of indigenous technology after a long period of industrialization and adoption of modern techniques from developed industrial nations. The highly industrialized countries of the world are at the same time them most technologically advanced nations.
10. Promoted development of other sectors like agriculture, trade and commerce, tourism—given the linkages with such sectors. For example, the mining sector provides raw materials to the industrial sector such as coal, iron ore; the agricultural sector supplies food to the industrial sector and provides market for industrial goods such as fertilizers and tractors. This in turn increases the national income.
11. Improves the country's balance of payment position through increasing the receipts/ earnings from exports by adding value via processing the primary products. The processed goods command higher prices in outside markets. Still it reduces the expenditure on imports by substituting them with locally produced goods.
12. Promotes self-sufficiency in the production of manufactured goods (capital and consumer goods). This reduces economic dependence on other countries and problems of political and economic dominance by other countries.
13. Facilitates efficient exploitation/utilization of a country's resources such as mineral resources, forestry resources, water resources, agricultural resources.

Short comings/ negative effects of industrialization

1. Pollution of the environment that is, air, water and noise pollution. Industries pollute through direct emissions or indirectly through automobiles and other

products. Water sources are used as dumping grounds for industrial wastes, which reduces the quality of water sources. Pollution results into health problems like deadly diseases.

2. Urban-related problems due to industrial concentration like high crime rates, traffic congestion, overcrowding, poor garbage disposal, easy spread of diseases due to poor sanitation, growth of slums. it is difficult and very costly to eradicate these problems..
3. Leads to unemployment problems/ labour under utilization due to the failure of modern industries to create sufficient number of jobs. Many industries are highly capital-intensive and hence they are not a major solution to unemployment. This also reinforces the high crime rate in the urban areas.
4. Accelerates rural-urban migrations leading to urban labour surplus due to migration in excess of available job opportunities. It also results into decline of the agricultural sector due to reduced labour supply in the rural sector. (Rural-urban migration is due to income inequalities between the urban industrial workers and the rural dwellers who are mostly peasant farmers in developing countries).
5. Leads to profit repatriation and foreign dominance. The foreign ownership of especially medium and large-scale industries in developing countries has increased profit repatriation and foreign influence by the developed countries. More so, the expatriates used by foreign companies are expensive to support since they are paid in hard currency.
6. Leads to over exploitation of natural resources such as minerals, forest resources, and water resources in most countries, leading to quick resource exhaustion.
7. Destruction of vegetation cover through increased deforestation / clearance to set up industrial sites or expand the industrial establishments. This negatively affects the climate and soils.
8. Industrialization contributes to global warming through destruction of the ozone layer; through emission of dangerous gases to the atmosphere.
9. Leads to destruction of the natural landscape such as through leveling the landscape, reclaiming of swamps—hence destroying natural beauty.

10. Displacement of other activities / encroachment on land for other activities like agriculture, forestry and settlement. The location and expansion of industries in a particular area leads to displacement of other activities or people with less or no compensation.
11. Results into regional imbalance in development due to the concentration of industries in a particular area. There is rapid progress of that area in terms of infrastructure at the expense of other areas. Most industries are urban-based.
12. Industrial accidents for example fire outbreaks leading to loss of lives and industrial property . This undermines industrial production.
13. Industrialization undermines the traditional values by completely diverting the way of life such as by changing the cultural identity of dressing, the tools used in daily activities – to adapt to the manufactured goods

EGYPT

Egypt is the second most industrialized country in Africa after South Africa; and most of the industries are found in Lower Egypt.

The building of the Aswan dam provided power for expansion in industrial production such as production of cement, iron and steel, fertilizers, oil refining, textiles, light abd heavy engineering, electrical goods. This has saved the cost of importing manufactured goods.

The major industrial centres include:

1) Cairo

   The major industries include: oil refinery, textiles, electrical engineering, iron and steel, petro-chemical, cement, food processing, sugar refining and drinks.

2) Alexandria

   This is the second after Cairo city. Industries include: oil refinery, textiles, salt industry, chemicals, ship building and repair, food processing.

   Other industrial centres apart from Cairo and Alexandria include:

- Helwan—with iron and steel industry expanded due to iron ore from Aswan and Bahariya oasis; textiles due to cotton growing along the Nile valley.
- Port Saidi, Giza, El Mahalla el Kubra, Tenth of Ramadan, Ismailiya, Kafra and El Mansura.

A sketch map showing the major industrial regions of Egypt

Factors which have influenced the distribution/location of industries in Egypt

1. Availability of abundant /large supply of raw materials to use in industries. For example the country has large deposits of oil that exist in Ramadan, Belayim and El Morgan in the Gulf of Suez that have promoted the development of oil refineries and chemical industries in Cairo and Alexandria. The iron and steel industry at Helwan has expanded due to the presence of iron ore from Aswan and Bahariya oasis. Cotton along the Nile valley and Nile Delta supports textile industry and cereals support the grain milling factories. There are also imported raw materials, which have supported various industries such as at Alexandria and Port Saidi.
2. Availability of large quantities of power to run the machines in industries for example hydroelectric power from Aswan high dam and oil refining (thermal power) at Alexandria.
3. Presence of ready/steady water supply for example water from the Nile River is used in the Delta region and along the Mediterranean coast.
4. Presence of abundant skilled and unskilled labour to work in the industries for example Cairo and Alexandria which are highly populated.
5. Availability of efficient/ improved transport network such as road and railway in the Nile delta region.
6. Availability of adequate capital for industrial investment.
7. Industrial inertia—many industries located where others exist, hence concentration of primary and secondary industries in Alexandria and Ismailiya.
8. Etc.

NIGERIA

Nigeria is located in West Africa and has a developing industrial sector in Africa. There are three main industrial areas: the southeast, southwest and the north (around Kano). These are the most densely populated areas, hence labour and market are readily available.

The industrial centres include:

- Lagos—the industries are: grain milling, asbestos factory, cement, motor assembly, extraction of palm oil, fruit canning, fish canning, timber processing (for plywood and furniture), breweries, oil refinery, chemical industries.
- Port Harcourt—the industries are: grain milling, extraction of palm oil, oil refinery, chemical industries, motor tyre factories, cement, fruit canning , cigarette,
- Ibadan— timber processing, grain milling, etc
- Kaduna-motor assembly, grain milling, etc
- Kano- extraction of groundnut oil, cotton ginning, meat canning, grain milling,
- Enugu-metal manufacture using scrap, milk processing in enugu, cement at enugu,
- Others are processing of latex and manufacture of rubber at Calabar, Benin, and Warri, cotton ginning in Benin, steel plant at Ajoakuta, confectinaries in the major towns, grain milling in major towns,

Qn. Assess the contribution of raw materials to the development of manufacturing industries in Nigeria

Approach

→ Identify the major industrial centres and corresponding industries , plus any other facts related to industry in Nigeria

→ Explain the contribution of raw materials to the dveleopment of industries in Nigeria

- Presence of large deposits of mineral resources for example petroleum/ oil in the Niger delta and offshore deposits supporting oil refinery and chemical industries (producing dyes, plastics, fertilizers etc) at port Harcourt and Lagos, , limestone and iron ore at Itakpe, coal at Enugu.
- Availability of large supply of agricultural raw materials such as cotton for cotton ginning and textiles, dairy farming, oil palm, rubber, ground nuts
- Abundant water resources such as water itself, fish from the Atlantic ocean, Lake Kainji and Niger river.
- Presence of forest resources/ timber products in southern Nigeria (tropical rain forests and planted forests)

- Availability of imported raw materials such as car spare parts for motor assembly at lagos and Kaduna.
- Industrial linkage such as grain milling industries have favoured the development of confectionaries in the major towns.

→ However explain the contribution of other factors to the development of industries

- Availability of large quantities of power etc

USA

USA is the world's leading industrial country, although North America as a whole started her industrialization process later than Europe. USA is also the most developed country in the world.

Major industrial regions and centres

There are six (6) major industrial regions:

1) Southern New England

   This comprises of the North Eastern USA centred at Boston and was the earliest to be developed by the settlers from Europe (especially the British). The main industries include electronics, armaments, Aircraft manufacture, computers, and medical instruments. The major industrial towns include Boston, New Bedford, Hartford, Holyoke, Springfield, Bridgeport, and New Haven.

2) The mid-Atlantic states

   This is the most densely populated part of USA and the most heavily industrialized. The main industrialized cities include New York, Philadelphia, and Baltimore. The major industries are iron and steel, engineering, electronics, printing, and publishing, textiles, luxury articles, chemical, and food processing.

3) Pittsburgh –lake Erie region

   This region is the core of USA's heavy industry. The major industries are mechanical engineering, glass, pottery, chemical, HEP generation at Niagara Falls in buffalo city, milling. The main industrial centres are Buffalo city, Wheeling, Youngs town, Cleveland, and Pittsburgh.

4) The Detroit industrial region

This is located at the western end of Lake Erie and is the greatest automobile region of USA. Detroit is the head quarters of most giant motor corporations such as Ford, Chrysler, and General Motors. Car assembling is associated with other branches of industry such as tyre making, electrical wire, glass, batteries, and spare parts.

5) The lake Michigan region
   This is located at the southern shores of Lake Michigan centred at Chicago. It is a major automobile region, has chemical industries, iron and steel. Others are meatpacking, grain milling, agricultural machinery, railway engine repairing, and coach construction.
6) The southern Appalachian region.
   This is centred at Birmingham to the south of the Appalachians in the state of Alabama. Industries have greatly been promoted by the presence of coal, iron ore, oil and hydroelectric power. The major industries are steel making, textiles, chemical, metal works, and machinery. The main centres are Birmingham, Atlanta, and Gadsden.

Other important industrial regions include Eastern Texas, St .Louis, Kansas City, New Orleans, San Francisco, Los Angeles and San Diego, Seattle, Washington.

<u>Factors which influenced the location and development of industries in USA</u>

1. Availability of a wide range of mineral resources for industrial use. USA produces large quantities of petroleum, natural gas, coal, and iron ore. USA's important minerals are petroleum and coal used as raw materials in chemical industries; iron ore and copper used in iron and steel industries and engineering industries. This promotes industrial expansion and production.
2. Availability of large quantities of power since USA is a major producer of petroleum, natural gas, coal and hydroelectric power. There are many HEP stations such as Tennessee valley dams, Niagara Falls and Shasta dam. Today USA has the world's biggest installations of nuclear power. The ready supply of power has facilitates the running of industrial machinery and heating such as aluminum smelting, iron and steel and engineering.
3. Availability of a wide variety of other raw materials, apart from minerals.

USA has a wide range of agricultural raw materials for example fruits from the central valley of California favouring soft drinks and brewing ; cotton from the southern states for textiles; maize and wheat favouring grain milling; ranching favouring meat packing, and foot wear. There are also fishing –related industries at the ports like New York, Baltimore, Los Angeles, Boston, San Diego, and San Francisco. This ensures continued industrial production.

4. Availability of adequate capital to invest in industry generated from international trade and especially from the oil industry. It is also provided by the federal governments of various states, large companies such as Coca Cola at Atlanta, Pepsi cola in New York, Henry ford which opened up automobile technology. There is also credit provided by the banking sector such as in New York and Boston. This has led to large –scale investment in oil refineries, chemical, electrical engineering, and food processing.
5. Presence of skilled and semi-skilled labour originally made of immigrants from advanced European countries such as Britain, France, Netherlands, and Germany who settled in centers like New York, Boston, and New Bedford. They came in with experience and technical knowhow needed for industrial development.

   Besides the education system of USA is technologically biased because people are allowed to develop their fields of interest from the early stages and hence bringing up skilled engineers, researchers, managers, skilled entrepreneurs and other industrial workers. This has promoted industries like automobile in the Detroit and Lake Michigan regions.
6. Modern /Advanced technology continuously upgraded by the sound education and training which is technologically biased. Many skilled scientists and technologists are trained and others attracted form Europe. Today USA is the world's leader in scientific modern industries such as computer technology- with important companies like Microsoft and IBM (international Business Machines Corporation), Netscape Communications Corporation based in California.
7. Presence modern transport and communication network involving railway, road, air and water transport. USA has the densest railway and road networks in the world, many airlines and aircraft manufacture. The most important

waterway the St. Lawrence sea way shared by the Canada and USA; and all these promote the movement of raw materials, workers and finished goods.

8. Availability of a large market for industrial goods both local and foreign.
   USA has a population of over 300million people for domestic market. The Great lakes region and New York are some of the most highly populated regions. Still the US goods are exported to Europe, Asia and Africa due to high quality and USA's reputation/influence in other countries. USA greatly influences the WTO, World Bank, and IMF—hence a growing world market, which continuously promotes the expansion of industry (like textiles, machinery).

   There is also industrial linkage with some industries providing inputs or market for other industries. For example, the iron and steel industry promotes the engineering industry, electronics, and automobile. In addition, car assembling in the Detroit region is associated with other branches of industries like tyre-making, electrical wire, batteries, spare parts, and glass.
9. Inter-state competition in USA has also promoted large-scale manufacturing industries. Due to competition, some states have tended to monopolize certain industries for example the southern states in the Air space industry, while the Great lakes are monopolizing the motor vehicle industry. Still many states of USA have diversified industrial production for example southern New England has engaged in armaments, aircraft, electronics, musical instruments, and industrial machinery.
10. Availability of extensive land for industrial development such as for the large manufacturing industries in the Great lakes region. Some industries require large land area and hence availability of cheap land becomes important. For example the Ford Automobile plant at Dagerham—Essex (New Ark city) covers over 200 hectares of cheap non-agricultural land. This eventually increases industrial production.
11. Supportive government policies towards industrialization such as encouraging export promotion industries such as electronics, computers, coaches, textiles, and chemical industries in Chicago, Detroit, and Cleveland. It has also developed transport infrastructure; carried out sound financial and economic planning to

maintain USA's supremacy in the world as a "super power"—hence great industrialization.

12. Strategic location of industrial zones such as coastal ports-Los Angeles, New York and Boston which are trans-shipment points for oil products either to other parts of USA or imports from abroad. Therefore, they are natural sites for oil refining and chemical industries. The ports are also centres for smelting imported ores and using other imported raw materials such as rubber, cotton, maize and timber. The industries in the Great lakes and along the St. Lawrence Sea way are also strategically located.
13. Initiative by a number of local businessmen who include Bill Gates who co-founded with Paul Allen—the Microsoft Corporation, which is the leading computer software company in USA; Henryford who founded the Ford Motor Company (one of the world's largest automobile compoanies based in Detroit region). Others are Andrew Carnegie (founder of the iron and steel industry in the US) and Walter Chrysler (an American automobile manufacturer). These invested large sums capital, carried out technological research and set pace for industrial development.
14. Highly developed industrial research for example, Microsoft Corporation based in Washington is the world's largest company creating computer software products like Word processor, Access, Spreadsheet. Many industrialists have invested in automation, production of synthetics and adopted labour-saving technology. There is also research into the elimination or minimizing of chemical, biological or physical hazards in the industries in many states of USA.
15. Political stability of the country for over 250 years which has enabled the establishment and maintenance of industrial infrastructure and motivated many local and foreign investors to invest in US industry such as in food processing and printing and publishing in New York.
16. Availability of large water supply for industrial use. Certain industries such as iron and steel, aluminum smelting, power generation, timber pulping use large quantities of water for cooling machines or as a raw material. Many industries are located along rivers, by-lakes, along the coast such as in New York, Boston, Los Angeles, Chicago, Detroit, Houston; or where piped water supply is available.

17. Industrial inertia, where by the recent types of industries such as electronics and petro-chemical industries are located in areas where old industries like iron and steel exist to easily acquire inputs. Industries that were once started due to advantages of raw materials, market or fuel have tended to persist in such areas due to inertia or the momentum of early start, despite changes in locational advantages.
18. US influence in many countries and its military supremacy taken as a role model which has meant easy acquisition of imported raw materials and expansion of market for industrial output. This supremacy is added to the industrial threat from other nations like China, Taiwan, North Korea, and Switzerland –which threat has forced US to greatly industrialize in attempt to maintain its position.

GERMANY

Germany is one of Europe's most developed nations and one of the most industrialized countries in the world. The biggest industrial complex in the country is the Ruhr West Phalia industrial region. It is the largest and most concentrated industrial complex in Europe.

Structure of industries

1. Iron and steel industry

   This consumes raw materials like cool water, coke, pre-heated air, iron ore, scrap iron, fluxing stone. It is only iron ore which is imported, but the rest are available locally. Steel is on great demand in many secondary fabricators of steel on the Ruhr and other parts of Germany such as automobile industries, container industries, electrical machinery, appliances, and utensils, agricultural machinery, and shipbuilding. It is also needed in the construction industry— road, rails, warehouses. The major centres of iron and steel are Duisburg, Essen, Bochum, and Dortmund.
2. Engineering industry. The main engineering products are agricultural machinery, blast furnaces, heavy vehicles plus those above. The main centres are Essen, Dortmund, Dusseldorf, Gelsenkirchen, Solingen, Oberhausen, and Rheinhausen.
3. Chemical industry. This has developed rapidly due to the presence of coal, local limestone, and the recent use of petroleum. The products include bleaches and dyes for textiles, plastics, synthetic fibre for textile, detergents,

pharmaceuticals, and fertilizers. The main centres include Dusseldorf, Leverkusen, Essen, and Duisburg.

4. Textile industry. This is dominant in the Valley of Wupper River in the south of the Ruhr region. The products include cloths, artificial textiles, threads, leather products, carpets etc. The main centres are Krefeld, Wuppertal, Elberfeld, and Leverkusen.

   Other industries in the Ruhr region include paper, pottery and glass, rubber, brass, bronze, ship building.

Apart from the Ruhr region, other industrial regions in Germany include:

a) The middle Rhine industrial area. This is at the confluence of the Rhine and the main rivers. Industries include railway engineering, automobile, electronics, chemical, iron and steel, and brewing. The major centres are Frankfurt, Mainz, Mannheim, and Ludwigshafen.
b) West Berlin (capital). The industries are consumer goods (furniture, luxury articles), chemicals, and engineering.
c) Hamburg. The industries are shipbuilding, marine engineering.
d) Munich. The industries are brewing, musical instruments, photographic equipment.
e) Stuttgart, Hannover, Aachen, Saar brucken, and centers in East Germany (like Leipzig, Jena, Dresden, and Strassfurt).

Factors responsible for industrial development in Germany

1. Availability of various power sources

   Coal was for long the main source of power for industrial development in Germany and the Ruhr coal field had large quantities of coal and relatively cheap to extract due to being near to the surface (exposed). However, the use of coal has declined due to development of other sources of energy like natural gas, petroleum/oil, and hydroelectric power—used to run industrial machinery and in industrial boilers—encouraging large-scale production.

2. Availability of a variety of coal types in the Ruhr region which include anthracite coal containing a high percentage of carbon and burning with great heat, thereby suitable for heat boilers. Coking coal is particularly valuable for the smelting iron ore-hence iron and steel industries. It is also for chemical

industries as a raw material. Gas coal results into gas supply for domestic and industrial purposes.

3. Presence of large quantities of other raw materials which include iron ore used in the iron and steel industries. Iron ore is both in the Ruhr and imported from Sweden and France. Timber from the Black forests of south Germany used in the paper industries, grapes grown in the Rhine rift valley for the wine industry, livestock products for dairy processing plus foot wear industries ; and imported cotton for the textile industry. This leads to continuous production and supply of industrial goods.
4. Availability of adequate capital to invest in the industrial sector provided by the developed banking sector. More so, the Marshall Aid plan of 1945 after the Second World War provided the necessary capital for industrial recovery, that is, construction and rehabilitation of the Ruhr industrial plants and other infrastructure, as well as modernizing technology in industry.
5. The initiative of a number of local businessmen with the required capital for industrial investment. For example, Krupp family based at Essen—who was the owner of the largest steel and armament combine in Europe. Thyssen based on the Ruhr who invested in the steel industry. Others were Mayer based at Bochum, and Igparen. Given their example, many other industrialists later came up, and thus more industries have concentrated in the same areas.
6. Presence of a wide/ large market both domestic and foreign partly due to the high quality production. Still Germany has a big and rich population which provides market for industrial goods. There is a large foreign market in the rich European countries such as Switzerland, Italy, France, Belgium, and Austria and the former colonies for goods like electronics, chemicals and textiles. This further promotes industrial investment.
7. Regional cooperation also promotes industry since Germany is a member of the European Union (EU). This organization is widening the market potential for the industrial products in the member countries. This in turn promotes industrial expansion to satisfy the expanding market.
8. Developed/efficient transport system for example the Rhine waterway providing a cheap form of transport for heavy goods, both imports and exports. Communications have further been improved by the construction of canals such

as Dortmund—Ems canal linking the Ruhr region to the North Sea and facilitating the importation of Swedish iron ore. Other canals include Rhine—Herne canal, and Lippeseite canal. There are also modern road and railway networks-all used in the transportation of raw materials and finished goods.

9. Strategic geographical location of Germany in the centre of Europe giving it access to a wider area for market and raw material supply. Still as the use of coal declines and the use of oil rises, the location of the Ruhr region on the Rhine waterway not very far from Rotterdam port is being more advantageous to industry. It is for this reason that the petro—chemical industry is increasingly becoming a major industry in the country such as in the Ruhr region.
10. High level of technology employed in all forms of industry and this involves the use of highly efficient machinery at various stages of production, including automation in iron and steel, engineering, and food processing. In Germany, there is a constantly growing generation of industrial technologists. This results into high quality and quantity industrial output.
11. Availability of large supply of skilled manpower such as skilled entrepreneurs, managers, and engineers in iron and steel works, automobile, and petro—chemical industries in the Ruhr region. This leads to greater innovations and high quality industrial goods that command a large market.
12. Internal competition among industries and industrial centres for example Duisburg, Essen and Dusseldorf are competing in the iron and steel, engineering and chemical industries. This leads to increased inventions and innovations in industrial production. The Germans are known world over for their capacity for hard work that arose out of their national desire to restore their country as an industrial giant.
13. The destruction of many industries during the world war/ the post-war national desire of the Germans to rebuild their country.

    This enabled many firms to re-start with newer and modern equipment that existed in other countries, which were less affected by war. There was need to uplift efficiency and productivity of the industrial sector –hence modernizing the engineering, textiles and food processing industries.
14. Political stability of Germany since the end of the Second World War (1945). More so, the Berlin wall separating West and East Germany was removed in

1989. This has boosted the confidence of both local and foreign investors – hence large-scale investment in automobile, electrical engineering, railway engineering especially in the Ruhr industrial complex.

15. Favourable/ supportive government policy towards industrialization for example the government accepted the Marshall Aid plan of 1945 to rehabilitate and establish industrial plants such as engineering and chemical industries at Essen and Duisburg. The government has also funded the improvement of waterways, railways and road network and putting up enabling policies such as those encouraging production for export.
16. Industrial inertia where by many old industries have failed to change location despite changes in locational advantages. Accordingly many new industries are attracted near the already existing industrial centres to benefit from the existing infrastructure. This explains why many industries have been attracted to and concentrated in the Ruhr industrial centres like Essen, Dortmund, and Duisburg.
17. Developed industrial research.
18. Availability of large/ ready water supply for industrial use.

SWITZERLAND

Switzerland has a highly developed industrial sector in Western Europe and one of the highest standards of living. Industrialization began with textiles manufacture and for long it employed the largest number of workers. Today however engineering has taken the lead. Other industries include watch-making, precision instrument, and footwear.

The Swiss industrial structure

1) Engineering industry

   Engineering is the most important accounting for a large percentage of the total exports. The products include turbines, electrical appliances, marine diesel engines, locomotives, wagons, vehicles, cableways, ski lifts, weighing and printing machines, and sewing machines. The major centres are Zurich, Basel and Baden.

2) Watch-making industry

   Switzerland is the world's leading watch-making country based on the Swiss Jura region (for over the last 200 years). It was originally a cottage industry (home-

based) but greatly developed. There are over 2700 factories (producing components and complete watches), with a high degree of standardization. The principal centres are La Chaux-de-Fonds, Biel, Le Locle, and Blenna in the Jura region.

3) Precision instrument industry
   This requires less raw materials but great skill in making high quality products. The optical instruments include binoculars, microscopes, surveying instruments, navigation and meteorology instruments, cameras. Other instruments are balances, voltmeters, and electronic calculators. The main centres are Zurich, Basel, and Baden.
4) Textile and foot wear industry
   Textile is the oldest industry and emphasizes high quality than mass production (i.e. targeting the latest fashions). It does not venture in mass production because fashions come and go quickly. Cotton is mainly imported from Egypt, but synthetic fibres are also used. The main centres are St.Gallen, Zurich, and Appenzell; and most products are exported.
5) The chemical and pharmaceutical industry
   This is also an important industry and produces dyes, drugs, soaps, explosives, insecticides, plastics, cosmetics, paper chemicals, photo-chemicals, and pigments. Basel is the most important centre. Other centres are Geneva, Bern and Zurich.
6) Food processing industry
   The products include condensed milk, cheese, milk chocolate, soups, meat extracts etc. the major centres are Lindt, Tobler, Vevey, Geneva, and Lausanne.

A sketch map showing the distribution of major industrial centres in Switzerland

Factors which have favoured industrial development in Switzerland

1. Availability of various sources of power for industry for example large quantities of hydroelectric power from the Alps which supports various industries. There are other forms of power especially nuclear power. The natural gas and oil are also imported. Some of such forms of power is for domestic use and thus more Hydro electricity is secured for industry such as textile and engineering industry.

2. Availability of large sums of capital to invest in industrial development provided by the government, local and foreign investors from Europe. The capital is used to buy modern industrial machinery, carrying out research to develop high quality output, constructing the necessary transport infrastructure. This in turn encourages industrial expansion.
3. In addition, the country has a highly developed banking sector, with a net work of over 4000 banks covering the whole country. Many wealthy individuals and companies bank their money in the Swiss banks, and hence many industrialists find it easy to access credit from the banks. Many industries have developed like the watch making in Jura and chemical industries in the Swiss plateau.
4. Large supply of raw materials from different sources. Though the country virtually lacks most viable natural resources / raw materials, certain inputs are available especially from the agricultural sector such as milk, meat, sugar, vegetables. The livestock industry provides raw materials for producing cheese and milk chocolate in Lindt, and Tobler. The grapes provide materials for wine making. Remember however that most raw materials are imported such as oil, and cotton. This leads to reliable supply of industrial goods.
5. Availability of large /extensive land for industrial development especially the Swiss plateau which is relatively flat and this favours the construction of industries like engineering at Zurich, textiles at St.Gallen, chemical at Bern. Many industrial sites have been set up in the country and thus increase in industrial output.
6. The long policy of neutrality of the country which saved Switzerland from the destruction by both world wars and European wars. It also favours rapid development of the banking sector and made the country the head quarters of many international organizations such as International Red Cross and FIFA. The coming of these organizations provides a large market for the Swiss industrial products, since the delegates take the information back to their home countries.
7. Switzerland's strategic position in the heart/centre of Europe which has given it an advantage of acquiring market in all directions such as Germany, Italy, France, Belgium, and The Netherlands. Switzerland also gets raw materials from such countries. Swiss industrial products such as watches, binoculars, cameras,

and engineering products command a worldwide demand and the products go to countries like USA, Japan, china, and African countries.

8. Availability of large skilled labour supply to work in industries. Most Swiss industries trace their skills from the old cottage industries such as textiles and watch making. The Swiss have kept on increasing their skills and they produce high quality products such as precision instruments which require less raw materials. These have helped the Swiss to partly overcome the problem of Landlockedness and to compete favourably on the world market.
9. Well developed transport networks, including road, railway, air and water. The Rhine is the most important route for Switzerland linking it to the North Sea. About 90% of the incoming cargo consists of liquid and solid fuels, raw and semi-finished materials. There is a modern electrified railway network and modern air transport for moving inputs to industries and finished goods to various parts of the country and neighboring countries.
10. High level of technology employed in the industrial sector which has promoted the engineering, watch making, textile and the precision instrument industry. The precision instrument industry uses limited raw materials and yet produces high quality products such as cameras, binoculars , calculators, microscopes; which are highly branded depending on international demand.
11. Availability of large water supply for industrial use such as cooling machines and as a raw material such as chemical industries and food processing. Therefore many industries are located along rivers (like Rhine), by-lakes (like Geneva, Zurich), or where piped water supply is available.
12. The effect of the developed Swiss tourist industry based physical and man-made features. Many guests tour and ended up becoming industrial investors. Tourism has also greatly advertised the Swiss tourist products in the rest of the world, since the guests take the information and samples of the products in Switzerland to their home countries. This promotes industrial expansion.
13. Favourable government policy towards industry such as by encouraging sound education and research to discover new industrial production techniques. It has also financed certain industries such as power generation, engineering with a desire to maintain the global image of Switzerland. The government also encourages local and foreign investors in industry.

14. Developed/intensive industrial research for example in watch-making companies in the Jura region (making complete watches and spare parts). Many industrialists invest in automation, production of synthetics and labour-saving technology especially in the engineering and precisioninstrument industries. There is also research into the elimination or minimizing of chemical, biological or physical hazards in the industries.
15. Industrial inertia

Problems facing the Swiss industrial sector

1. The country lacks most of the valuable natural resources/ raw materials, which propelled early industrialization in most developed countries such as coal, iron ore, copper, and oil. The country only has limited coal, iron ore, and salt in the Rhine valley. The country also has few agricultural raw materials due to infertile soils and cold winters. As such, the industries have little bearing on the natural resources and this explains why most raw materials are imported.
2. Rugged terrain/ mountainous nature of the landscape which limits accessibility. The Swiss Jura and Alps make the construction of roads and railway lines difficult and thus problems in the delivery of raw materials and finished goods to industries and markets respectively.
3. Small domestic market since the country has a small population (just over 7.8m) which cannot support industrialization. This undermines industrial production.
4. Competition from other industrial countries for market notably Japan, China, USA and Germany. This results into fluctuations in prices and incomes.
5. Shortage of labour to work in the industries, leading to high labour costs and consequently increased costs of production.
6. The country is landlocked with no direct and easy access to the sea. It is enclosed by several countries like Italy in the south, France in the west, Austria in the east and Germany in the north. However, this problem is undermined by the presence of the Rhine River that helps the country to access imported raw materials and to export finished goods.
7. High costs of production. The production of high quality capital-intensive goods is very costly, the precision products are particularly expansive to make.

8. Limited land for industrial expansion partly due to the rugged terrain in the Jura and Alps. The industrial centres in the Swiss Plateau are already congested. This undermines industrial production.
9. Pollution due to wastes from industries which negatively affects the quality of the industrial output.
10. Congestion of the Rhine—which is the main waterway linking Switzerland to the rest of the world and the frequent delays affect the Swiss industry.
11. The system of imposing high tariffs on imported goods by developed countries, which meant that Switzerland had to fight the tariffs.

INDUSTRIALIZATION IN JAPAN

Japan is a highly industrialized country in Asia and one of the most industrialized nations in the world. Despite the shortage of industrial raw materials and fuel, the country has been able to industrialize and it is a major exporter of industrial goods.

Major industrial regions of Japan

A. The Keihin region

This is the greatest industrial region of Japan formed by the conurbation of three major towns of Tokyo, Kawasaki and Yokohama. Tokyo is noted for electrical engineering (especially television sets, refrigerators, washing machines, and computers). Yokohama has precision engineering, shipbuilding, oil refining, and petrochemical. Kawasaki has marine engineering, cement works and glass works.

B. The Hanshin region

This is the second greatest industrial region formed by towns of Osaka, Kobe and Kyoto. Osaka is the greatest textile town, with plastics, footwear, and textile machines. Kobe concentrates on shipbuilding, oil refining, and petrochemical industries. Kyoto has traditional handcrafts, toy and lacquer works. The Hanshin ports handle much of the foreign trade.

C. The Ise bay region

This is the third industrial region of Japan dominated by one major town-Nagoya. The industries include textile mills that process local silk, imported cotton and wool, and also synthetic fibres ; engineering industries of all kind of machinery , automobiles , locomotives and air craft. Other towns are Tajimi, and Seto towns

noted for musical instruments (guitars, violins and pianos), ceramics, and motorcycles.

D. The Kitakyushu region

This occupies the Northern Kyushu area, the Chikugo coalfield and good accessibility giving rise to a conurbation with towns like Yawata, Kokura, and Moji. Other towns are: Tobata, Fukuoka, and extends up to Nagasaki. The major industries are: iron and steel, ship building, machine parts, chemical industry and textile industries. There is also rice milling, wheat milling, distilling. This area is dominated by large-scale factories and massive operations.

Apart from the above four major industrial regions, there are scattered industrial towns including Hiroshima, Kagoshima, Muroran, Akita and Niigata, Kure, Okayama, Chukyo, Hakodate, and Sapporo.

A sketch map showing major industrial regions of Japan

Factors responsible for industrial development in Japan

1. Availability of a wide variety of raw materials to use in the industries such as the coal (from Chikugo coalfield) supporting the iron and steel; limestone in Niigata and Toyama; manganese, iron ore, timber. These few raw materials are put to the greatest use by producing high quality output that commands high prices to offset the high costs of production. The textile industries have turned from cotton to synthetics (like rayon, polyester) which are made within the country from local timber, imported timber or imported oil.
2. Japan is the world's leading fishing nation and fishing provides raw materials for various industries such as fish canning, cosmetics, oil manufacture, animal feeds, and drugs, chemicals, for example located in Tokyo, Osaka, and Kobe. Still the fishing sector provides market for industries making fishing equipment such as fishnet industries, boat making, shipbuilding, and marine engines.
3. Availability of large quantities of power to operate the industries. Japan has compensated the limited coal by developing almost all her hydro electricity sources to provide power to run machinery in the industries. Japan's largest dam is the Kurobe dam on Kurobe River in Toyama. The country also has nuclear energy and continues to import oil for power supply in the industrial sector.

4. The large population of Japan which provides a large supply of cheap labour for industries. Still employment in the industrial sector relieves pressure on the rather small agricultural land. Japan has a population of about 130 million, which also supplies a ready market for the industrial products. This promotes further investment in industry.
5. Proximity of Japan to mainland Asia/ Japan is near other Asian countries like china, Koreas, which have large populations and hence provide large market for industrial products; since they import manufactured goods mainly from Japan. Despite the rising costs, the market in Europe, North America and Africa is maintained high quality production in the Japanese industries.
6. Japan's indented coastline and hence development of modern ports for example Tokyo, Kobe, Osaka, Yawata; for the importation of raw materials like scrap and coking coal, iron ore, oil, natural gas—which support the iron and steel industries, electronics, oil refineries, and chemical industries. These ports also help in the exportation of manufactured goods to other parts of Asia, Europe and Africa.
7. The destruction of many industrial installations during the Second World War which helped Japan to replace the old industrial establishments with new and more efficient ones. This increased the competitiveness of Japanese industries like iron and steel, automobile, and electronics. Indeed, there arose a post-war national desire to rebuild the country.
8. Availability of large sums of capital to invest in the industrial sector. After the Second World War, loans were advanced to Japan (particularly from USA) to assist in the post-war recovery program. This acted as capital for industrial investment such as purchasing industrial machinery, raw materials, payment of labour and carrying out research in industrial output. In addition, more local and foreign investors have invested in the industrial sector.
9. Presence of many large corporations which have invested much in industry, they are well-managed and corporate worldwide. These include Honda motor co ltd based in Tokyo—a major manufacturer of automobiles and motor cycles; Sony corporation—Japanese electronics manufacturer; Toyota motor corporation—a major manufacturer of automobiles based in Toyota.

10. Availability of skilled labour to work in the industrial sector. After the Second World War, many Japanese workers were trained in industrial production. Still many Americans were brought in to work in industry with new ideas. Today Japan is among the world leaders in the production and export of automobiles, ships, steel, and electronic equipment due to great skill used. More so, the presence of many local industrialists, Japanese engineers and scientists has greatly contributed to industrial development.
11. Presence of advanced technology employed. The Japanese were able to copy and improve on new techniques from western industrialists, hence producing high quality products like televisions, radios, computers, microscopes, marine ships, automobiles, jet fighters, commercial planes, which command a large market. Japan is one of the world's leaders in the invention of modern industrial technology and production of highly durable goods.
12. The willingness of the Japanese industrial workers to adopt automation than elsewhere in the world , which automation is today very necessary in mass production assembly lines for example in the motor vehicle industry. This has promoted high productivity and efficiency in production.
13. Well-developed transport system such as water transport with modern ports equipped with modern handling facilities; electrified railway network connecting various industrial centres (such as Tokyo connected to Osaka) and a highly advanced air transport. All these have been used to boost industry by promoting foreign trade in manufactured goods and raw materials.
14. Large / ready water supply for industrial use such as for cooling machines or as a raw material such as iron and steel, metal works, engineering industries, power generation, food processing, soft drink and brewing industries. This is why many industries in Japan are located along the coast, along rivers or where piped water supply is available.
15. Stiff internal competition among industries which produce similar products and this promotes industrial efficiency. For example in the Automobile industry with companies like Honda motor company, Toyota Motor Corporation, Nissan motor company, and Mitsubishi. This has led to manufacture of high quality cars, trucks, buses, motorcycles to meet world standards.

16. Political stability of the country since the Second World War, which has enabled long-term and large scale investment in the industries like in the computer and electronics industry –where the Sony Company designs and manufactures video cassettes, recorders, cellular phones, television systems, and various types of computers.
17. Intensive research in the industrial sector by the Japanese leading to better products. For example, Toyota was the first manufacturer to produce a hybrid car powered by a combination of electricity and gasoline. The Nintendo co Ltd based in Kyoto is the leading manufacturer of home and portable video games due to a lot of research.
18. Favourable government policy towards industrialization such as encouraging industrialists and formulating a technically biased education system. Government also ensures quality control through compulsory inspection to meet the export standards. It has spearheaded research and encouraged investment by large corporations.
19. Industrial inertia where by old industries fail to change location despite change in locational factors such as raw material supply. Many new industries are attracted to the already existing old industrial centres to benefit from the existing infrastructure and the primary industries. For example in the Keihin region where secondary industries like metal works, electric cookers, washing machines, refrigerators, chemicals—have been attracted by the accessibility and the presence of primary industries like iron and steel, and oil refineries.
20. Availability of extensive land for industrial development.

Guiding questions

1) Assess the contribution of manufacturing industries to the development of either Japan or Republic of South Africa.
2) With reference to either Germany or Nigeria, examine the impact of industrialization on the environment.
3) To what extent has the presence of market contributed to the concentration of industries in either Manchuria region of china or the Greatlakes region of USA?
4) To what extent has the presence of raw materials influenced industrial distribution in the Republic of South Africa?

5) Examine the factors which have influenced industrial development in the Greatlakes region of USA.
6) To what extent has the presence of power and energy influenced the distribution of industries in USA?
7) To what extent has the presence of mineral resources contributed to industrial development in either Germany or the Republic of South Africa?
8) Assess the significance of natural resources as a basis for industrial development in either USA or Switzerland.
9) To what extent has the presence of minerals influenced the location of industries in Germany?
10) Account for the distribution of manufacturing industries in USA.
11) To what extent are natural resources a basis for industrial development in republic of South Africa?

- Identify the various natural resources in South Africa and show their contribution to industrial development.
- Mineral resources such as gold, iron ore, coal, limestone, phosphates, diamonds, copper etc
  - Minerals act as raw materials such as phosphates in fertilizer industry, limestone for cement, iron ore for iron and steel industry—engineering at Johannesburg etc
  - Source of power such as coal, oil derived from coal at Vereeniging, provides power in petro-chemical industries.
  - Gold and other valuable minerals generate large sums of capital for industrial development when exported.
- Other energy sources such as rivers from which HEP is generated such as Vaal and Orange rivers.
- Water resources –the country has one of the most developed fishing industries in Africa. This has led to the development of fish canning , fish meal, fertilizer etc
- Forest resources—though not well endowed. Sawmills, furniture making, paper making.
- Soils and agricultural resources

- Discuss the role of other factors in industrial development apart from natural resources such as capital, market, technology etc

TOURISM

Tourism refers to an invisible trade where people move in search of pleasure, curiosity and study. The movement can be categorized into as:

a) Domestic tourism-which involves movement in search of curiosity, pleasure, and study within the boundaries of a country. This mainly includes holidaymakers, students and others.

b) Foreign (international) tourism—which involves foreigners from different countries of origin moving to another country in search of pleasure, study and curiosity.

Tourism potentials: These things attract tourists to a specific place or country. These are both physical and man-made. Physical tourism potentials unique natural phenomena that tend to attract tourists like relief features, water bodies, vegetation, and wild animals, climate etc

Man-made tourist potentials include cultures (dressing, marriage, dances), historical sites, traditional burial sites, archeological sites, industrialization, mining, farmlands etc

General role of tourism in economic development

1. Tourism generates foreign exchange to the economy because it is an invisible export. The tourists bring in foreign currency when they spend on travel, hotel resort accommodation, entertainment, shopping local items and crafts. The foreign currency is used to purchase foreign technology, payment of expatriates, which helps in the development process.
2. Tourism leads to international recognition and respect of the country. For example, today Switzerland is recognized worldwide based on the developed tourism industry. It is for this reason that many head quarters of international organizations are located in Switzerland such as FIFA, Red cross etc. Hence, tourism advertises the country abroad, and this increases the number of foreign investors.

   More so tourism promotes international relationship / cooperation, which can be expanded economically. This arises from free movement and interaction of the foreign visitors and the host population, which acts as a basis of economic contacts and trade between the respective countries. It also encourages the inflow of investors.

3. Conservation of natural beauty/ the environment of the country. Tourism helps in the conservation and preservation of the natural environment for future generations such as the temperate forest species, tropical vegetation, animals (fauna) etc
4. Facilitates the development of other sectors such as the service sector. Increased flow of tourists increases the demand for institutions to convert currency such as banks, forex bureaux, shopping services, transport services which are always upgraded to international standards to cater for tourists needs. More so tourism stimulates the construction industry due to hotels, resorts etc. The tourists provide market for local goods such as food items for tourists, art and craft; hence improving the general standard of living.
5. The tourism sector generates employment opportunities to the people such as tour guides, hotel operators, tour and travel agencies, game rangers, instructors etc. This is because tourism has a range of interconnected activities, in which direct and indirect employment is created. The people earn wages and salaries which they use to improve their standards of living.
6. Tourism leads to innovation and invention of technology due to the need to increase the standards such as accessibility. Facilities like electrified railway systems, cable cars, ski-lifts, satellite telephone, aerial photographing, remote sensing which are continuously upgraded.
7. Facilitates the development of transport infrastructure such as electrified railway in Switzerland, South Africa, and USA. It also facilitates the development of runways and airports to cater for tourist arrivals and departures. These transport networks are also used to develop other economic activities such as trade and commerce, agriculture.
8. Tourism promotes urbanization in the country, that is , the development of urban centres. These develop as tour resorts but have attracted population concentration as the tourist activities increase. These urban centres develop with accompanying services such as health, accommodation, education, shopping facilities etc
9. Promotes diversification of the economy since tourism acts as an alternative income earner to the respective countries instead of over depending on a few sectors like agriculture, mining. More so tourism leads to the development of

many related activities such as trade and commerce; which helps to stabilize incomes and the general economy.

10. Tourism generates government revenue though taxing the tour operators and the workers' incomes. the revenue generated is used to develop the social services like health, education, power supply, recreation services etc
11. Promotes cultural exchange and diffusion of ideas. The tourists bring their cultures and traditions such as way of construction, language, and way of dressing, which are incorporated into the host country. This enhances transformation of society.

Shortcomings / negative effects of tourism

1. Pollution of the environment such as air and water pollution. Tourism reduces the quality of air and water through sewage disposal from hotels, restaurants, lodges, camping sites. Also the powered boats used or boat racing cause water pollution through fuel spillage. Much of this damage is caused by increased number of tourist arrivals at particular destinations.
2. Destruction of natural vegetation cover due to increased tourism activities. Natural vegetation is destroyed in order to set up accommodation facilities and recreation facilities for the tourists. This also leads to environmental degradation.
3. Displacement of other activities /occupies land that would be used for other economic activities such as agriculture, industry, etc. The conservationist and preservationist theory of tourism conflicts with economic development.
4. Displacement of people which normally occurs when the local community is shifted to provide room for national parks, game reserves and sanctuaries or any form of protection. Many people lose their settlement areas and sometimes they are not compensated.
5. Promotes urbanization with related problems such as increased crime, congestion, alcoholism, prostitution , high cost of living and other social evils. Tourism accelerates criminal tendencies since the tourists are normally associated with wealth/ money of which the idlers take advantage such through highway robbery.
6. Results into cultural erosion/ degeneration due to the commercialization of tourism. It leads to the removal of charity with tourism becoming a business.

There is total distortion of culture to encourage tourism audience for example by turning the traditional mud and grass-thatched huts into brick huts. More so it leads to the adoption of foreign cultural and evil activities such as poor dress code, drug trafficking, distorted language –hence eroding the cultural heritage.

7. Results into spread of diseases due to the influx of foreigners into the host country such as STDs; which eventually reduce labor productivity and life expectancy in the country.
8. Political –related problems because some people disguise as tourists but are political spies or terrorists who are likely to carry deadly bombs and even plotting coups. This explains why today there is a limit on international travels and tourism in some developed countries.
9. Diversion of labour from other sectors such as agriculture leading to food shortages.
10. Profit repatriation by foreign companies in tourism.

TOURISM IN KENYA

In Kenya tourism is the second most important foreign exchange earner after the agricultural sector and it is a fast growing sector. Tourist arrivals are mainly from Europe and North America.

Major attraction centres and potentials

1. Nairobi. Nairobi itself is an attraction and a focal point of many tourists. It has a higher altitude giving it pleasant weather and it is the largest city in East Africa. Many tourists spend their holidays here and equip themselves ready for safari to the other areas such as interior Kenya, Uganda, and Tanzania.
2. Nairobi National Park-in the heart of the city enables residents and business tourist who lack enough time to make a quick tour through it. It has animals like gazelles, lions, zebras, giraffes, buffalos, cheetahs, leopards, rhinos.
3. Tsavo Park (West Tsavo and East Tsavo). It is the largest park in Kenya and divided into two by the main road to Mombasa. It is famous for big games like lions, elephants (red elephants), giraffe, and rhinos.
4. Aberdare Park. This is famous for its treetops hotel –which view point enables the tourists to watch hundreds of elephants, buffalos, and rhinos which visit the rift valley floor that the hotel overlooks.

5. Lake Nakuru Park. This is famous for millions of flamingos which provide an exciting unique attraction and other attractions.
6. Other National Parks and Reserves of importance include: Amboseli NP, Malindi and Watamu marine NP, Sibiloi NP, Meru NP, Fort Jesus park, Marsabit park, Masai Mara national Park , Mt. Kenya NP, Simba hills reserve, Amboseli reserve, and Rahole reserve
7. Relief features. There are many mountain ranges which include: Mt. Kenya (with glacial features)—the second highest mountain in Africa (after Kilimanjaro), Mt. Elgon on the western border. In addition, the eastern arm of the Great Rift Valley appears in Kenya.
8. Drainage features. These include: the warm beautiful beaches at Mombasa for sun bathing, coastal features (like caves, stacks, arches, cliffs at Mombasa and Malindi). The famous beaches include: Nyali, Kikambala, and Shanzu. Lakes include: Lake Turkana—Kenya's largest lake, Lake Victoria (Victoria Nyanza),Lake Baringo, Lake Nakuru, Lake Magadi, Lake Bogoria among others . Rivers include: Tana, Athi, and Nyando. These lakes and rivers have creatures like fish, crocodiles, hippopotamus—which attract tourists.
9. Vegetation. Kenya has diverse plant life. This includes savanna vegetation consisting of grassland and tree species like Baobab, Euphorbia and Acacia; Tropical rainforests, Mangrove forests and palm trees along the coast; some temperate forests on the higher levels of highlands (above 3000m); Desert and Semi-desert vegetation. All these attract tourists.
10. Historical and cultural attractions. Historical sites include: Fort Jesus at Mombasa (built by the Portuguese in the 1590s), Fort Gedi near Malindi, the national museum of Nairobi, Kariandus, Olorgesailie (showing conditions of early Stone Age).

    One culture is that of the Maasai –which centres on their cattle for food, prestige and wealth. They believe that they own all cattle in the world. Other groups / tribes include Kikuyu, Luhya, Luo, Kalenjins, and Nandi.

<u>Factors responsible for the development of the tourism industry in Kenya</u>

The tourism industry of Kenya is more developed than other east African countries. This is explained by the following factors:

1. Availability of various fauna potentials in the country for example Kenya is endowed with the largest and richest animal species in the world such as giraffes, antelopes, lions, elephants, zebras, buffalos, leopards; plus ostriches, flamingo birds and vultures conserved in various national parks and wildlife reserves such as Nairobi NP, Tsavo NP, Lake Nakuru NP, and Maasai-Mara. This promotes sport hunting and animal/bird viewing. Kenya's major parks are also near Nairobi and Mombasa which minimizes inconveniences to tourists and encourages more return visits.
2. Varied vegetation types which include savanna vegetation consisting of grasslands and tree species like baobab, acacia and euphorbia; tropical rain forests, mangrove forests (along the coast), desert and semi-desert vegetation. Therefore, many people who live in the large urban centres/ conurbations of Europe and North America where nature has been destroyed are attracted to the large stretches of natural vegetation in Kenya for study, relaxation and adventure.
3. The magnificent / beautiful landform scenery that attracts tourists including Mt. Kenya with glacial features (like arêtes, cirques, and pyramidal peaks), Mt. Elgon, Mt. Longonot, Machakos Ranges, Mathew range. There is also the Great Rift Valley and associated features (such as escarpments). This encourages mountaineering, rift valley viewing and thus attracting many tourists for pleasure and study.
4. Presence of many attractive drainage features/Water bodies such as L. Turkana, L. Nakuru, L. Natron, L. Naivasha, Nyando River, Galana River, Tana River, Athi River, and the Indian Ocean. These water bodies do promote swimming, boat racing, rafting which activities attract tourists. More so coastal ports and beaches have developed such as on Malindi island, Pate and Lamu islands; important for tourism such as for sun bathing. This attracts a large number of tourists.
5. Presence of varied climatic types for tourism. Kenya's climate contrasts with other parts of the world and varies within Kenya itself. For example the cool to cold Kenya highlands and the warm to hot Mombasa coast. The tourists in need of cool conditions go to the Kenya highlands. The Mombasa coast attracts tourists from the cold regions at the time of winter in countries like USA,

European countries and Asia to enjoy the warm tropical sunny conditions at the coast for sunbathing . The northern part has a semi –arid climate which also attracts many tourists for study and adventure.

6. Geographical location near the coast (proximity to the coast) which promotes easy movement and accessibility of visitors into the country (unlike the big Tanzania and landlocked Uganda). Therefore, Kenya experiences more tourist arrivals and return visits since inconvenience to tourists is minimized. This also explains why Kenya's tourist industry is more developed in the region.
7. Availability of large sums of capital to invest in the tourist industry provided by foreigners from Europe and Asia, prosperous Kenyans as well as government. This has been invested in developing and maintaining parks and reserves , developing accommodation facilities , tours and agencies to the required standards. This in turn increases the number of tourist arrivals.
8. Improved transport network including road and railway networks, and a more efficient air transport responding to the required tourism standards. The Air ports include Jomo Kenyatta international air port which is linked to many international airlines, and hence Kenya is an entry point for tourists from far origins into the region. Others are Moi and Nairobi international Air ports. There are also smaller but improved Airports/ Air strips in strategic locations such as Kisumu and Malindi –transporting many tourists each year.
9. Rapidly developing accommodation facilities for example Kenya has the best hotels in the region, more in number and on international standards. These include: Hilton hotel, Serevo Stanley hotel, Hotel Diplomate, Intercontinental hotel, Ambassadors hotel, Fairview hotel, and Tiwi travelers beach hotel. These provide good accommodation, local and western foods, entertainment to tourists. It is impossible to view the skyline of Nairobi without being impressed by the number of hotels, symbolic of modern developments in tourism.
10. Presence of skilled and semi-skilled labour recruited by the tourism agencies as Tour guides, game rangers, receptionists in hotels and lodges, hotel managers, chefs/professional cooks, supervisors among others. These have been trained to cope with international tourism standards—hence attracting more tourists.

11. Relatively stable political atmosphere for a long period of time. Remember that tourists are easily discouraged by an atmosphere of unrest/insecurity. But since independence Kenya has been relatively stable which has boosted the confidence of tourists and also promoted the development of the required infrastructure such as modern roads in Nairobi. This in turn has encouraged tourist arrivals in the country.
12. Efficient tourism management and this was spearheaded by the Kenya Tourist Development Corporation established in 1965. Today there is the Kenya Wildlife Authority controlling/ managing the wildlife attraction areas, many Tours and Travel agencies which are linked to many international companies which offer attractive tour packages to tourists. This also leads to increase in the number of tourists.
13. Effective and increasing publicity/ advertising, both locally and internationally such use of local and international newspapers, magazines, DSTV, internet, brochures, and stickers. Such informative and persuasive adverts have opened Kenya's tourist potentials to the outside world, hence its development.
14. Hospitality of the Kenyans/ long presence of foreigners in Kenya. The Kenyan coast was earlier settled by the Arabs and the Portuguese who influenced the early developments. Kenya was also a British colony and many Europeans settled especially on the Kenya highlands. The European presence has continued to create an impression that Kenya is a friendly country, hence boosting the confidence of many tourists visiting Kenya, implying more tourist arrivals.
15. The cultural diversity of the country with various ethnic sites and cultures attracting many tourists such as the Maasai with their pastoral culture and the way of housing, the Kikuyu—the largest tribal group in Kenya, Luhya, Luo, Kalenjins, Kamba, Kisii. This relates to the way of living, homesteads, dressing, food eaten, and cultural dances. Besides, there are many historical sites especially related to the Portuguese and the Arab settlement on the coast like Fort Jesus mosques. This increases the inflow of tourists especially adventurers and education-oriented tourists.
16. Favourable government policy for tourism for example encouraging economic diversification to reduce over reliance on the agricultural sector. The government also supports tourism through maintaining good international

relations with many western countries; carrying out publicity campaigns abroad. It has also established tourist promotion offices in all the major tourist markets such as Paris, Newyork, London, and Tokyo. This has motivated the tourists and thus increased tourist arrivals.

17. Increasing research in the tourist industry for example the department of zoology—University of Nairobi, Tsavo ecological research centre—conducting research in eco-systems to maintain natural settings, improve wild life ecology. This has controlled the destruction of tourist potentials and continuous attraction of tourists from various parts of the world for study, pleasure and adventure.
18. Development / growth of package tour flights in Europe and North America – from which Kenya has benefited. Many people are given the opportunity to visit various parts of the world especially during winter when there are very few activities going on. This explains the increased number of tourists during this time of the year in countries like Kenya.

PROBLEMS FACING THE TOURISM INDUSTRY IN EAST AFRICA

1. Poaching which is the illegal hunting and killing of animals in national parks and game reserves –for meat, hides etc. The white rhinos are now almost extinct. Other threatened animals are elephants, buffalo, and chimpanzee. This reduces the tourist potentials in East Africa.
2. Population pressure/ rapidly Increasing population leads to increased demand for land for both settlement and farming such as in Tsavo Park in Kenya, and Kibale Park in Uganda –hence reducing the biodiversity and hence reducing the number of tourist arrivals.
3. Political instability/ insecurity in some areas which makes tourism both difficult and expensive such as in parts of northern Uganda (like Gulu district) and western Uganda (in Bundibugyo and Kasese) which have experienced insurgency for a long time. In the past rebels also attacked tourists in Bwindi impenetrable national park and of recent there has been terrorist attacks in some parts of Kenya. This is discouraging tourists and thus reduced income from the tourism sector.

4. Poorly developed transport net work/ remoteness of some tourist attractions far from the main cities of Mombasa, Nairobi, Dar es Salaam, and Kampala. For example Marsabit wildlife reserve in northern Kenya, Sibiloi national park in northern Kenya, Serengeti national park in northern Tanzania, Katavi plain reserve in Western Tanzania, Kidepo national park in north eastern Uganda. Poor road net work, lack of railway facilities and airstrips in many tourist attraction areas limit tourist visits. In East Africa, many roads are not up to standard which increases the costs and inconvenience to tourists and hence discourages return visits.
5. Less developed accommodation facilities for example very few hotels , lodges, camping sites and resorts to accommodate tourists ; and many of these existing facilities do not much to international standards and hence limiting on the number of foreign tourists .There are limited /no hotel facilities in some areas with tourist attractions such as Northern Kenya, North eastern Uganda and South western Uganda. This also limits the number of tourist arrivals.
6. Limited skilled man power/professional labour to manage the tourism industry such as managers and guides in hotels, tours and travel agency workers who can perform to international standards. This explains the poor management standards in many cases /areas in East Africa. This leads to a bad image and discourages many tourists.
7. Limited capital to invest in tourism which limits the setting up of tourist facilities such better hotels because it requires large capital investment. The alternative source of funds is borrowing, and yet tourists may not come in large numbers to cover costs and pay debts. This limits the growth of the tourism sector.
8. Low level of advertisement/ Inadequate publicity which limits awareness about the existence of some attractions and hence limiting the number of tourists visiting the areas. In East Africa it is Kenya which has performed better in international advertisement of the tourism potentials.
9. Competition from other countries such as South Africa, Egypt, morocco, Switzerland, Mexico —which countries have even better facilities. There is also competition among the East African countries due to the general similarity of tourist attractions such as wild animals and wild birds. This limits the benefits

from the tourism sector as some areas receive a small number of tourists per year.

10. Presence of hostile tribes to foreigners in their land who they at times suspect to have intentions of stealing their property especially grabbing land and animals. Such tribes include Karamajong of northeastern Uganda, the Turkana of northern Kenya, and the Maasai of Kenya rift valley. This also discourages the coming of many tourists and thus low tourism income.
11. Negative attitude/lack of a strong tourism spirit among local people in East Africa. Most people do not treasure wild life and other tourist attractions. And thus few local people tour within the region even when the charges are lower for local tourists. Therefore, the over reliance on foreign tourists undermines the development of the tourism industry in East Africa.
12. Low income levels among the local people and the majority spend their limited incomes on basic necessities such as food , clothing and shelter; instead of spending on travels for tourism. This factor also discourages local tourism and limits tourism revenue.
13. Language barrier between local people and foreign tourists due to limited use of international languages in many parts of East Africa, but a multiplicity of local languages. This limits communication with the tourists and hence few tourist arrivals. The main international languages are English and to some extent Kiswahili.
14. Geographical location far from areas where international tourists come from such as USA, Europe and parts of Asia. This has meant increased costs to foreign tourists and therefore many of them choose to visit neighboring countries such as the tourists from USA visiting more the Caribbean countries and parts of West Africa instead of visiting distanced countries of East Africa.
15. Seasonality of tourism activities/International tourists are seasonal and tend to come during the harsh winters in their homelands (that is, North America, Europe and Asia). This implies that East Africa doesn't receive large numbers of tourists throughout the year; and this undermines the development of the tourism industry.

16. Tropical pests and diseases which include tsetse flies causing sleeping sickness, mosquitoes causing malaria. This scares away many international tourists from visiting countries in the tropics including East Africa.
17. Pollution is becoming a major threat in some areas. For example Lake Nakuru and Lake Victoria is threatened by pollution from the various chemicals and oils from industries, vessels and farmlands. This makes such places less attractive to tourists and thus reduces the tourist arrivals.
18. Seasonal migration of wild animals to neighboring countries due to weather changes and other reasons. This implies seasonal reduction /lack of the attractions in certain tourism centres. This discourages return visits.
19. Poor management of some tourist attractions/tourism facilities for example uncontrolled tourism which has resulted into damaging of the environment. In some cases the tourists congest in specific areas, and in other cases the wild animals congest in particular areas—hence over straining the natural habitat.
20. Fires have destroyed some parts of parks, wild life reserves and forest reserves. The fires are either intentional or accidental caused by cultivators, hunters or careless smokers near or in the wild life conservation areas. This undermines the tourism potential in East Africa.
21. Unfavourable government policy towards tourism sector for example the government has given out some potential attraction areas to investors to carry out plantation farming such as parts of Ssese islands given out for oil palm growing. Many swampy areas/wetlands have been turned into industrial sites – hence limiting the tourist potentials and thus reduced number of tourists. The government also imposes high taxes on hoteliers and tours agencies which discourages some of them.

<u>Steps being taken to solve the above problems</u>

1. Regular patrols and setting up anti-poaching units to minimize poaching of wild animals, hence maintaining tourist potentials.
2. Eviction of encroachers and reduction of the human population within the surroundings of national parks, forest and wild life reserves.
3. New national parks have been opened up in various parts of East Africa purposely to protect the rare species such as gorillas, baboons, Chimpanzee, and Impala. This also increases the tourist potentials.

4. Diversifying the tourist products. This involves providing various tourist attractions apart from the traditional wild life attractions such as cultural, historical attractions and entertainment parks, in turn increasing the torust arrivals.
5. Using population control measures to reduce population pressure on conservation areas.
6. Resettling of people to avoid encroachment on the tourist attraction areas.
7. Restoration of political stability through peace talks and democratic governance, to raise the confidence of tourists.
8. Improving accessibility to the tourist attraction centres by rehabilitating roads and constructing airstrips.
9. Building more hotels and other accommodation facilities and also renovating the existing facilities to the required standards.
10. Educating and sensitization of the local people about the values of wild life conservation through the media, wild life clubs, and educational centres. There is also massive sensitization aimed at increasing the number of local tourists. Community participation is being encouraged to reduce poaching and encroachment on conservation areas.
11. Training manpower both locally and abroad to carry out work in the tourist industry such as tour guides, travel agents, and managers.
12. Attraction of local and foreign investors to invest in the tourist industry such as by constructing hotels, lodges, camps, travel agencies. Currently private investors have been allowed to construct hotels and develop other attractions such as amusement parks.
13. Increasing the advertisement of the tourist attractions / potentials through the media, stickers, and brochures, to raise awareness both locally and abroad; and hence increase the number of tourists.
14. Hostile tribes are being disarmed such as the Karamajong, and they are also being sensitized about the value of tourism.
15. Discouraging the burning and clearing of vegetation in areas surrounding parks and game reserves.

Guiding questions

1) Account for the growth and development of the tourist industry in Kenya.
2) The development of the tourist industry in Kenya is mainly attributed to physical factors. Discuss.
3) Examine the factors that have hindered the development of tourism in Sub-Saharan Africa.
4) (a) Identify the major tourist potentials of East Africa.
   (b) Discuss the problems facing the tourist industry in East Africa.
   © What steps are being undertaken to develop the tourist industry in the East African region?

Tourism in South Africa

South Africa is located in the southern part of the African continent. Tourism has expanded greatly in South Africa providing a great potential for job opportunities and foreign exchange.

During the apartheid years, the tourism potential could not be realized because of the country's negative image and perceived political instability. However, since 1994 the industry has expanded dramatically, with the number of overseas visitors greatly increased. Generally, the country receives over 3 million tourists per annum).

Tourist attractions

1) Relief landforms.
   The scenic beauty of the cape mountain ranges region, the Drakensburg, Mpumalanga Mountains and the Highveld plateau mountain Aux sources near Lesotho is a major tourist mountain.
2) Drainage features
   The rivers include Orange River, Vaal River and Limpopo River. Other shorter rivers include Great fish, Tugela, Umfolosi, Umgeni, UMzimkhulu and Umkuse. South Africa's notable lakes are artificial and include those created by Vaal dam and Gariep dam on the Orange River. Other attractions are the Atlantic and Indian Ocean beaches. Notable coastal beaches are at Cape Town, East London, Durban, Port Shepstone, Mosselbaai, Cape Agulhas, and Cape of Good Hope.
3) Vegetation types

Grassland covering most plateau areas, resembling a prairie on the nearly treeless Highveld. The Bushveld is characterized with scattered trees like baobab in the Limpopo province. There are coarse desert grasses in the semi-desert Northern Cape. The extreme southwest has Mediterranean vegetation. There are also flowers of Cape Town.

4) National parks and national reserves.

   The national parks include Kruger national park (the largest and oldest reserve) with nearly every species of indigenous wildlife such as impala, small black rhinos, elephant, baboons, lions, leopards, zebras, giraffe, and antelopes. Other parks are Kgalagadi Transformer Park (shared with Botswana) in the northwest, Addo Elephant national park near Port Elizabeth, Mountain Zebra national park, Tanka-Karoo national park, west coast national park, Bontebok national park, Zuurberg national park, St.Lucia park.

   The game reserves include Maputo elephant reserve, Giant Castle reserve, Umfolosi reserve, Mala Mala reserve, Mkambati reserve.

5) Historical sites, libraries and cultural attractions.

   There are many large museums and the most notable include National Museum in Bloemfontein, Museum Africa in Johannesburg, South African National Gallery in Cape Town, and South African Cultural History Museum in Cape Town. These have ancient collections like archaeology, paleontology and anthropology collections; as well as the history of South Africa. The libraries include Johannesburg public library, South African library in Cape Town, state library in Pretoria, and university libraries.

   There are also historical monuments such as Blood River monument in the east, Voortrekker fort north of Pretoria. Rock paintings and caves such as east of Mt. Aux sources, Kango caves near Bontebok national park are also attractions to tourists.

   There are cultural attractions in Zulu land such as Zulu wood carvings, basket work and stone carvings.

6) Recreation attractions.

   Sports are a major activity in South Africa. South Africa's rugby and cricket teams are among the world's best. Rugby is most popular among Afrikaners and cricket among the English speakers. Rugby and cricket taught in many

schools and hence other groups of people are taking up the games. Swimming and water sports, tennis and golf are also popular in the white community.

7) Mineral resources and associated industry.
   Gold fields on the Witwatersrand, diamond fields in Pretoria, Bultfontein and other areas. Other minerals are coal, tin and iron ore. There are many industries set up on the rand such as in Kimberley, Pretoria, Johannesburg, and Witbank.
8) Major fishing ports
   These include: Port Cape Town, port Nolloth, Saldanha port—all on the western coast.
9) Farming systems/areas.
   This includes Sugar cane growing in Natal region, Vine growing in Cape region, sheep rearing and cattle rearing especially ranching.
10) Climate

<u>Factors which have favoured the development of the tourism industry in South Africa</u>

1. Varied climatic types. South Africa enjoys a generally warm temperate climate. Most of the country experiences light rainfall and long hours of sunshine. There is semi-desert climate in the north west of the country with desert features which attract tourists. The extreme southwest has a Mediterranean climate. There is a striking difference between temperatures on the east coast and west coast. The east coast has higher temperatures due to the warm Mozambique /Agulhas current while the west coast is cooler due to the cold Benguela current. This therefore attracts tourists of different interests.
2. Varied vegetation types which includes grasslands covering most of the plateau areas of the Highveld, savanna vegetation with scattered trees like baobab in the Limpopo province, coarse desert grasses in the semi-desert Northern Cape, and Mediterranean vegetation in the extreme southwest. There are also planted coniferous pines from Europe and North America –to provide timber and wood pulp. All these attract many tourists interested in study and adventure.

3. Presence of many/ a variety of fauna potentials which include large mammals like Lions, Elephants, Zebras, Leopards, cheetah, Baboons, Hippopotamuses, Rhinos, and Antelopes. These are conserved in the national parks and reserves like Kruger national park, Kgalagadi Transformer Park, Addo Elephant Park, Mountain Zebra national park. The various birds like Ostrich, Francolin, Quail, Guinea fowl, Grouse, and Cape sugarbird. This also attracts tourists for study, adventure and leisure.
4. Beautiful landform scenery which includes mountains like Cape Ranges, Drakensburg, and Mpumalanga Mountains. These attract many tourists for mountain climbing and mountain viewing. There are also many coastal beaches such as at Port Elizabeth, East London, Saldanha bay, Durban, and Cape Town which attract many tourists to the sea activities like sun bathing, and boat racing.
5. Presence of attractive drainage features/water bodies which include the Atlantic and Indian Ocean, rivers (like Vaal, orange and Limpopo). These water bodies help in transporting tourists to various tourist destinations, and in other tourist activities like sport fishing, and boat racing. Besides the oceans offer beautiful beaches which attract more tourists for leisure activities.
6. Developed economic activities such as mining, industry, farming, trade and commerce. The miningof gold on the Rand, iron ore, coal, diamonds, and platinum attracts many tourists. South Africa is the most industrialized country on the continent with many industries concentrated on the Rand. Many people are attracted to these economic activities especially the scale of operation and the technologies involved—hence increasing the number of tourist arrivals.
7. Variety of heritage sites, monuments and historical sites in the country such as large museums—National Museum in Bloemfontein, Museum Africa in Johannesburg. Another unique museum is the Kimberley Mine Museum (to see the world famous diamonds). The historical monuments include Blood River monument in the east, Voortrekker fort north of Pretoria, rock paintings and caves. These attract many tourists who are interested in study and adventure in South Africa.
8. Presence of diverse cultures due to various ethnic groups in South Africa with different lifestyles such as dressing, dances, music, and cultural events. Each

ethnic group has its own eating customs and etiquette. The groups include the whites, Afrikaners, the Zulu, Swazi, Xhosa, Sotho, and Tswana. Whereas the urban people tend to adopt western patterns, the rural people tend preserve the traditional cultures. All these cultures offer interesting attractions to the tourists.

9. Strategic coastal location of South Africa which enables South Africa to receive tourists from all parts of the world such as North America, South America, Europe, Asia and Australia. This location makes it easily accessible by tourists since transport costs are reduced, and this increases the number of tourist arrivals.
10. Presence of developed accommodation facilities catering for all needs and classes of tourists such as Hotels, Rest houses, camping sites; coupled with entertainment facilities and dishes in various parts of the country. The national parks have lodges such as Kruger National Park with African-style huts. This increases the number of tourist arrivals. Examples of hotels in South Africa include: Cape Town Blouberg Beach Hotel, Haga Haga Hotel in East London, Trans—Karoo Hotel south of Kimberley, Mountain Peak Hotel and Holiday resort in Kwazulu Natal and Cathedral Peak Hotel in Kwazulu Natal.
11. Presence of modern/developed transport facilities with railways, roads and air lines comparable to Western Europe and North America. As such the tourists travel to and from South Africa quickly, easily and relatively inexpensive, and more so comfortably. More so the transport facilities themselves provide another attraction such as the electrified railway. This increases the number of tourists.
12. Hospitality of the South Africans/they are welcoming people given the long presence of whites in the country. More so, the end of apartheid changed the attitudes of many people of South Africa towards foreigners, hence accommodating all sorts of people from different parts of the world. This has increased the number of tourists in the country per year.
13. The diversity of languages spoken which adds to their ability to handle various categories of tourists regardless of social and political consideration. The languages include Afrikaner, English, Kiswahili, Dutch, Zulu, Tswana, and Xhosa.

Many tourists have therefore been encouraged to visit South Africa due to easy and comfortable communication.

14. Presence of skilled labour to manage tourism such as game rangers, receptionists, chefs, tour guides, managers, supervisors in hotels, tours and travel agencies, tour resorts in various parts of South Africa. These have been trained to cope with the world tourism standards, and hence attracting more tourist arrivals from different parts of the world.
15. Efficient tourism management standards such as by developed Tours and Travel Agencies with experienced management and many of them are liked to international companies which offer attractive tour packages. South Africa has some of the best beach hotels on the continent such as Cape Town to Durban with developed beach tourism that measures to world standards-hence attracting many tourists.
16. Availability of adequate capital to develop the tourism sector provided by the government, local and foreign investors. More capital is also generated from mining, industry and farming. This has enabled the modernization of accommodation facilities, developing of more tourist attractions, payment of labour and doing more research in the tourism industry. this attracts more tourist arrivals.
17. Improved communication and advertisement (developed local and international publicity), with increased use of local and international news papers , magazines , journals; use of the internet , use of DSTV system. This has increased the number of local and international tourists, since more information is given about the tourist potentials that South Africa has to offer.
18. Relative political stability of the country unlike other African countries, which has enabled tourism investment. More so, since the end of apartheid the tourism industry has greatly expanded with the number of overseas visitors increasing by a large percentage. This is because of the improved international image and increased confidence of tourists of South Africa.
19. Supportive government policy towards tourism development such as by gazetting national parks and wild life reserves such as Kruger National park, Maputo Elephant reserve; encouraging local and foreign investors in the tourist industry to develop accommodation facilities and in the tours and travel

companies. It has also developed road and railway net work. This has modernized the tourism sector.

20. Good international relationship between South Africa and other countries due to developed import and export trade such as the Rest of Africa, Asia, North America, and South America. There are also many foreign investors in South Africa. Therefore, many people have links with the country and encourage their colleagues to do business, study and adventure in South African tourism.
21. Participation in international organizations. With the end of apartheid, South Africa resumed participation in international organizations from which it was excluded for many years for example the United Nations in 1994 and it also became a member of the Common Wealth in the same year. South Africa is also a member of the African Union and the Southern African Development Community. The delegates pass on information about tourist potentials, hence increasing the inflow of many tourists.
22. High level of technology employed
23. Developed research in the tourism sector
24. Historical factor.

Note: rafting—an outdoor leisure pursuit of floating on a lake or river in a raft.

Tourism in EGYPT

Egypt is located in northern Africa and the country has a prominent tourist industry, and the country receives a large number of tourists per year. The major tourist attractions include:

a) Climate. A large area of the country (about 90%) is desert including the western Desert in the west and the Arabian Desert in the east. There are many desert features such as sand dunes, rock pedestals, and oases (Siwa, Baharia, Farafra, Dakhla and Kharijah found in the west). There is also Mediterranean climate in the extreme north.
b) Drainage features . These include the Nile River and Nile delta, Delta features such as lagoons and flood plains of the Nile delta, Mediterranean Sea, Red Sea, the Suez canal(195km long), Lake Nasser (a huge reservoir behind the Aswan high dam). There are also beaches such as Red Sea beaches (like Safaga), Sidi Abdul Rahman beach and other several Mediterranean Sea beaches. These beaches provide facilities for sea sports.

c) Relief features. The main tourist mountain is Mt. Sinai found in the north east (where the old testament says Moses was given the ten commandments) , several depressions within the desert including the Qattara depression (which has an area of about 18,000km^2 and reaches a depth of 133m below sea level). There is also the Libyan plateau which extends into Egypt.
d) Wild life .Varied vegetation types such as Mediterranean vegetation, desert vegetation, palm trees and flowers around the oases. Wild animals in national parks like Ras Muhaammed national park near Mt. Sinai, Catherine, and Montaza national parks. The wild animals include desert fox, hyena, jackal, wild ass, boar, etc
e) Historical sites/ attractions. Egypt is reknown worldwide for the the pyramids— which served as tombs for kings and queens,. There are several museums such as the Egyptian museum in Cairo, the museum of Islamic art in Cairo, Coptic museum in Cairo, the Greco-Roman museum. These have collections of ancient Egyptian art, Islamic artifacts, and woodcarvings. There are also many mosques, great monuments in Cairo (like the statue of President Nasser), Egyptian national library and Al-Azhar university library in Cairo, and El Sibu temple.
f) Diverse cultural attractions especially the Arabs and mixed races; with varying ways of life especially religious beliefs such as dressing in Hijabs , praying while facing Kabba in Mecca , eats etc. other people are the Bedouins who are nomadic Arabs, Tuaregs and Berbers.
g) Industrial establishments and towns such as in Cairo (El Qahira), Alexandria (El Iskandariya), El Minya, El Giza, Qena Ismailiya , El Mansura, Damanhur, Tanta, El Mahalla El Kubra, Port Saidi, and Mut . The industries include oil refineries, machinery, chemical, textiles, food processing. There are also urban facilities such as libraries, banks, recreational centres, and schools.
h) Water management schemes which include Aswan high dam project with a reservoir lake—lake Nasser, irrigation projects along River Nile and west of the Nile delta where crops like wheat, rice , cotton and fruits are grown.
i) Mining areas. The minerals include petroleum, natural gas, and phosphates. Over 80% of the oil/ petroleum comes from the fields around the Gulf of Suez-with Ramadan being the most important area. Natural gas fields occur in the western desert, offshore near Alexandria and in the Nile delta.

Note: The tourists come from Europe (Spain, France, Holland, Italy, and Germany), Asia and North America, plus the rest of Africa.

Factors for the development of the tourism sector in Egypt

1) Presence of varying and attractive climatic types. About 90 % of Egypt is desert including the western desert in the west and the Arabian Desert in the east. There are many desert features such as sand dunes, rock pedestals, and oases (Siwa, Baharia, Farafra, Dakhla found in the west) which attract many tourists for adventure, study and photography. There is also Mediterranean climate in the extreme north, which attracts tourists especially for beach activities like sun bathing, beach volley ball.

2) Presence of various attractive wild life which include vegetation types such as Mediterranean vegetation, desert vegetation, palm trees and flowers around the oases. There are also wild animals conserved in national parks like Ras Muhaammed national park, Catherine and Montaza national parks. The wild animals include desert fox, hyena, jackal, wild ass, and boar. These attract many tourist for study tours, adventure and photography.

3) Presence of beautiful/ impressive landform scenery which includes mountains like Mt Sinai; depressions like the Qattara depression. These attract many tourists for mountain climbing, mountain viewing and study tours.

4) Presence of attractive drainage features/water bodies which include the Red Sea, Mediterranean sea, the Suez canal, River Nile and the man-made lake Nasser. These water bodies help in transporting tourists to various tourist destinations such as the irrigated farmlands along the Nile, Cairo industrial centre, and still enhance tourist activities like sport fishing, and boat racing. Besides the oceans offer beautiful beaches such as Red Sea beaches (like Safaga), Sidi Abdul Rahman beach and Mediterranean Sea beaches which attract more tourists for leisure activities such as sun bathing, beach volley ball.

5) Presence of various developed economic activities such as mining of oil from the gulf of Suez; industry in Cairo and Alexandria; irrigation farming in Baharia and Dakhla oases; trade and commerce in urban centres like Cairo , Alexandria ,Qena, Ismailiya and Suez. All these attract many tourists to see the level of investment and the technology employed. Still many people who come for business find time relaxation and thus promoting the tourism sector.

6) Presence of diverse Egyptian cultures for example the Arabs with varying ways of life especially religious beliefs such as dressing in Hijabs , praying while facing Kabba in Mecca. Other groups are the Bedouins who are nomadic Arabs, Tuaregs and Berbers. All these have different lifestyles such as dressing, dances, music, and cultural events. All these cultures offer interesting attractions to the tourists who are interested in educational tours and adventure.

7) Strategic coastal location of Egypt near the Mediterranean sea and in close proximity to Europe and Asia which enables the country to receive many tourists from countries like Italy, Germany, France, Saudi Arabia, china, and India interested in adventure, beach activities, photography and leisure. The location makes it easily accessible by tourists since transport costs are reduced and this increases the number of tourist arrivals.

8) Presence of developed accommodation facilities catering for all needs and classes of tourists such as Nasser international hotels, forte grand pyramids hotel in Cairo, and other first class and middle class hotels in Cairo, Port Saidi, Aswan and Alexandria . These plus Rest houses and camping sites have large swimming pools, buffet/ dishes, and entertainment facilities to cater for the tourist needs. This increases the number of tourist arrivals.

9) Presence of modern/developed transport facilities with railways and roads linking various centres like Cairo, Alexandria, Aswan, Asyut, and Qena. The international airlines provide regular service between Cairo and Alexandria and the major world centres. Egypt has very many airports and airfields. Therefore the tourists travel quickly, easily and relatively cheaper, and comfortably to various attraction areas like the Aswan high dam and irrigated fields of the west. More so, the transport facilities themselves provide another attraction. This increases the number of tourists.

10) Hospitality of many Egyptians /they are welcoming people given the long. , hence accommodating various people from different parts of the world who are interested in attractions like mining areas of the gulf of Suez and historical museums in Cairo. This has increased the number of tourists in the country per year.

11) The diversity of international languages spoken which adds to their ability to handle various categories of tourists regardless of social and political

consideration. The languages include Arabic, English, Kiswahili, Italian and French. Many tourists have therefore been encouraged to visit Egypt due to easy and comfortable communication.

12) Large supply of skilled labour to manage tourism such as game rangers, receptionists, chefs, tour guides, managers, supervisors in hotels, tours and travel agencies, tour resorts in various parts of Egypt. These have been trained to cope with the world tourism standards, and hence attracting more tourist arrivals from different parts of the world.

13) Efficient tourism management standards such as by developed Tours and Travel Agencies with experienced management and many of them are linked to international companies which offer attractive tour packages. Egypt has some of the best beach hotels on the continent with developed beach tourism that measures to world standards such as at the Red Sea and Mediterranean sea beaches hence attracting many tourists.

14) Availability of adequate capital to develop the tourism sector provided by the government, local and foreign investors. More capital is also generated from mining, industry and irrigation farming. This has enabled the modernization of accommodation facilities such as hotels in Cairo and El Giza, developing of more tourist attractions, payment of labour and doing more research in the tourism industry. This attracts more tourist arrivals.

15) Improved/ wide advertisement (developed tourism publicity), with increased use of local and international newspapers, magazines/ journals; use of the internet, television networks like Aljazeera, CNN (cable news network) and BBC. These provide information about various tourist attractions/potentials such as the ancient pyramids of the pharaohs, the Aswan high dam, Nile delta and irrigation faming projects west of the Nile delta. This has increased the number of local and international tourists.

16) Relative political stability of the country which has enabled tourism investment and welcoming of many overseas visitors. This is because of the improved international image and increased confidence of tourists. Hence many tourists come to see the attractions like oil mining areas of the gulf of Suez, Mt. Sinai, the Qattara depression.

17) Supportive government policy towards tourism development such as by gazetting national parks and wild life reserves such as Ras Muhaammed national park, Catherine national park, and Montaza national parks; encouraging local and foreign investors to develop hotel facilities and invest in the tours and travel companies. It has also developed road and railway net work leading to various attractions areas like Cairo, Alexandria and Port Saidi. This has modernized the tourism sector.

18) Good international relationship between Egypt and other countries due to developed import and export trade such as the Rest of Africa, Asia, and North America. There are also many foreign investors in Egypt. Therefore, many people have links with the country and encourage their colleagues to do business, study and adventure in Egyptian tourism.

19) Tourism development in Egypt is also explained by the historical factor such as early civilizations, the pharaoh ancient palaces, the pyramids, museums in Cairo, temples. The relatively recent was Muhammed Ali and Khedive Ismail who carried out modernizations in urban areas like Cairo. This attracts many tourists interested in study tours, pleasure, and adventure.

Tourism in Switzerland

Switzerland has one of the most developed tourist sector in the world and tourism is the leading source of foreign exchange and a dominant employer. Switzerland's tourism started way back in the 18th century when Europeans admired and described the diversity of scenery and beauty of the Alps. The first were the British who discovered Switzerland as a holiday resort, followed by German visitors. In the last 80 years, the Swiss tourist industry has witnessed a complete revolution to the extent that today it commands a global image.

Tourist attractions and tourist resorts

1) The Alps—a magnificent mountain scenery which is also snow-capped with many glacial features such as hanging valleys, U-shaped valleys, pyramidal peaks, arêtes, corries/cirques, cirque lakes/tarns.
2) Water bodies. The Alps are dissected by rivers such as the Rhine River (one of Europe's major rivers), Rhone River, Ticino River, and River Inn. Lakes include

Lucerne, Geneva, Constance (Bodensee), Lugano, Maggiore, Neuchatel and Lake Zurich.

3) Wild life including plant and animal life. In the cooler more northerly parts , there is a mix of deciduous trees and coniferous trees—which are carefully managed to prevent any net loss of woodlands , preserving water quality and scenic beauty. The forests contain animal species such as the deer, fox, graceful chamois, ibex (wild goat); and many bird species such as wood pecker, peregrine falcons, golden eagles, and jay.
4) Industrial centres and urban centres. Due to the traditional policy of neutrality, many Swiss cities retain their good image such as Zurich, Basel, Bern, Geneva, Blenna, Vevey, Interlaken, St.Moritz, Le Locle, and St.Gallen among others. The main industries are: engineering, watch making, textiles, and chemical industries.
5) Culture and traditions. Swiss culture especially paintings, music and architecture are of great interest to tourists. There are many roman monuments in the towns of Martigny and Windisch; numerous cathedrals. The Swiss museums found in most towns contain thousands of old and rare works that date from the 8^{th} century. The national museum in Zurich houses many historical collections.

   Note: A Tourist resort is a place which attracts large numbers of holiday makers and having special facilities to look after them. In summer, the greatest activity is in the towns of the Swiss plateau such as Lausanne, Geneva, Bern, Zurich and the shores of Lake Lucerne. In winter the well known resorts are Grindelwald, Kandersteg, Murren, and St.Moritz. St.Moritz has the second largest number of hotels to Geneva.

Factors favouring the development of the Swiss tourist industry

Physical

1. Magnificent landform scenery which includes the Alps Mountain ranges dissected by many rivers and also glaciated with snow capped peaks and features like U-shaped valleys (e.g. Brunnen valley), hanging valleys, cirques and pyramidal peaks. The Swiss Jura is also a lower mountain found in the north west of the country and the ranges are separated by valleys and having limestone features. Many people are attracted to mountaineering and mountain viewing.

2. Varied drainage features for example Switzerland is the source of four major rivers of Europe, which have their sources from the heavy water precipitation and glacial melt waters of the Alps. Rhine River is the biggest river covering the central—northern part. Other rivers are Rhone flowing into Lake Geneva, Ticino flowing into Lake Maggiore, Inn flowing north east to join Danube River into the Black sea. Lakes include Geneva, Constance, Zurich, and Neuchâtel; which water bodies promote tourism activities like swimming, sun bathing, boat racing, blue water viewing, and sport fishing.
3. Varied vegetation types such as a mix of deciduous and coniferous trees which dominate in the cooler northerly parts. The most common deciduous trees include oak, beech, maple, and chestnut. Coniferous trees include spruce, pines and firs. There are also alpine flowers which attract tourists. The vegetation promotes forest walk, flower viewing, and hence a holiday resort for adventurers and study tourists.
4. Presence of many fauna potentials such as Chamois, marmot and ibex inhabit the Alpine region as well as the golden eagle and vulture. The forests contain animal species like the deer, fox; and many species of birds like the wood pecker, pheasant, peregrine falcons, and jay. All these promote animal and bird viewing and study tours, hence attracting large numbers of tourist arrivals.
5. Ideal climate for tourism and this has given Switzerland an opportunity throughout the year. In summer, the warm sunny days enable tourists to view the magnificent scenery of the snow capped peaks, clear blue lakes, and cascading waterfalls. In addition there is swimming, sun bathing, and boat racing among other activities. During winter, the big attraction is the abundance of snow on mountain slopes enabling ice skiing and ice skating.
6. Limited viable natural resources such as due to the rugged relief of the Jura and Alpine regions discouraging other economic activities such as crop growing due to the rocky soils and problems of mechanization. The Swiss Jura is also composed of limestone soils, which are highly permeable and thus not good for farming. Switzerland has limited viable mineral resources. All this has meant that tourism is the best alternative economic activity alongside industry.
7. Strategic geographical location in the centre of Europe and the link to the Rhine River which has enabled Switzerland to have a wide market of the rich nations

with many people capable of making holiday tours from all directions. About 70% of the tourists approximately come from European countries like Germany, France, Britain, Austria, Belgium, and USA. The remaining 30% are Swiss guests. This implies that the country receives very many tourists per year.

Human factors/ other factors

8. Presence of large sums of capital to invest in tourism sector provided by the developed banking sector (with a network of over 4400 bank offices covering the whole country). Many nations and wealth personalities have accounts in Swiss banks. This has facilitated easy converting of currency and provision of the required capital to develop various tourist facilities in form of loans. Many of the bank customers are also tourism investors.
9. Developed accommodation facilities such as hotels which are built to keep pace with the tourist demands. Originally, these were small inns and turbans to cater for travelers. Also chalets and camping sites to keep pace with the demand of holiday accommodation have been set up. These accommodation facilities occupy areas like Geneva, Montreux, Martigny, Zurich and St. Moritz. St.Moritz has the second largest number of hotels to Geneva.
10. Modernization of transport facilities such as the electrification of the railway system with modern tracks and locomotives to transport millions of visitors each year to various destinations in the country. About 99% of the Swiss railway is electrified. There are also cable cars and ski-lifts to ferry tourists to the higher grounds. The improved accessibility has meant lowered transport costs and saving time since the means are relatively quick, safe and comfortable.
11. High level of technology used in tourism which has enabled the development of cable cars, ski-lifts, and electrified trains. There are hundreds of finely engineered tunnels and bridges across the country's rugged terrain (Trans-Alpine tunnels that permit travel through the Alps). This increases efficiency in the tourism and encourages more tourist arrivals.
12. Hospitality of the Swiss people/ the Swiss are very welcoming people , whose culture of hospitality results from the fact that Switzerland is composed of diverse people in language , religion and culture ; yet they have stayed together for over 7 centuries. The Swiss are very friendly and always willing to serve the tourists regardless of political and social consideration.

13. The diversity of international languages spoken by the Swiss people such as German, Italian, Spanish, English, French, Rhato-Romania; and this has helped the natives to comfortably communicate with the tourists regardless of origin. In fact many people are bilingual and with English being the first language to be taught in school , many people become trilingual which has positively influenced service delivery in the tourism industry.
14. Efficient publicity and advertisement of the tourism sector such as using internet (a computer-based global information system) via which millions of tourists can access information about the Swiss tourist industry. The tourist industry is also well advertised worldwide through newspapers, magazines, televisions, brochures and this has greatly widened the market for the Swiss tourism sector, hence more tourist arrivals.
15. Highly skilled labour to manage the tourist industry since tourism has been a tradition for long. This tradition dates back in the 18th century when the Europeans admired and described the diversity of scenery and beauty of the Alps. Many people have been trained as hotel managers, supervisors, accountants, tour guides, chefs, and drivers. This has increased the quality of service delivery and encouraged more tourist arrivals.
16. Efficient tourism management standards catering for the particular needs of tourists like entertainment and food in relation to modern standards. The Swiss have a genuine art in hotel management with a classic worldwide example. There are many tours and travel agencies which organize tour packages on a very large scale such as air, coach travel, train travel, and arrange accommodation for the tourists in various attraction areas.
17. Switzerland's policy of neutrality which dates back since the 16th century with the Swiss confederation not being involved in any war. This has made the country politically stable so as to save the resources available for promotion of tourism, unlike other countries which spend their resources on military warfare. A stable political history has also made Switzerland a holiday resort for many people from various parts of the globe.
18. Switzerland is the headquarters of many international organizations such as the International Labour Organization (ILO) in Geneva, World Health Organization (WHO) based in Geneva, International Committee of Red Cross (ICRC), and

Federation of International Football Association (FIFA) in Zurich. This attracts many delegates who are either tourists or even tourism investors.

19. The developed industrial sector of Switzerland for example it is the world's leading watch making country based in the Swiss Jura region. The country exports over 97% of her watches and satisfies a large percentage of the world demand. Other major industries include engineering, textiles, chemical and precision instrument industries. Many tourists are attracted to see the advancements in technology in the industrial sector.
20. Supportive / positive government policy towards tourism such as large capital investment in the sector, regulated tourism standards through policy, spearheaded and encouraged tourism research to modernize the attractions as well as private investment in the tourist industry. This is due to the need to protect the global image of Switzerland.

Problems facing the tourism industry in Switzerland

- Competition from other tourist countries which reduces the number of tourist arrivals. The countries include USA, Italy, South Africa, and Mexico—which countries have many facilities. Some countries like Italy have some similar tourist attractions such as glaciers, wild animals and wild birds. This limits the benefits from the tourism sector by limiting the number of tourists per year.
- Seasonal nature of tourism which leads to fluctuation in incomes from tourism. There is a variation in the number of tourists depending on seasons of winter, spring, summer and autumn because the tourists have different interests. For example, some tourists do not want to visit the country during harsh winters. Therefore, the country doesn't receive large numbers of tourists throughout the year; and this undermines the development of the tourism industry.
- Harsh winters which limits the movement of tourists, hence limiting tourist arrivals.
- Rugged / mountainous landscape in some areas making them less accessible to tourist. For example, some parts of the Alps are not easily accessible by tourists due to rugged landscape. This limits the tourist from fully experience the tourist potentials. The use of cable cars increases the costs to the tourists.

- Language barrier in some cases which limits the number of tourist arrivals . There is a Language barrier between local people and foreign tourists due to some tourists are not familiar with the international languages in many parts, which limits communication with the tourists and hence few tourist arrivals.
- The threat of deadly diseases today in some parts of the world such as ebola, which limits the number of tourists visiting the country. Deadly diseases break out in various parts of the world such as ebola which broke out in many parts of West Africa in 2014. Accordingly, the various countries including Switzerland restricted on the number of people coming from Africa to control the spread of the disease, hence limiting on the number of tourists and hence reduced tourist incomes. Still some tourists just fear to move around the world to reduce risks of interacting with infected people.
- Poaching of wild animals which reduces the tourist potentials in the country. Poaching is the illegal hunting and killing of animals in national parks and wildlife reserves –for meat, hides etc. Some of the animals and birds are threatening extinction and this reduces the tourist potentials.
- Wild fires such as in the coniferous forests which also reduces the tourist potentials. Fires sometimes destroy some parts of national parks and forest reserves in some areas. The fires are either intentional or accidental caused by hunters or careless smokers near or in the wild life conservation / tourism potential areas. This undermines the tourism potential and thus limiting the incomes from the sector.
- Pollution of the environment such as water and air pollution due to disposal of wastes and emission of dangerous gases which destroys tourism potentials. Pollution is becoming a major threat in some areas with many industries such as the Swiss Plateau. This makes such places less attractive to tourists and thus limiting incomes from tourism.
- Shortage of labour to manage the tourism industry. This is because some people prefer to work in other sectors with better payment, and this limits efficiency.
- Population pressure in some areas which leads to increased demand for land for both settlement and other activities, hence reducing the biodiversity and hence reducing the number of tourist arrivals.

- Restrictions in the giving of visas, deportation of some people, which limits the number of tourist arrivals.
- World economic recession which has reduced world incomes and therefore reducing the numbers of tourists.
- Terrorism threat in the world today which limits the number of tourist arrivals/ which scares away tourists.
- Accidents due to avalanches, and melting ice which leads to the death of tourists, hence scares some other potential tourists.

Tourism in USA

USA is part of North America and the country has a well developed tourism industry which plays an important role in the development of the country.

Major tourist attractions

a) Drainage features

   These include the St. Lawrence Seaway which connects the Greatlakes region to the Atlantic seaboard. It has several locks, canals and dams. The Greatlakes (lake superior, lake Michigan, lake Huron, lake Erie, and Lake Ontario). Rivers such as Mississippi river, Tennessee river, river Ohio, river Colorado , river san Joaquin and river Sacramento. Waterfalls such as Niagara Falls (known as a natural wonder)

b) Relief features

   These include the Appalachian Mountains in the east (states of North Carolina, West Virginia and Virginia). The Appalachian mountain system is nearly parallel with the Atlantic coast extends up to 2400 long. The Rocky mountain system in the west, the Sierra Nevada Mountains in California.

c) Varied climatic types

   This ranges from cool temperate, warm temperate to arid climate. The arid climate of southern California with plenty of sunshine is a major tourist attraction. In winter season (Nov—Feb.) the tourists engage in skiing and ice skating while in summer the tourists enjoy sun bathing , boat racing and swimming.

d) Wild life

The varied vegetation types include coniferous forests, Mediterranean vegetation, desert vegetation, sub-tropical forests. Most tropical vegetation and animals exist in the southern sunny states of USA. Also yellow stone national park is famous for geysers and cascading waterfalls.

e) Historical sites and cultural attractions

USA has several museums such as Newyork international museum; Croker Art Museum in Sacramento, the Oakland Museum of California. The Statue of liberty in Newyork city, the famous Golden Gate Bridge in San Francisco. Mt.Rushmore National Memorial (in the Black hills of Dokota) with magnificent carvings of America's past presidents (like Washington, Jefferson, Lincoln and Roosevelt).

USA has many cultures ranging from blacks, Red Indians, Spanish, Italians, Dutch and mixed races; with varying ways of life including dressing, dances etc

f) Industrial establishments such as in the Greatlakes region, Newyork, Boston, Pittsburgh, San Francisco, Los Angeles. The industries include: iron and steel, chemical, motor vehicle, food processing, and the unique film industry in California State.

g) Water management schemes which include Tennessee valley project, the delta Mendota scheme in California, Shasta dam and Friant dam in California.

h) Mineral resource areas. These include the Rocky mountain region, Appalachian region, and the Greatlakes region. The minerals include iron ore, gold, coal, copper, petroleum, and natural gas.

Factors favouring the development of tourism in USA

1. The varied climate types from region to region. The winter season occurs between November and February; spring follows between February and April; summer (April to August) and autumn (September to November). In summer the tourists enjoy sun-bathing, boat racing and swimming while in winter they engage in skiing and ice skating. Newyork area has an attractive sub-tropical (warm temperate) climate. California is an example of a semi-arid especially the southern part (with associated desert features). This leads to large numbers of tourists with varying interests.
2. The magnificent landform scenery for example the western highlands (Rocky Mountains) running from Mexico to Alaska for 4800km parallel to the coast. The

eastern highlands (Appalachian Mountains) running from the end of the St.Lawrence river to the Gulf of Mexico and parallel to the coast. USA also has beautiful beaches on both the eastern and western coasts conducive to accommodate tourists such as Newyork, Boston, and Santa Monica beach on the coast of California. Many people are attracted to mountaineering and coastal activities.

3. Presence of varied drainage features like Niagara falls, St. Lawrence, the Greatlakes, Mississippi River, Tennessee, Colorado, San Joaquin. Such water bodies are tourist attractions and also help in transporting tourists and other tourist activities like boat racing.
4. Presence of varied vegetation types which include coniferous forests, warm temperate vegetation and desert vegetation. For example the temperate grassland on the interior plateau towards the prairies attracts many study tourists. There are also a variety of flowers and infact Georgia and Carolinas are famous to be 'homes of flowers'. These attract many tourists for pleasure, curiosity and study tours.
5. The varied fauna potentials for example most tropical animals and birds exist in the sunny southern states of USA. The conservation of wildlife is done in national parks, reserves and research centres. The national parks include Rocky Mountains national park, Zion national park and Bryce canyon national park, Grand Teton national park in Salt Lake City, Yellow stone national park. The western states boast of having the most spectacular national parks in North America. USA has bird species like California condor, bald eagle, parrots. All these attract many tourists for curiosity, adventure and educational tours.
6. Availability of large sums of capital to invest in the tourism sector provided by the banking sector, wealthy local businessmen, and government and foreign investors.
7. Well developed accommodation facilities such as hotels, lodges, holiday apartments, and camping sites. The luxurious hotels attract high-class and middle class tourists especially on the coastal seaboard (Newyork, Boston, Halifax, Los Angeles, San Francisco). Hotels include Hilton in Newyork, California Holister beach hotels, and Miami Beach hotels in Florida.

8. Efficient transport and communication system with the most dense railway and road network in the world. USA also has the greatest air traffic in the world and world standard airports such as new ark airport and john f Kennedy airport in Newyork, Los Angeles international airport and San Francisco airport. Other transport systems include the St. Lawrence Seaway, pacific and Atlantic Ocean transport. This facilitates easy movement of tourists to various attraction centres and yet they are attractions themselves.
9. Efficient publicity and advertisement for the tourist industry.

10. USA'sposition as the head quarters of many international organizations which include United Nations Organization (UNO) in New York, IBRD (World Bank), international monetary fund (IMF).
11. USA has been politically stable for a long time and not been directly affected by major wars since even the world wars were fought off the continent of North America. The peace and stability has enabled the continuous improvement of the tourism attractions, and also gives confidence to the tourists.
12. Presence of many people in the affluent class (many rich people) and the country has a high per capita income. This factor avails more local tourists in USA and the development of package tours. The high population of USA further enhances tourism development.
13. Historical factor and cultural heritage for example USA is made up of people of various origins such as blacks, Spanish, red Indians, Chinese, and Dutch with diverse cultures. There are also many historical centres/sites.
14. Presence of skilled manpower to manage tourism.
15. The hospitality of the Americans
16. The diversity of international languages used, which include Arabic, Jewish, Spanish, Afrikaner, English, German, Latin, French, etc
17. Presence of a developed economic activities such as mining, industrial sector, trade , farming etc
18. Advancement in technology in the tourism sector.
19. Rapidly growing research to promote the tourism sector.
20. Favourable government policy towards the tourism sector. The federal governments fund tourism development.

21. Strategic geographical location of USA bordered by the Atlantic and Pacific oceans.

[Note: The tourist activities include: picnics, educational and scientific research, forest viewing, nature walk, forest walk, animal viewing, game hunting, flower viewing, camping, sun bathing, boat racing, rafting, mountaineering / mountain climbing, ice skiing, ice skating urban tourism, etc

Tourism industry involves development and conservation of tourist potentials like conservation of nature; transportation of tourists, tour guides and operators, hotel management etc]

Guiding questions:

1) Assess the contribution of the tourist industry to the economic development of either developed or a developing country.
2) To what extent are physical factors responsible for the development of tourism in either Switzerland or Egypt?
3) Examine the factors that have contributed to the development of tourism in either Switzerland or Kenya.
4) Account for the growth and development of the tourist industry in either republic of South Africa or USA.
5) Discuss the problems facing the tourism sector in either USA or Tanzania.

TRANSPORT

Transport is the physical movement of people or commodities from one place to another. The level of development of transport and communication network is usually a reflection of the level of economic development in any given region.

Accessibility is the ease of reaching a desired destination. Mobility in the transport context is the ability of individuals to move about.

Role of transport in economic development

1. Transport opens up new markets for produce such as highways, feeder roads. This promotes agricultural development by lowering costs, saving time, extending extension services, and opening up the formerly unproductive areas. In order to develop economically, countries must able to export their produce.
2. Promotion of industrialization by encouraging investors and therefore increases capital inflow, influences industrial location and distribution. This is due to easy movement of raw materials to the industries and movement of finished goods to markets.

3. Allows regions to specialize in the production of commodities where they have comparative advantage. This creates effective demand and supply relationships. The goods are easily transferred from areas of production to areas of market.
4. Joining areas of surplus and deficit. The export and distribution of commodities leads to sustainable development of economies and minimizing scarcity of commodities. This in turn controls the rate of inflation.
5. Promoting local, regional, and international trade and this leads to interstate cooperation and unity. This is because the agricultural products, industrial products are easily transferred from areas of production to marketing centres. This in turn increases national income.
6. Encouraging spread of ideas leading to cultural, economic, social, and political transformations. Transport enables diffusion of ideas such as on science and technology leading to innovation and invention in the countryside. This in turn supports various economic activities like agriculture, and trade.
7. Promotion of tourism development such as in Republic of South Africa, Switzerland, Mexico, Kenya, and USA. This makes the tourist areas easily accessible/ facilitates easy movement of tourists to various tourist potentials. This eventually increases foreign currency which is invested in various sectors like education, and health.
8. Generation of many employment opportunities, associated with all transport systems and networks. Many people are employed as engineers, pilots/ drivers, cargo managers, and accountants. These earn salaries and wages which they use to improve their standards of living in areas of health , housing, and recreation.
9. Enhancing political control, national unity and efficient administration. This is because the government bodies like ministerial head quarters and police are easily set up in various parts of the country. It also promotes political stability due to easy monitoring of various parts of the country and this is associated with balanced regional development.
10. Promoting urbanization/ growth of urban centres. There is a relationship between transport and settlement especially urban and coastal areas, depending on the trend it takes. Therefore transport increases population concentration in many areas such as towns and this results into expansion of

urban activities like trade and commerce, banking, insurance, ware housing, and entertainment.

11. Generation of government revenue through taxation of the sectors using the transport systems such as agriculture, tourism, banking, and industry. The government revenue is to meet the government budget, hence financing more infrastructural development.
12. Promotion of economic diversification because of the diversified forms of transport such as road, railway, water and air. The transport systems uplift various economic sectors like tourism, mining and industry. This in turn widens the gross domestic product (GDP) and the export base of the country.

Negative effects/short comings

1. Transport is associated with accidents which are disastrous to lives of people and property. This is noted with railway, road, water and air transport such as crashing of planes, capsizing of vessels, collusion of vehicles.
2. It is associated with traffic congestion causing unwanted delays in the delivery of goods and services, and thus undermining the development process.
3. Results in high rates of environmental pollution, that is, air, water and noise pollution. The emitted fumes from automobiles are dangerous to the life forms of the environment like it causes respiratory diseases.
4. Results into destruction of vegetation such to construct roads, railways, and airports. This results into soil erosion and land degradation due to reduced soil stability on the road/ railway sides.
5. Transport is associated with increased crime rates, wherever they occur. For example there is highway robbery on the Trans-African highway in particular sections like valley areas, and forested zones; railway station theft and of recent world terrorism evident in air transport.
6. High costs of construction and maintenance of the networks such as port facilities, railway lines, roads etc. In turn, there is increased government expenditure on the maintenance of such networks, hence straining the government budget.
7. Over exploitation of environmental / natural resources leading to quick depletion. This is through increased accessibility to various resources such as mineral resources, forest resources- working against the future generations.

8. Results urban-related problems such as congestion/ overcrowding, and slum growth. The eradication of such problems is very costly to the government.
9. Leads to regional imbalance in development. Easily accessible areas are more developed in terms of infrastructure than other areas, leading to income inequalities.
10. Results in rural-urban migration which has disastrous impacts on both the source areas (rural) and receiving areas (urban). For example decline in crop cultivation in the rural areas yet there are urban problems created (like slums).
11. Displacement of many people during transport development. As transport routes are being constructed or expanded, many people are displaced from their settlement and production areas with little or no compensation. There is also a problem of resettlement of the displaced people.

Guiding questions

1) Explain the role of railway transport in the development of either Switzerland or the republic of South Africa.
2) Examine the contribution the transport sector to the development of either USA or Egypt.

FACTORS LIMITING THE EFFECTIVE UTILIZATION INLAND WATER TRANSPORT IN AFRICA

Inland water transport in Africa involves the use of rivers and lakes. Rivers include: Congo River, Niger River, Nile River, Volta River, Zambezi River, Senegal River, among others. The lakes include: Victoria, Tanganyika, Malawi, Kyoga, Chad etc. The factors/problems limiting the effective utilization of inland water transport in Africa include:

1. Presence of waterfalls, rapids and gorges along the courses of rivers and therefore a few rivers are navigable throughout their length. For example the Nile River has 5 major waterfalls and several rapids. The Congo River is navigable up to 140km, but the course is broken by rapids and falls up to Stanley Pool.
2. Presence of floating islands and vegetation/Sudd along the courses of rivers such as along the Nile papyrus rids close in and navigation is not possible up to Juba. This also makes the rivers unnavigable throughout their length. Also the

existence of swamps and swamp vegetation on lake shores such as Kyoga limits the use of such lakes for transport.

3. Presence of rock outcrops along rivers and shores of lakes such as Nile and Lake Victoria. These prevent the movement of water vessels in such areas. The rivers are also fast flowing in the highland areas, and hence a higher risk of accidents.
4. Fluctuation in volume seasonally/river regime. Water levels fluctuate between wet and dry seasons. At low water the rivers may not be navigable yet at flood it may be too dangerous. For example the 4200 km long Niger River is subject to marked seasonal fluctuation. Others include: Vaal, Zambezi, and Limpopo.
5. Shallowness and narrowness of rivers. Many rivers are too short and too shallow for navigation especially the rivers flowing in mountainous regions like Ethiopia highland areas. There are sandbars at the mouth of rivers which make water shallow making it hard for ocean-going vessels. Also many lakes have shallow waters which limit navigation such as Lake Kyoga, Lake Chad.
6. Remoteness of rivers/ many rivers which would be capable of carrying much trade flow through sparsely populated areas and thus water transport there would be uneconomical. A case in point is river Congo.
7. Rivers tend to meander in their flood plains making the distance covered by the river much longer than a similar journey on land. Some people chose to use land transport instead of water transport.
8. Presence of steep-sided valleys such rift valley lakes –Lake Tanganyika, Lake Albert, and Lake Malawi, rendering water transport on such lakes less attractive.
9. Low level of economic development in the immediate hinterland. Some rivers flow across empty and unused land, thereby being uneconomical to use, since the areas lack cargo like river Congo. Yet also some areas lack major water bodies to be utilized for water transport.
10. Silting of many large rivers especially at their mouths. This increases the shallowness of channels such as Nile River and Nile delta, and Niger River and Niger delta. There is also siltation of lake shores due to deposition.
11. Strong winds on lakes and some rivers causing accidents, in certain times of the year. This limits the use of the lakes and rivers for water transport for fear of losing life and property.

12. Presence of predators such as crocodiles, and hippos. These at times over turn boats and threaten the lives of the travelers on water, and hence limit the effective use of water transport.
13. Limited capital to develop the inland water ways. Canal construction and the streamlining of rivers (e.g. by blasting rocks) requires a lot of capital. Also establishing ports requires high capital engineering. More so the volume of traffic is too small to warrant development of inland water ways.
14. Low levels of technology and limited skilled labour to modernize the inland waterways such as to develop ports and related facilities. This also limits the volume of cargo handled by inland waterways.
15. Political differences between countries through which the rivers pass. African countries in some cases do not cooperate yet the rivers cut across many countries. For example political differences between Senegal and Gambia have prevented development of the Gambia River, yet it is one of the most navigable rivers on the continent. Other cases are Uganda and Sudan (the Nile River).
16. Political instability / lake pirates such as on Lake Victoria, along river Congo. This puts the lives and property of the water travelers at risk all the time especially in the isolated parts where the rivers pass. Eventually the number of people using the inland water transport reduces.
17. Competition with faster means of transport such as by road and railway. These are more convenient and quicker means of transport than water transport. These limit the number of people using water transport.

PROBLEMS FACED IN THE UTILIZATION OF INLAND WATER TRANSPORT IN NORTH AMERICA AND WESTERN EUROPE

Inland water transport in Europe and North America involves the use of rivers and lakes. The major rivers in Europe include: Volga, Danube, Rhine, Rhone, Po, Inn, and Elbe. The lakes include Lodoga (N.W Russia), Geneva, Maggiore, Lugano, Lucerne, Constance etc.

The major rivers in north America include: St. Lawrence, Mississippi—Missouri river system, Tennessee, Columbia, san Joaquin, Sacramento, Colorado, Fraser, Yukon, Mackenzie (Canada). The lakes include Greatlakes (superior, Michigan, Huron, Erie, Ontario)

The problems limiting the utilization of inland water transport include:

1. Freezing of the water ways during winter which limits their use during this season. For example the St. Lawrence sea way is frozen 3 to 4 months (December to march)
2. Flooding of rivers especially during spring to summer. For example in spring when the winter snow begins to melt and in early summer when the glacial melt water comes down from the Alps.
3. The rivers meander in their lower courses which makes navigation difficult. For example, the Mississippi river meanders through the flood plains for about 1600km.
4. Shallowness and narrowness of river valleys. The materials eroded upstream is deposited on the river's bed in the lower section making it shallow and therefore limiting the size of the vessels it can handle. There are also narrow valleys and fast flowing rivers in the highland regions, making navigation very difficult.
5. Presence of rapids and waterfalls along river channels .For example Niagara Falls and rapids along the St. Lawrence River. The Rhine River is only navigable up to Basel and beyond this point; there are many waterfalls and rapids especially in the rapids.
6. Some rivers flow through unproductive and under populated regions, which also limits their use.
7. Foggy conditions cause poor visibility and accidents. For example at the mouth of the st. Lawrence, and this affects shipping.
8. High costs of maintenance of the waterways such as costs of constant dredging, construction of canals and locks.
9. Delays in shipping of cargo. For example St. Lawrence seaway has many locks used to adjust water levels for navigation(both single and double)
10. Limitation in the size of ships/vessels especially the canal sections. Due to ever growing technology, the bigger ships cannot sail through these sections; which affects the delivery of goods. This is a case with St. Lawrence Seaway and Rhine waterway.
11. Water faces competition from other forms of transport such as road net work and railway.
12. Flooding during the rainy seasons also limits the use of the waterways.

Steps taken to solve the above problems

1. Construction of locks in areas where the water levels are different, some single locks and other double locks. For example Beauharnais locks and st. Lambert locks along the st. Lawrence Seaway.
2. Construction of canals to bypass some rapids and waterfalls such as Welland canal which by-passes the Niagara Falls.
3. Constant dredging to maintain the depth of the water channels /rivers by removing the silt to allow large cargo-liners to sail.
4. Construction of dams or barrages which hold back water and give greater depth thus overcoming the problem of shallow channels.
5. Use of ice-breakers during the winter season to enable navigation.
6. Use of alternative routes such as roads and railway in winter when the waterways are frozen. This enables continuous distribution of goods.
7. Blasting using explosives to shatter rocks into small pieces, which can easily be removed. This makes the rivers deep and wide for navigation.

Guiding questions

1. Examine the problems encountered in the utilization of inland water transport in either USA or Africa and suggest the steps that can be taken to improve water transport in the chosen area.
2. Examine the influence of inland water transport on urban development in either North America or Europe.

THE RHINE WATERWAY

The Rhine is the most important waterway in Europe and is the world's most efficient waterway system. It is the principle route from Basel in Switzerland to Rotterdam in Netherlands. It is linked with a system of canals which improves its transportation capacity; such as Rhine-Rhone canal, Main-Danube canal, the Mosel-Rhine canal, Dortmund Ems.

The Rhine passes through the most industrialized part of the continent-the Ruhr region) and enters the busiest sea in the world –the North Sea. From the source (Swiss Alps) to the mouth (Rotterdam) it serves 6 Western Europe countries – Switzerland, Germany, France, Netherlands, and Belgium. Its tributaries include: Mainz, Lippe, Mosel, and Ruhr.

A sketch map showing the Rhine waterway

Factors which have favoured the development of the Rhine waterway

1. The availability and exploitation of various mineral resources such as iron ore from the Ruhr, coal from the Ruhr and from the Saar coalfields of Germany; limestone from Swiss Jura. These needed to be shipped to industries such as in the Ruhr Westphalia region, Zurich and Berlin in Germany. This has increased the importance of Rhine waterway-hence its development.
2. The Rhine waterway is linked with a system of canals which improves its transportation capacity. These canals include: Dortmund Ems, Lippeseite canal, Main-Danube canal, Mosel-Rhine canal (connecting to the Lorraine coal fields of France); Rhine-Rhone canal to Basel. This has enabled the Rhine to be a transit waterway for bulky goods from Germany, Switzerland, Austria, and France.
3. Strategic location of the Rhine in the centre of Europe. Still its mouth is on the North Sea which is the busiest sea in Europe. This made the Rhine usable by many vessels in countries such as Belgium, France, Germany, Switzerland, and The Netherlands.
4. High level of industrial development. The Rhine passes through one of the most industrialized parts of the world—the Ruhr industrial complex of Germany and enters the North Sea (the busiest sea). Rapid industry has enabled the Rhine to trans-ship cargo to and from the Ruhr region. The cargo to the interior includes iron ore, cotton, tropical timber, coffee and today the most important is oil. The seaboard goods include automobiles, engineering machinery, chemicals, and general merchandise.
5. The rapid development of Rotterdam port. The Rhine enters the North Sea at Rotterdam which also owes its growth to the rich hinterland. Rotterdam is an entreport to Europe, has a New Waterway and major industrial establishments. This has also increased the importance of the Rhine waterway.

   Apart from Rotterdam, other important ports along the Rhine include Bonn, Koblenz, Mainz, and Basel. This has made the waterway to handle thousands of deep sailing ships handling over 220 metric tons per year.
6. The desire to link the Rhine countries such as Switzerland, Germany and Netherlands. The Rhine has a position as a unifying factor in Europe. It upon this that the governments have made the Rhine developed such as modernizing

Rotterdam port at the mouth, development of canals, New waterway. Political unity among the countries increases the volume of traffic handled by the waterway.

7. Ice free conditions of the waterway. In the lower part of the Rhine, there are ice-free conditions throughout the year due to the effect of the north Atlantic drift ocean current. This enables usage of the Rhine for a greater part of the year.
8. The Rhine is navigable for a large part from Rotterdam up to Basel. For this part it is not interrupted by waterfalls/rapids in its channel this increases its use and the volume of cargo handled by the waterway.
9. Presence of adequate capital provided by the Swiss, Germany and Dutch governments. This helped to streamline the river for navigation, establishing ports for shipping and purchasing technology used for dredging, straightening and construction of various canals.
10. High level of technology/ Advanced technology is used for dredging, straightening and the vessel construction technology. This in turn increases the number of vessels using the Rhine waterway.
11. Presence of highly skilled labour force such as engineers, geologists who helped the waterway such as dredging of the waterway to deepen it for use, vessel construction for shipping, port construction, and canal construction. This has increased the importance of the waterway.
12. Relative political stability in the area where the Rhine waterway flows. This has increased the confidence of investors in developing the waterway and also increasing the volume of cargo transported along the waterway.
13. The rapid urbanization in parts of Europe where the Rhine passes, hence capable of handling much trade. It flows through the densely populated Ruhr conurbation, Basel area of Switzerland, port Rotterdam area. This makes the use of the Rhine waterway more economical.

<u>Importance of the Rhine waterway</u>

1. Facilitates trade and commerce through importing and exporting large quantities of commodities for countries like Germany, France, Belgium, Netherlands and Germany. The upstream cargo(imported goods) comprises of

iron ore, coal, crude oil, cotton wool, food stuffs(like wheat, dairy products); and tropical hard wood timber. The downstream cargo (exported goods) comprises of chemicals, vehicles, machinery, diesel engines, newsprint, textiles, optical instruments (like cameras, binoculars from Switzerland), and automobiles especially from Switzerland –Germany. This leads to the expansion of productive activities such as industry.

2. Promotion of industrial development along the length of the Rhine River, the most spectacular being the Ruhr industrial complex attributed to the cheap water transport for imports and exports. Duisburg is known for smelting, metal works, and chemical industries. Other industrial regions are Rotterdam in the Netherlands, Cologne in Germany, and Basel in Switzerland. The waterway provides cheap and easy transport for bulky industrial raw materials such as coal, petroleum, limestone, steel, iron, agricultural products as well as accessibility to the overseas markets.
3. Promotion of port and urban development, the most spectacular being Rotterdam port at the mouth of the Rhine River acting as the entreport for Western Europe with modern facilities such as containerization use of cranes. Other important towns include Basel, Strasburg, Mainz, Bonn, Essen, Dusseldorf, Leverkusen, and Koblenz. These are developed industrial towns, trade, recreational, and financial centres, and with high population concentration.
4. Promotion of mineral exploitation for example coal mining from the Ruhr and Saar fields of Germany, limestone from the Jura region of Switzerland. The waterway helps to transport bulky ore from the fields to the processing and smelting centres and to various industries where they are needed as raw materials. This in turn increases the income levels.
5. Facilitation of agricultural development by opening up agricultural regions such as the alluvial plains of Germany for growing of sugar beet, maize, tobacco, vines and market gardening in Germany; horticulture and cattle rearing in Netherlands. The waterway provides cheap and easy transport to the industries and markets to be processed and consumed respectively.
6. Promotion of tourism development in the Rhine lands especially in Switzerland apart from the waterway being a tourist potential itself. It provides cheap

transport for tourists from Germany, Holland, Belgium, Luxembourg, to the tour resorts. Most of these resorts are linked to the Rhine by road and rail. The resorts in Switzerland include Kloster, Arosa, Davos, Murren, and Kandersteg. This in turn increases the inflow of foreign exchange which is used to import foreign technology and consumer goods.

7. Provision of employment opportunities to many people such as engineers who carry out dredging, straightening of the waterway, hydrologists who monitor the water levels. There is employment in shipping companies as pilots, cargo handling, and hostesses in passenger liners. They earn income for improving their social and economic welfare /standard of living.
8. Generating of government revenue by taxing the shipping companies /cargo handling companies pay and workers' incomes. The revenue is used to develop various sectors such health, education, recreation, and agriculture.
9. Facilitation of international relationship between the Rhineland countries that is, Netherlands, Germany, Switzerland. The countries ensure diplomatic relationship for the joint and smooth operations on the Rhine. This forms a basis of economic contacts/trade relations and economic integration (such as in the European Union).
10. Diversification of the economy in the Rhineland countries. It has diversified transport in Western Europe but also the economy by providing an alternative source of income /revenue which can be used to develop various activities such as mining, agriculture, service sectors.
11. *Stimulation of forestry development by enhancing the exploitation of forests such as the black forests of south Germany, and Haardt forests of central Germany. The Rhine opened up these forests by providing cheap transport means for logs to be floated to the saw mills, furniture workshops and ship building workshops at cologne, Mainz and Basel.

Negative Effects/Short Comings of the Rhine Waterway

1. Congestion of vessels on the waterway due to increasing use of the waterway by many vessels, it limits its size causing delays.
2. The waterway limits the size of vessels used on the route. Due to the ever growing technology the bigger ships cannot sail easily along some sections of the waterway especially the canal sections.

3. Silting of some sections of the Rhine River and this calls for continuous dredging which is costly yet the period of dredging limits the use of the waterway.
4. The upper course of the waterway has rugged relief that is, from Basel towards the Alps. This makes the upper part less or not navigable and thus foregone economic opportunities.
5. Freezing of the Rhine River during winter season especially in the upper course, which limits its use as a waterway.
6. The waterway is associated with urbanization and related problems such as traffic congestion, slum growth, drug trafficking, unemployment, and high crime rate.
7. Pollution problems are associated with the waterway such air and water pollution due to moving water vessels, growth of industries due to the discharge of toxic wastes and other urban activities. this is disastrous to the environment (flora, fauna and aquatic life)
8. The Rhine waterway results into regional imbalance in development since it has attracted most economic activities along its course from Basel to Rotterdam in Netherlands such as agriculture, tourism, industry, social services at the expense of other areas in the interior.

Guiding questions

1. Account for the development of the Rhine waterway as an important waterway in Europe in the area where it is located.
2. For either the st. Lawrence Seaway or the Rhine waterway, assess its contributions to the development of the region where it occurs.

St. Lawrence sea way

The St. Lawrence Seaway is the most important waterway in North America shared by Canada and USA. It connects the great lakes region and the Atlantic Ocean on the eastern part of North America.

It stretches for over 3760km (2350miles) from Duluth on Lake Superior to the estuary of the St. Lawrence below Quebec.

The major construction activities along the sea way included:

- Construction of locks in areas where the water levels were different, some are single locks and others are double locks. Examples are: Beauharnois locks, St. Lawrence lock, St. Lambert lock, Iroquios lock
- Construction of dams in some sections to raise the water levels and submerge the rapids such as the Moses Saunders dam
- Construction of canals to by-pass some rapids and waterfalls such as the Welland canal which by-passes Niagara falls a distance of 40mk (Niagara falls is about 99m high (326ft). the drop of 6m (20ft) by a rapid at Sault Ste. Marie is avoided by the Soo canal between Lake and lake Huron. There are also canals that link the seaway to major production areas such as the 320 km Superior canal from Lake Erie at Buffalo via the Mohawk gap and Hudson River to New York. Also the Carillion and Greville canals from Montreal to Ottawa, Rideau Canal to Kingston.
- Constant dredging to maintain a depth of over 7.5m (25ft) to allow large cargo-liners into the Greatlakes (to widen the waterway by removing silt).
- Blasting using explosives to shatter rocks into small pieces which could easily be removed (remove the islands), hence making the river deep for navigation.

Note:

- The US and Canadian governments constructed the St. Lawrence sea way which was completed in 1954.
- The main traffic on the water way includes iron ore, coal, grains, (especially wheat), timber, furs, dairy products, metallic ores (nickel, copper, gold) and a whole range of manufactured goods.

A sketch map of the St. Lawrence sea way

Factors that favoured the development of the St. Lawrence sea way

1. Availability of large deposits/ a variety of minerals which include iron ore, uranium, gold, copper, and coal at the great lakes fields. The sea way was to provide cheap transport for these mineral resources to the major industrial centres such as Montreal, Detroit, Pittsburgh, Chicago, and Toronto. This increases the volume of cargo handled by the seaway.

2. High level of industrial development in the great lakes region and along the sea way such as in Chicago, Detroit, Quebec, Montreal, Pittsburgh which manufacture bulky products such as automobile, machinery which required cheap means of transport especially to overseas markets. This also increases the volume of goods transported along the seaway.
3. Availability of adequate capital provided by both the US and Canadian governments shared equally (the project spent over one billion US dollars). This capital was invested in the purchase of modern technology, construction of canals, building of locks in case of different water levels , dredging of the riverbed to deepen it for vessels, and straightening the sea way.
4. The high level of technology which involved the use of earth movers, excavators for dredging , construction of modern canals and locks, dam construction, which also explains the development of the waterway to navigable level.
5. Availability of highly skilled labor provided by the US and Canada in form of engineers , hydrologists, surveyors, who carried the feasibility study and construction activities like construction of dams, locks and canals to make the sea way more navigable.
6. Political stability in the continent of North America for a long period of time which has enabled establishment and maintenance of the seaway. It also increases the confidence of people to transport their goods via the seaway.
7. The rapid development of ports making the seaway to handle much trade. The inland ports include Duluth, Chicago, Detroit, Cleveland, buffalo, Toronto, Montreal, Quebec with major industrial establishments. The sea way can now handle thousands of ocean-going vessels.
8. The large scale agricultural production in the region such as wheat from the prairies , cotton from north and south Carolina, maize/ corns from Illinois, and Ohio, dairy production in Michigan and Iowa, etc the St. Lawrence sea way was constructed to provide cheap transport for the bulky agricultural products to the major industrial centres and urban markets as well as overseas markets.
9. The St. Lawrence Sea way is linked with a system of canals, which increases its transportation capacity. The canals include the 320mk canal from Lake Erie at buffalo via the Mohawk gap and Hudson River to New York, the Carillion canal

and Grenville canal from Montreal to Ottawa, Rideau Canal to Kingston; and these link the sea way to the major production areas, making it a transit waterway for bulky goods to and from the interior.

10. Positive / favourable government policy towards the construction and maintenance of the seaway. For example by providing the required capital and purchasing modern machinery for construction of the seaway, hiring labour to maintain the seaway. This in turn increases the use of the seaway.
11. Strategic geographical location of the seaway in the centre of North America and linking to the Atlantic Ocean. This enables it to handle large volume of cargo from both Canada and USA. It also transports large quantities of goods (imports) from Europe.

Economic significance of the St. Lawrence sea way

- The sea way has promoted trade and commerce in the region for example Importing large quantities of commodities like iron ore, coal, crude oil, cotton wool, food stuff; tropical hard wood timber. Transporting large amounts of exports from North America such as chemicals, vehicles, machinery, diesel engines, newsprint, textiles, and automobiles. This in turn increases national income.
- Promotion of industrial development along the length of the St. Lawrence seaway attributed to the cheap water transport for imports and exports. Today the great lakes region is known for smelting, metal works, chemical industries, textiles, automobiles, agro-based industries in Detroit, Quebec, Toronto and Chicago. The waterway provides cheap and easy transport for bulky industrial raw materials such as coal, petroleum, limestone, steel, iron, agricultural products as well as accessibility to the overseas markets.
- Promotion of port and urban development with modern facilities such as containerization, use of cranes. These include buffalo, Chicago, Duluth, Montreal, Cleveland, Thunderbay, and Toronto. These are developed industrial towns, trade centres, and recreational centres, financial centres with high population concentration. This also increases national income.
- The sea way has facilitated mineral exploitation for example coal mining from Pittsburgh, and Appalachian coalfields, iron ore from Labrador and Mesabi

ranges. The waterway helps to transport bulky ore from the fields to the processing and smelting centres and to various industries where they are needed as raw materials.

- Facilitation of agricultural development by opening up agricultural regions such as dairy farming at Michigan, wheat growing in the prairies, horticulture and market gardening, maize production, agro-based industries. The waterway provides cheap and easy transport to the industries and markets to be processed and consumed respectively.
- The sea way promotes of tourism development in the region, apart from the waterway being a tourist potential itself. It provides cheap transport for tourists from Europe, Africa and other parts of the world, to the tour resorts. Most of these resorts are linked to the seaway by road, rail and canals. The tourist attractions are the waterfalls and rapids, industries, mining centres of Appalachians, canals, dams and locks. This also in turn increases the foreign exchange and re-investment in the economy.
- Provision of more employment opportunities to the people of Canada and USA such as engineers who carry out dredging, straightening of the waterway, hydrologists who monitor the water levels. There is also employment in shipping companies as pilots, cargo handling, and hostesses in passenger liners. They earn income for improving their social and economic welfare /standard of living.
- Generating of government revenue through taxing the shipping companies /cargo handling companies and workers' incomes. The revenue is used to develop various sectors such health, education, recreation, and agriculture.
- The sea way has promoted political harmony/ relationship between the USA and Canada. The countries ensure diplomatic relationship for the joint and smooth operations on the seaway. This forms a basis of economic contacts/trade relations and economic integration (such as in the European Union).
- Diversification of the economy because it has diversified transport in North America and by providing an alternative source of income /revenue which can be used to develop various activities such as mining, agriculture, service

sectors. This in turn widens the national income and the export base of the two countries.

- Promotes the development of other infrastructure such ad road and railway network in the Great lakes region, education facilities, canals linked to other areas such as the Hudson-Mohawk canal. This has increased the volume of trade and other economic activities.

Negative Effects/Short Comings of the Seaway

- Congestion of vessels on the waterway due to increasing use of the waterway by many vessels, it limits its size causing delays.
- The sea way has limitation in the size of vessels used on the route. Due to the ever-growing technology, the bigger ships (super tankers) cannot sail easily along some sections of the seaway especially the canal sections. This limits direct delivery of goods into the Great lakes region.
- Silting of some sections of the river and this calls for continuous dredging which is costly yet the period of dredging limits the use of the waterway.
- Freezing of the river during winter season which limits its use as a waterway. The sea way is frozen (bound by ice) for 340 4 months in a year (December to march), which limits its use greatly during these months and navigation comes from a standstill.
- The sea way has many locks used to adjust water levels and ease navigation. These various locks lead to delays in the shipment of cargo.
- The Seaway is associated with urbanization and related problems such as traffic congestion, slum growth, drug trafficking, unemployment, high crime rate. Fighting such evils is very costly to the government.
- Pollution problems are associated with the waterway such air and water pollution due to moving water vessels, growth of industries due to the discharge of toxic wastes and from other urban activities. This is disastrous to the environment (flora, fauna and aquatic life)
- The seaway results into regional imbalance in development since it has attracted most economic activities along its course such as agriculture,

tourism, industry, social services due to easy accessibility at the expense of other areas in the interior.

RAILWAY TRANSPORT IN NORTH AMERICA

The continent of North America has the most extensive and dense railway network in the world; with over 330,000km^2 in the USA, 93,000km^2 in Canada and the rest in Central America (together making up nearly 40% of the world total).

The trans-continental railways (another name) run across Canada and the United States of America. The densest railway network is found in the east—central USA, and southern Canada, south of the Greatlakes and on the Atlantic seaboard where most of the main cities are linked by rail. The main lines follow an east-west direction linking the main centres of settlement in the east and on the west. The railway network is extensively used for transporting of bulk freight such as iron ore, metals, timber, machinery, grains, coal, sometimes crude oil etc

A sketch map of the Trans-Continental Railways

Role of the railway network in North America

1) It has promoted the exploitation of minerals such as iron ore and coal at Pittsburgh, copper in Arizona and Michigan (Lake Superior region), coal mining in the Appalachians, rocky mountain province and the gulf province. Railways networks connect the mines and processing industries, as well as accessibility to both local markets and foreign markets via ports like New York, Los Angeles, Boston, and Seattle.
2) Railway transport has opened vast empty land in the interior such as the prairies and the Rocky Mountains states/ provinces (Arizona, Utah, Wyoming, and Nevada). This has encouraged settlement in these previously remote and rural areas, hence reducing the problem of rural-urban migration.
3) Promotion of industrialization by encouraging investors and therefore increases capital inflow, influences industrial location and distribution. This is due to easy movement of raw materials and workers to the industries and movement of finished goods to markets. For example movement of automobile products, iron and steel and machinery from Montreal, Quebec, Chicago, Pittsburgh and Detroit to the export ports along the Atlantic ocean. This further encourages investment in the industrial sector and increases national income.

4) It has promoted agricultural production by transporting produce to distant markets on the seaboard such as wheat from the prairies, and dairy products from Wyoming and Utah to the coastal towns of Boston, new York and los Angeles. In this way, it connects areas of plenty to areas of deficit, and this encourages further investment in the agricultural sector.
5) Promoting local, regional, and international trade and this leads to interstate cooperation and unity. This is because the agricultural products, industrial products are easily transferred from areas of production to marketing centres. This in turn increases national income.
6) Encouraging spread of ideas leading to cultural, economic, social, and political transformations. Transport enables diffusion of ideas such as on science and technology leading to innovation and invention in the countryside. This in turn supports various economic activities like agriculture, and trade.
7) Promotion of tourism development in north America by making the tourist areas such as the Appalachian mining areas, rocky mountain areas, lake superior region, coastal beaches (like New Orleans, Miami) easily accessible/ facilitates easy movement of tourists to various tourist potentials. The trans-continental railways also themselves tourist attractions for the tourists interested in exposure and pleasure. This eventually increases foreign currency, which is invested in various sectors like education, and health.
8) Generation of many employment opportunities to the people of Canada and USA such as engineers, pilots/ drivers, cargo managers, accountants and service providers at the stations. These earn salaries and wages which they use to improve their standards of living in areas of health , housing, and recreation.
9) Enhancing political control, national unity and efficient administration. This is because the government bodies like ministerial head quarters and police are easily set up in various parts of the country. It also promotes political stability due to easy monitoring of various parts of the country and this is associated with balanced regional development.
10) Promoting urbanization/ growth of urban centres because railway transport links the major cities especially in central USA, southern Canada, Greatlakes region to the Atlantic seaboard and pacific seaboard. The developed cities include Washington, New York, St. John, Halifax, Los Angeles, San Francisco,

Vancouver and Boston. Therefore, transport increases population concentration in many areas such as towns and this results into expansion of urban activities like trade and commerce, banking, insurance, ware housing, and entertainment.

11) Generation of government revenue through taxation of railway transport systems such as companies and the workers. The government revenue is to meet the government budget, hence financing more infrastructural development such as roads, schools, and hospitals in Illinois, Utah, Nevada, and Florida.
12) Promotion of economic diversification because of the diversified forms of transport such as road, railway, water and air. The transport systems uplift various economic sectors like tourism, mining and industry. This in turn widens the gross domestic product (GDP) and the export base of the country.
13) Railway transport promotes international relations between Canada , USA and Mexico. The joint ownership of some of the railway systems by USA and Canada has improved the diplomatic relations and also trade and commerce between the countries, as well as Mexico in the south. In turn, many investors move between the countries and spread development ideas.

Negative effects/short comings

1) Results in high rates of environmental pollution, that is, air, water and noise pollution from the resulting industrial development. The emitted fumes are dangerous to the life forms of the environment like it causes respiratory diseases. There is also pollution by coal-powered trains which discharge toxic gases into the atmosphere.
2) Results into destruction of vegetation such to construct railways and stations. This results into soil erosion and land degradation due to reduced soil stability on the railway sides.
3) High costs of construction and maintenance of the networks such as railway stations, railway lines, etc. In turn, there is increased government expenditure on the maintenance of such networks, hence straining the government budget.
4) Over exploitation of environmental / natural resources leading to quick depletion. This is through increased accessibility to various resources such as

mineral resources in the Appalachian region and rocky mountains, forest resources in British Columbia - working against the future generations.

5) The expanded urban centres are associated with problems such as congestion/ overcrowding, drug abuse, and slum growth near Chicago, new Orleans, salt lake city and Winnipeg. The eradication of such problems is very costly to the government.
6) Displacement of many people during railway transport development. As transport routes are being constructed or expanded, many people are displaced from their settlement and production areas with little or no compensation. There is also a problem of resettlement of the displaced people.

RAILWAY TRANSPORT IN SWITZERLAND / THE SWISS RAILWAY SYSTEM

Switzerland is part of Western Europe and has a dense railway network and about 99% of the Swiss railway system is electrified using Swiss hydro electricity. As such, it does not depend on imported oil / petroleum or even coal. Examples of railway transport routes in and out of Switzerland include Basel—Bern—Geneva, Basel—Zurich—St. Gallen into Austria, Zurich—Zug—Bellinzona into Italy, Chur—Sion—Lausanne—into France, Solothum—Bern—into Italy, and Solothum—Neuchatel—Lausanne.

Switzerland has developed a dense and efficient railway system due to the following reasons:

- The country imports large quantities of goods. About 68% of the goods arriving at Basel port are transferred to other areas of the interior by rail.
- Switzerland exports large quantities of goods and such goods are transported by railway from various parts of the country to Basel port for export.
- The need to promote the tourism industry. Railway transports millions of tourists each year to various attraction areas.
- The central location of Switzerland in Europe making her a natural route way for international rail links from North to south and East to west.
- The need to transport thousands of workers who commute to their work places each day for long distances.
- The need to develop the manufacturing industries in Switzerland.

SOUTH AFRICAN RAILWAY

South Africa has the most developed railway network in Africa with over 13,000 rail line miles. The main railway routes are the Cape Town—Pretoria railway via Kimberley and Johannesburg; East coastal railway (from Umzimkulu to Empangeni via Durban); Port Elizabeth –Namibia railway; Durban—Johannesburg line.

Some rail lines are electrified such as the Durban—Johannesburg line which is the longest electrified railway lines on the globe.

A sketch map of South Africa showing the major railway transport routes

Significance of railway transport in South Africa

1. It has promoted the exploitation of minerals such as coal, gold, iron ore and diamonds in the Witwatersrand (like Krugersdorp and Johannesburg gold mining areas). Railways networks connect the mines and processing industries, as well as accessibility to both local markets and foreign markets via ports like Durban, cape town and east London.
2. Promotion of industrialization by encouraging investors, influencing industrial location and distribution. This is due to easy movement of raw materials and workers to the industries and movement of finished goods to markets. For example, movement of iron and steel and machinery from Witbank, springs and Johannesburg to the export ports like Durban, Port Elizabeth and Cape Town. This further encourages investment in the industrial sector and increases national income.
3. It has promoted agricultural production by transporting large quantities of produce to distant markets or export ports such as maize, wheat and sheep from Orange Free State to cape town via the Cape –Johannesburg railway, development of Natal sugarcane plantations is also explained by the East Coast railway and also the Durban-Vereeniging railway between the plantations and the interior cities. In this way, it connects areas of plenty to areas of deficit, and this encourages further investment in the agricultural sector.
4. Promoting local, regional, and international trade and this leads to interstate cooperation and unity. This is because the agricultural products, industrial

products are easily transferred from areas of production to marketing centres. This in turn increases national income.

5. Encouraging spread of ideas leading to cultural, economic, social, and political transformations. Transport enables diffusion of ideas such as on science and technology leading to innovation and invention in the countryside. This in turn supports various economic activities like agriculture, and trade.
6. Promotion of tourism development by making the tourist areas such as the Kruger national park, Bontebok national park, Witwatersrand industrial region, the Johannesburg gold mining areas easily accessible/ facilitates easy movement of tourists to various tourist potentials for study tours, exposure and pleasure. This eventually increases foreign currency, which is invested in various sectors like education, and health.
7. Generation of many employment opportunities to the people of south Africa such as engineers, pilots/ drivers, cargo managers, accountants and service providers at the stations. These earn salaries and wages which they use to improve their standards of living in areas of health, education, housing, and recreation.
8. Promoting urbanization/ growth of urban centres because railway transport links the major cities through handling import and export commodities. The urban centres include East London, Durban, Port Elizabeth, Kimberley, Johannesburg, Witbank, and springs. Therefore, railway transport increases population concentration in such towns and this results into expansion of urban activities like trade and commerce, banking, insurance, ware housing, and entertainment.
9. Generation of government revenue through taxation of railway transport systems such as companies which pay taxes for importation and exportation of goods and taxes on the workers. The government revenue is to meet the government budget, hence financing more infrastructural development such as roads, schools, and hospitals in states of Orange Free State, Transvaal , Cape province and Durban
10. Promotion of economic diversification because of the diversified forms of transport such as road, railway, water and air. The transport systems uplift

various economic sectors like tourism, mining and industry. This in turn widens the gross domestic product (GDP) and the export base of the country.

11. Railway transport promotes international relations between south Africa and neighboring countries such as Namibia, Botswana, Zimbabwe, Mozambique and this enhances diplomatic relations and also trade and commerce between the countries. In turn, many investors move between the countries and spread development ideas.

Negative effects/short comings

1. Results in high rates of environmental pollution, that is, air, water and noise pollution from the resulting industrial development. The emitted fumes are dangerous to the life forms of the environment like it causes respiratory diseases. There is also pollution by coal-powered trains which discharge toxic gases into the atmosphere.
2. Results into destruction of vegetation such to construct railways and stations. This results into soil erosion and land degradation due to reduced soil stability on the railway sides.
3. High costs of construction and maintenance of the networks such as railway stations, railway lines, etc. In turn, there is increased government expenditure on the maintenance of such networks, hence straining the government budget.
4. Over exploitation of environmental / natural resources leading to quick depletion. This is through increased accessibility to various resources such as mineral resources in some areas of the Rand, forest resources on the Johannesburg slopes- working against the future generations.
5. The expanded urban centres are associated with problems such as congestion/ overcrowding, drug abuse, and slum growth near springs, Vereeniging , cape town, and Durban. The eradication of such problems is very costly to the government.
6. Displacement of many people during railway transport development. As railway transport routes are being constructed or expanded, many people are displaced from their settlement and production areas with little or no compensation. There is also a problem of resettlement of the displaced people.

URBANIZATION

Urbanization is the process whereby an increasing proportion of the population becomes concentrated in towns. There is a continuous shift of the population from rural areas to towns and cities, and the resultant growth of urban areas.

The criteria of classification /identification of urban areas is based on: population size, population density, administrative and legal status, social and economic functions. But the most common determinant of whether an area is a town or not is the population size.

Basic concepts

- Urban morphology

  This refers to the internal structure and arrangement of the town. The morphology of towns differs from place to place due to differences in site, functions, history of development and the age of the town.

- Urban fields

This is the area around a town which it serves and from which it draws customers for its goods and services. The town itself is called the central place and the area around it is the field of influence (urban filed). The urban field depends upon the size of the town and kind of services it offers.

- Urban hierarchy

  This is the ranking of towns according to the services they provide and the size of their fields.

- Urban sprawl

  This the outward spread of built- up areas caused by their expansion. Or it is the areal expansion of rapidly growing cities (as a result of urbanization)

  Towns are continuously growing and in some areas the suburbs of a number of neighboring towns may be so close together as to form an almost continuous urban development called a conurbation

- Hinterland

  This is the area which serves and is in turn served by a port. Or It is the area from which supplies are drawn for export and to which imports are distributed. For example the hinterland of Rotterdam covers countries like Netherlands, Germany, Belgium, and Switzerland.

FUNCTIONS OF URBAN AREAS/TOWNS

Towns are multifunctional and the major functions include:

1) Commercial function. The major function is business /trade and commerce.
2) Manufacturing/industrial function
3) Administrative function
4) Residential function
5) Cultural function
6) Entertainment function
7) Defensive function
8) Recreation function/resorts

CONSEQUENCES /EFFECTS OF URBANIZATION

Positive effects

1. The increased population widens the market potential for goods and services produced. It also provides market for agricultural output –hence linking rural and urban areas.
2. The increased population increases the labour potential due to a large number of people who can be employed in various sectors like trade, banking and industry.
3. Results into cultural integration and unity .There is also transmission and diffusion of ideas/information, which in the long run leads to balanced regional development.
4. People acquire skills which can be used for rural transformation. Labour is trained in urban areas, which may in turn, establish small scale industries/projects in the rural areas.
5. Creation of employment opportunities in the urban areas than the countryside. The job opportunities in the industrial, business and service sectors lead to increased standards of living for the urban dwellers such as in Lagos, Tokyo, and London.
6. Leads to industrial development due to increased investment.
7. Expands the tax base for collection of government revenue. Many urban activities are taxed by the government in order to develop various sectors like transport, tourism.
8. Stimulates production due to competition. This leads to increased investment and innovativeness, and hence increase in national income.
9. Results improvement in social services such as education, health services etc. urbanization awakens the government to provide social services to support the large numbers of people.
10. Results into technological transfer and development since urban areas attract many economic activities such as trade, and banking.

Negative effects

1. Urbanization results into unemployment which in turn leads to high crime rate. In many cases the people who are flocking to the towns in developing countries are unemployed .the increased movements of people to towns does not match with the available job opportunities. Many young men and women seeking employment in cities, unfortunately fail to find the jobs.

2. Leads to strain on the social economic infrastructure such as roads, medical facilities, piped water, electricity-due to increasing demand by the increasing population. This strains the government budget especial with the case of urban sprawl (such as in Cairo-Egypt and Lagos-Nigeria).
3. Leads to the growth of slums due to inadequate housing. The squatters cleared from one area may settle in another unless housing can be found for them. Therefore the town dwellers inevitably outnumber the housing facilities provided. Slums are characterized by poor conditions especially poor /inadequate housing such as the blacks who have squatted in and around Johannesburg in South Africa. Slums are also characterized robbers, drug abuse, and easy spread of diseases.
4. Results into traffic congestion in the urban areas leading to unnecessary delays. The larger the town and the more important its functions become, the need for vehicle s increases for the town dwellers and outsiders. Increased trade leads to increased demand for commercial vehicles, which add to the traffic .the greatest traffic congestion occurs in the central business districts (CBDs) of towns are concentrated.
5. Results into high crime rate since due to unemployment and overcrowding especially in the outskirts of the busy urban areas. There is increase in robbery, prostitution, and gambling.
6. Pollution of the environment leading to environmental deterioration. There is increased air pollution from car fumes, smoke from factories and houses, water pollution from factories and rubbish. There is also noise pollution from factories and traffic. Japan has one of the worst pollution problems in the world due to its rapid industrialization. Pollution from towns also affects the surrounding areas.
7. Expansion of towns results in deforestation and general vegetation destruction this is due to expanding built-up areas for settlement, industrial sites and other business activities. For example, the expansion of towns in the Rand is affecting the vegetation in the surrounding zones. There is also increased swamp reclamation and high rate of flooding in some areas of the expanding towns.

8. Encroachment on the adjacent land reduces the land for other activities and leads to the displacement of people who lose their settlement land and sometimes they are not fairly compensated.
9. Dereliction/destruction of the landscape for example due to exploitation of minerals –mining pits left behind. There is also garbage heaps created in some corners of urban areas.
10. Overexploitation of natural resources in the surrounding areas such as forest resources ,fisheries resources, mineral resources, due to increased demand in the urbanized areas.
11. Leads to break down of social norms and values because most urban inhabitants tend to ignore the traditional values and adopt western culture/values. More so urban areas are collections of various cultures from all areas –which influence erodes traditional values of a particular culture.
12. Threat of terrorism and tension in the urban areas. The terrorists are mostly interested in areas of large population and thus a potential destruction of life and property.
13. Results into regional imbalance in development. The urban areas are more developed in terms of infrastructure than other areas of the country. This in turn increases rural urban migration.

SOLUTIONS TO URBAN PROBLEMS

1. Developing a good transport system to reduce traffic congestion in the urbanities for example constructing subways, flyovers. There is also restricting the movement of certain vehicles into the central business districts.
2. Strengthening patrols and police in the urban centers to control the high crime rate.
3. Recycling, treating and proper disposal of waste material to reduce pollution and contribute to a clean environment.
4. Reclamation of swampy grounds to create more room for urban expansion.
5. Setting up /creating more public facilities to such as medical centers, education centers, recreation centers, to match with the rising population.
6. Politicization to reduce racial discrimination.
7. Construction of skyscrapers to solve the problem land shortage. These buildings usually have all the facilities such as shopping, and cinema.

8. etc

Case studies—ports and towns

- Rotterdam
- Newyork
- Lagos
- Tema
- Mombasa
- Calcutta
- Hongkong

ROTTERDAM

Rotterdam is an international port and it is situated at the mouth of the Rhine River as the river enters the North sea .it derives its name from a stream called Rotte and it has existed for over 600years .

Rotterdam is the most important port in the world and its greatest growth began with the construction of a new waterway through the polders. It was after the construction of this giant canal that the port got access to the North Sea usable by large vessels. This made it possible for Rotterdam's expansion such that today it is the world's largest port with the capacity of handling many vessels at a time.

A sketch map showing the location of Rotterdam and Europort

Factors responsible for the growth and development of Rotterdam as an international port and urban center

1. Presence of a well sheltered natural harbor at the sheltered estuary of the New Maas. This deep natural harbor makes Rotterdam to handle all types of ocean-going vessels (barges and ships) and has therefore developed a modern port due to handling large cargo.
2. The low tidal range which allows easy shipping/anchoring of vessels to the coastline of the North Sea. Therefore, ships easily come and go at any time.
3. Ice-free conditions throughout the year due to the effect of the warm north Atlantic drift (ocean current). This allows continued use of the port throughout the year and hence its modernization.

4. The topography of the area is relatively flat and this allows easy construction of port facilities and accommodation facilities for the large population.
5. The Presence of a large and productive hinterland. Rotterdam is situated at the mouth of river Rhine serving countries like Switzerland, Germany, Belgium, Luxembourg and The Netherlands itself. Rapid industrialization especially in the Ruhr region of Germany leads to increasing cargo handled at Rotterdam port because it was the easiest port to trans-ship cargo to and from the Ruhr. The cargo to the interior includes iron ore, cotton, tropical rubber, coffee, and oil. The cargo from the interior (seaboard goods) include general merchandise, automobiles, chemicals, machinery.
6. The strategic location of Rotterdam port- near the North Sea and on the mouth of river Rhine. The port is also located in the center of Europe. This made Rotterdam to develop into an Entreport to the interior and hence development onto an international port. The location also made Rotterdam to have an extensive hinterland.
7. Navigability of the Rhine River/ the Rhine is navigable for a large part from Rotterdam up to Basel. For this part, it is not interrupted by waterfalls/rapids in its channel. This increases the volume of goods handled at Rotterdam port.
8. The construction of a deep water channel called the New water way, linking port to the North Sea. This giant canal was completed in 1872 and it made the port usable by very large vessels since they could sail through. It enabled Rotterdam to become more of a transit port for bulky goods to the interior. More so major developments have taken place on the banks of the waterway, most important being the construction of Europort (5000 hectares large).
9. The reconstruction of the port after the devastation of the Second World War. This enabled new plans to be drawn up for the expansion of the port in 1947, and an industrial complex was set up at Botlek to the south bank of the New waterway.
10. The development of many industries at Rotterdam which include oil refineries, shipbuilding, general engineering, brewing, and food processing. This has attracted many people to the port to look for employment and also increased the cargo handled by the port.

11. High level of technology which led to improvement in modern port handling facilities .there construction of the new waterway, construction of Europort, dredging and reclamation of land from the sea. There is also increased containerization at the port.
12. Presence of adequate capital to develop the port and city. The Dutch government and other countries of Western Europe provided the necessary capital for port rehabilitation and development. This was important in designing Europort, the new water way and the implementation of the expansion programme.
13. Political stability of the region, which has enabled the port to expand without any ravages of war. The area has been stable since the Second World War and therefore many modern port handling facilities have been put up.
14. Improvement in transport systems linking the port to the large hinterland. For example roads and railways linking to the interior of The Netherlands and the Ruhr complex of Germany. This also increases the volume of cargo handled by Rotterdam port.
15. Supportive government policy for example the need to open up the Rhine basin as a whole—by easily accessing markets for the manufactured goods such as chemicals and sources of imported raw materials such as iron ore, topical rubber. This explains why the governments have heavily financed the modernization of the port.
16. Presence of skilled labour in the area—to carry out modern construction and development of the port. The large population of the region supplied the required labour.

Problems facing Rotterdam port and city

1. There is congestion of vessels and people. Due to this maintenance of the city is extremely expensive such as water supply, sewage disposal, law and order.
2. Pollution of the environment especially oil/petroleum related industries such as oil refineries, petro-chemical industries, automobile industries.
3. Silting of the new Maas River and the new waterway .this necessitates constant dredging which costly.
4. Some sections of the port experience winter freezing which at times interferes with port activities such inconveniencing shipping schedules.

5. Narrowness and shallowness. There is still work to be done to expand the port and to deepen it in order to accommodate even larger ocean-going vessels.
6. Risks of fire hazards due to presence of oil tanks all over the port.
7. Unemployment problems. This is attributed to high levels of rural urban migrations and settlements due to port attraction facilities.
8. High crime rate due to overcrowding.

Solutions to the above problems

1. Reclamation of land from the sea to create more room for expansion.
2. Vertical expansion of the port to minimize the problems of limited space (use of skyscrapers).
3. Containerization to ensure fast handling and dispatch of cargo.
4. Industrialists have advised to build elsewhere away from the concentrated area of Rotterdam.
5. Treating industrial wastes before disposal into water to reduce pollution.
6. Industrial fumes have been exposed high up in the atmosphere by very long chimneys.
7. Regular dredging to reduce the effects of silting.
8. Greenbelts have been created in the city to reduce CO_2 from the atmosphere and in turn produce O_2 which is in short supply.
9. Police has been strengthened to be more alert against crime among citizens, although it is still a challenge.

NEW YORK PORT /CITY

New York is located on the eastern coast of USA to the Atlantic Ocean on the Manhattan Island. It is the principal city of United States of America and the most developed port in North America.

Its growth and expansion started with the arrival of foreign settlers –the Dutch who bought Manhattan Island from the local Indians (Red Indians) in 1624 who had settled in the area earlier. At that time, New York was called New Amsterdam.

Later in 1664 the British conquered the island and re-named it New York from then many Europeans settled in New York port and it over powered all other cities to become the leading commercial centre of North America.

New York port is located/sited on may islands such as Manhattan(the major), Staten island, long island, Bronx island, Brooklyn island , Queens island.

A sketch map showing the location/ site of New York port/ city

Factors for the growth and development of New York port/city

1. Presence of a well sheltered natural harbor, with a deep and broad channel directly leading to the Atlantic Ocean. The harbor is well protected from strong water waves which favoured the construction of the port. This deep natural harbor makes New York to handle all types of ocean-going vessels (barges and ships) and has therefore developed a modern port due to handling large cargo.
2. The low tidal range of less than 2 metres which allows easy shipping or anchoring of vessels to the Atlantic coastline. Therefore ships easily enter and leave the port at any time.
3. Ice-free conditions throughout the year due to the conducive sub-tropical climate. This allows continued use of the port throughout the year and hence its modernization.
4. The topography of the area is relatively flat which allows easy construction of port facilities and accommodation facilities for the large population.
5. The Presence of a large and productive hinterland which covers the New York city, Great lakes region, the agricultural and interior plain of the south, the Appalachian region, Pittsburgh industrial area and New England. Rapid industrialization especially in the Great lakes region and New York City led to increasing cargo handled at New York port. This was because New York is one of the easiest ports to trans-ship cargo to and from the region .The imports/ cargo to the interior are agricultural products such as cotton, tea, coffee, cocoa, sugar mainly from Africa. Minerals are also imported such as oil, copper, gold, diamonds, uranium, and iron ore. The exports/ cargo from the interior include: general merchandise, automobiles, chemicals, machinery, electronics, wheat, and timber products.

6. The strategic location of New York port along the Atlantic Ocean and on the mouth of navigable Hudson River. This made New York accessible to major markets especially in Europe. Therefore the coastal location made the port to handle large volumes of cargo to and from the interior and hence development into an international port.
7. The construction of the Hudson –Mohawk canal, which connected New York to the Greatlakes region through Lake Erie. This gave New York port an advantage to handle large volumes of exports and imports, leading to the rapid development of New York port.
8. Presence of many water bodies such as rivers (Hudson, east), upper and lower bays. These provide a large area for anchoring of ships. The water bodies also favoured the setting up of landing sites upon which the modern port originated.
9. Relatively flat landscape of New York which facilitated the construction of port facilities. This in turn increases the volume of cargo handled at the port.
10. Presence of a hard rock which provided a firm foundation for the construction of port facilities and the construction of tall buildings.
11. The absence of strong Chinook hurricane winds on the eastern seaboard of north America also favoured the location of the port on that side of USA. The winds would otherwise make the landing of vessels difficult.
12. Historical factor—its position as the original capital city of USA made the government to develop Newyork into a port before shifting to Washington DC. New York was also the first state to be settled by foreigners such as the Dutch and the British. This led to a high population that favoured many activities like industry and trade, hence development into major urban centre and port.
13. Presence of adequate capital to develop the port and city. The initial capital was provided by early settlers such as the Dutch and British; and later the US government. This favoured the construction and development of port facilities.
14. High level of technology which led to improvement in modern port handling facilities, construction of the waterways, and reclamation of land to expand port facilities. There is also increased containerization at the port to save space and time of loading and unloading of cargo.
15. The development of many industries at New York which include oil refineries, iron and steel works, ship building, general engineering, textiles, paper and

printing, brewing, food processing. This has attracted many people to the port to look for employment and also increased the volume cargo handled by the port.

16. Political stability of the region which has enabled the port to expand without any ravages of war. The area has been stable for a long period of time and therefore many modern port handling facilities have been put up.
17. Improvement in transport systems linking the port to the large hinterland. For example roads and railways linking to the interior of USA such as New England, Appalachian region and Pittsburgh region. This also increases the volume of cargo handled by New York port.
18. Supportive government policy for example the need to open up the interior — by easily accessing markets for the manufactured goods such as chemicals and sources of imported raw materials such as iron ore, tea, and cotton. This explains why the government has heavily financed the modernization of the port.
19. Presence of skilled labour in the area to carry out modern construction and development of the port. The large population of the region supplied the required labour.

Problems facing New York port

1. There is congestion of vessels and this leads to delays in loading and unloading of ships. Also due to this congestion, the maintenance of the port is extremely expensive.
2. Pollution of the environment/ port area such as water pollution from oil spills and air pollution from industries such as oil refineries, petro-chemical industries, automobile industries.
3. Limited land for expansion which has made the port to develop vertically especially on Manhattan island.
4. Inadequate accommodation which has led to growth of slums and associated problems such as poor hygiene, moral decay and easy spread of diseases.
9. Unemployment problems, attributed to high levels of rural urban migrations and settlements attracted by port facilities. The unemployment leads to high crime rate due to overcrowding

10. Narrowness and shallowness. There is still work to be done to expand the port and to deepen it in order to accommodate even larger ocean-going vessels.
11. Risks of fire hazards due to presence of oil tanks all over the port.
12. Thick fog due to mixing of cold Labrador and the warm gulf stream. This leads to great risk of accidents due to poor visibility.

Solution to the above problems

1. Vertical expansion of the port to minimize the problems of limited space (use of skyscrapers).
2. Reclamation of land from the sea to create more room for expansion.
3. Containerization to ensure fast handling and dispatch of cargo.
4. Industrialists have advised to build elsewhere away from the concentrated area of New York.
5. Treating industrial wastes before disposal into water to reduce pollution.
6. Industrial fumes have been exposed high up in the atmosphere by very long chimneys.
7. Use of radars to solve the problem of fog.
8. Police has been strengthened to be more alert against crime among citizens, although it is still a challenge.
9. Construction of more industries to create more jobs.

Guiding questions

1) To what extent have physical factors contributed to the growth of either Rotterdam or Mombasa port?
2) Account for the growth and development of Rotterdam or Lagos into a modern port and urban centre.
3) Account for the development of either Port Tema or New York as a port and urban centre.
4) Examine the significance of New York as a port and an urban centre in North America
5) (a) Examine the factors which have favoured the development of Rotterdam as an international port
   (b) Explain the problems faced by the Rotterdam as a port.

CONURBATIONS

A conurbation is a large continuous built-up area formed by the joining of several towns/urban settlements. OR It is a single urban complex formed by the merging of two or more neighboring urban centers.

The towns grow and merge such that there is no clear distinction between them, and conurbations are often formed due to urban sprawl.

Examples of conurbations in the world include:

- The Rand industrial complex in south Africa
- The Great lakes region of USA
- The Ruhr industrial complex of Germany
- New York / Northeast of USA
- Los Angeles –san Francisco in USA
- West Holland conurbation –consisting of Amsterdam, Rotterdam, Utrecht, and The Hague
- London, Manchester, Liverpool, Sheffield and Bristol in Britain.
- Tokyo, Nagoya, and Osaka in Japan are centers of large conurbations.

THE RAND OF SOUTH AFRICA

The Rand (Witwatersrand) is the only true industrial conurbation in Africa, and it extends for approximately 100km from Randfontein to springs on the veld. The major towns in this conurbation include Johannesburg, Germiston, Krugersdorp, Pretoria, springs, Klerksdorp, Witbank. Others include Kimberley, Bultfontein, Vereeniging, Vanderbijl Park, Benoni, Middleburg, and Waterburg. The Rand has about 35% of all South African industrial establishments.

Factors for the location and growth of the Rand Conurbation

1. Presence of a wide range of valuable minerals for example gold in Johannesburg, springs, Krugersdorp, Klerksdorp; diamonds in Pretoria, Kimberley, Bultfontein; coal in Middleburg, Vereeniging, and Witbank. Many people have been attracted to provide labour in the mining companies.
2. Availability of large quantities of power such as in form of coal and hydro electric power. Coal has for long been the main source of power for industries in South Africa. Power has also supported various urban activities such as trade and commerce, banking, insurance, recreation, in urban areas like Witbank, Pretoria, and Germiston.

3. The development of many industries in the region by both local and foreign investors for example iron and steel industries in Pretoria, Vereeniging, and Johannesburg; chemical industries in Pretoria and Germiston. These industries have attracted a large population to provide labour and enjoy other industrial – related opportunities.
4. Internal competition among the industrial establishments leading to increased productivity, efficiency and development. This competition leads to the expansion of industries and related activities like transport, trade, and therefore the eventual expansion of the towns into a large conurbation.
5. Presence of large/abundant water supply for domestic and industrial use for example from the Vaal River supporting the iron and steel industries at Vereeniging (for cooling machines). Water is also used as a raw material in some industries such as soft drinks industries in springs and Vanderbijl Park. It is still used in many urban activities recreation, food preparation among others.
6. Well developed transport and communication network by road, railway, and air. The net works were easy to set up since the area is relatively flat. The railway network is directly comparable with those in Europe and North America for example by being electrified. The transport networks link various towns in the Rand –moving people and produce.
7. Abundant supply of skilled and unskilled labour who work in the industries, mining sector, and the service sector in the Rand. The unskilled labour is mainly provided by the black population originating from various parts of South Africa and migrants from the neighboring countries like Lesotho, Swaziland, Botswana, and Namibia. This has led to the expansion of urban facilities like banking, insurance and entertainment.
8. Presence of adequate capital to invest in various activities especially mining operations, industry, and trade, provided by white settlers from countries like USA, Britain, Holland. Still the government has invested in many urban facilities such as health centers, education, and power transmission.
9. Well developed social and commercial facilities such as educational facilities, recreation, health facilities, banking, insurance, and ware housing. These have also attracted a large proportion of the population to concentrate in the urbanized Rand region.

10. Geographical/industrial inertia—where industries /investments fail to change location even when the existing/present location is no longer the most advantageous. The investments are attracted by the developed facilities such as transport and this has resulted into increased population concentration in the Rand region.
11. Political stability of the region which has attracted many people and investments to the Rand. Since the end of apartheid many urban activities and facilities have been initiated and consolidated, hence the expansion of several towns like Germiston, Witbank, and Middleburg.
12. Positive government policy which promotes local production by restricting importation of similar goods. The governments also finances basic industries such generation of power. It has also spearheaded and encouraged industrial research, and still encouraged local and foreign investors in various urban development activities through enabling policies.

THE GREATLAKES REGION OF USA

The Greatlakes region is an example of a conurbation in USA with many towns /cities which have grown and merged. These include Pittsburgh-Cleveland, Detroit-Dearborn-Windsor, Chicago-Cicero-Milwaukee, Port Arthur and Fort William, Duluth and superior. Other towns include Buffalo city, Wheeling, Young's town, Greenbay, Gary, Thunderbay, Toledo, and Sudbury.

Factors for the growth and development of the Greatlakes region as a conurbation

1. Presence of valuable mineral resources such as iron ore and coal for example iron ore exists in the Lake Superior region (Mesabi Range, vermilion range). Coal is got from Pittsburgh region. This has led to increased population concentration in the region, since many people provide labour in the mining activities such as mineral extraction, processing, transportation.
2. Availability of reliable power supply in form of coal, oil, and hydro electric power. Coal and natural gas are got from the Pittsburgh region; hydro electricity from various dams along river St. Lawrence (such from Niagara Falls).the power has supported domestic work, industries and various urban activities like banking.

3. Well developed transport and communication network such as the St. Lawrence Sea way provides a cheap means of transport for bulky and heavy raw materials and finished goods, and opens up the great lakes region to the Atlantic sea board. The Greatlakes region is also connected with road and railway to the other parts of the continent. Easy accessibility has increased the number of activities in the region, hence increased population concentration.
4. Presence of a large and very productive hinterland which provides raw materials for industrial goods including agricultural raw materials (cotton, wheat, maize, dairy products). Cotton particularly comes from the Mississippi lowland yet wheat and livestock products come from the Prairie Provinces. There are also mineral resources such as limestone, coal, and iron ore. This has led to the concentration of activities in the Greatlakes region especially industry and trade-hence urbanization.
5. Availability of adequate capital to support various activities especially industry, mining, trade. This capital is generated from international trade, local and foreign investors and it is used to construct industries, construction of locks and canals, banking facilities, road net work—leading to the expansion of various urban centers like Cleveland, Duluth, and Chicago.
6. The dense population in the area, which is a source of labour to work in the established industries and other sectors. The large population also provides market for the manufactured and traded goods, hence leading to the concentration of activities in the region.
7. The development of many industries in the region, by both local and foreign investors. These include the automobile industries in the Detroit region and the Lake Michigan region, mechanical engineering and chemical industries in Chicago and Buffalo cities. The expansion and growth of industries has also led to the expansion of the urban centers forming a conurbation.
8. Availability of ready / reliable water supply for both domestic and industrial use. The water is provided by the Greatlakes –superior, Michigan, Huron, Erie, and Ontario. This supports industries like food processing and house hold activities , leading to increase in the urban population and accompanying activities like banking ,education and medical facilities.

9. Availability of a large/ extensive land for expansion of urban activities to the surrounding areas like industry, trade and commerce, recreation; hence forming a large/ continuous urban complex.
10. Well developed social and economic facilities which include health facilities, entertainment facilities, banking among others. These have attracted large population concentrations in the urban centers like Detroit, Windsor, Port Arthur, Superior, and Milwaukee; leading to their expansion.
11. Geographical inertia—where by old industries fail to change location even when the existing location is no longer the most advantageous. Accordingly, more new industries are attracted to the already existing investment/ industrial centers to take advantage of existing infrastructure. This has led to increased proportion of population being concentrated in such established urban /industrial centers —hence expansion.
12. Political stability of the region which has also enabled the expansion of the towns/cities. More modern facilities have also been set up like banking, insurance, recreation, and education facilities-which in turn have attracted large population concentrations in such towns like Cleveland, Milwaukee, and Duluth; leading to their expansion.
13. Initiative of a number of businessmen. Detroit became the first automobile centre because of the pioneers of industry happened to be located there. For example Henry Ford who made mass production possible so that automobiles became affordable to many people. Many people were attracted into the towns to get employment opportunities, leading to the expansion of the towns.
14. Favourable/positive government policy for example encouraging export promotion industries –which was a driving force in the setting up of large manufacturing industries. The government has also set up the necessary infrastructure like power supply as well as encouraging local and foreign investors in various urban activities like banking. This in turn leads to expansion of the urban centres into a conurbation.

THE RUHR INDUSTRIAL CONURBATION

The Ruhr region in Germany is the largest industrial complex in Europe. It has developed in the last 100 years into Europe's biggest iron and steel producer, coal producer, chemical centre and engineering centre. The region is enclosed by rivers

Lippe, Rhine and Wupper. The major towns within the Ruhr conurbation include: Duisburg,Essen,Dortmund,Bochum,Dusseldorf,Bottrop,Hagen,Dinslaken,Solingen, Wuppertal,Oberhausen,Herne,Recklinghausen,Gelsenkirchen,witten,Remscheid, Rheinhausen, Leverkusen, Krefeld, Elberfeld.

Factors for the growth of the Ruhr region as a conurbation

1. The industrial revolution which started in Britain in the 18th century and later it spread to Germany. It involved changes that transformed agricultural economies into industrial ones. It led to widespread replacement of manual labour by machines. Large groups of business enterprises were located within a limited area including the setting up of many industries such as engineering, chemical, and textile industries. This in turn led to the growth and expansion of cities in the Ruhr region as people moved from rural areas into the urban areas in search of work.
2. Presence of valuable mineral resources such as coal, limestone, and iron ore. There was high-grade coal (containing a high percentage of carbon that burns with great heat) providing a major source of energy for various industries. Besides the coal was of various types such as bituminous coal, and anthracite coal. The mining acvitites attracted many people to provide labour, and therefore the expansion of small mining centers that grew into bigger towns.
3. Availability of large quantities of power in form of coal, natural gas and hydro electricity. Coal was for long the main source of power for industrial development in the region. However, its use declined due to development of other sources of energy such as hydro electricity, natural gas, imported oil, and nuclear power. This has supported many urban activities such trade, banking, education, advertisement, and industry-hence the expansion of the towns.
4. Well developed transport and communication networks by road, railway, water and air. Water transport takes place on rivers such as Rhine, Ruhr, Lippe, Emscher; and water transport has been improved by the construction of canals such as Lippeseite, Dortmund-Ems, and Rhine-Herne. These have facilitated the movement of inputs and finished goods, hence supporting industrial growth and related activities—leading to increased population concentration in the Ruhr region.

5. Availability of large water supply for industrial and domestic use provided by rivers like R.Rhine, R.Ruhr, and R.Lippe. This has supported industrial development by acting as a raw material and for cooling machines. Water also supports many urban activities such as recreation, entertainment, and food preparation. This increases population concentration in the ruhr region leading to urban expansion.
6. Existence of a large and extensive hinterland which provides raw materials for the Ruhr industries such as agricultural, mineral and forest resources. These include iron ore, fruits, vegetables, sugar beet, maize, vines from the Rhine rift valley, timber from the Black forests and Vosges. In turn, industrial development and trade has enabled the growth/expansion of cities like Essen, Dusseldorf and Bochum.
7. Presence of adequate capital to invest in general development of the region provided by government, local and private investors. The developed banking sector has for long provided capital for industrial development. More so the Marshall Aid plan of 1945 after the Second World War provided the necessary capital for reconstruction and rehabilitation of industrial plants and other infrastructure. This in turn increased urban activities and thus expansion of towns.
8. The dense population of the region which has provided labour for industries and the service sector. It also provides market for the industrial and other sectors. The big population in the area favoured the development of better social and economic facilities such as entertainment, medical and banking facilities. This in turn led to the expansion of the Ruhr conurbation.
9. Availability of large land for expansion of urban activities to the surrounding areas like industry, trade and commerce. This leads to expansion of the conurbation.
10. Well developed social and economic facilities which include health facilities, educational facilities, banking, insurance, recreation among others. This has led to increased population concentration in the urban centres like Solingen, Bottrop, Duisburg, and Bochum; hence expansion into a large urban complex.
11. Geographical inertia—where new investments are attracted to the already existing industrial centres to take advantage of the existing infrastructure such

as power supply, advertising media, transport network, and insurance. This eventually encourages population concentration in the urban area, hence growth of the ruhr conurbation.

12. Political stability of the region for a long period of time since world war, hence encouraging developments without ravages of war. This has led to the growth of many urban activities such as industry, trade and commerce; attracting more people for employment opportunities and thus expansion of the conurbation.
13. Influence of early investors and these include Krupp at Essen, Mayer at Bochum. In the automobile industry, the invention by Gottlieb Daimler of the gasoline motor and power carriage which was completed by Rudolf Christian Karl. This increased the number of job opportunities offered and thus increased population concentration.
14. Favourable /Positive government policy as promoting trade and attracting investments from large companies from all over the world especially from developed countries like USA, Britain. The government has also improved waterways, railways, and road networks. This has increased the concentration of urban activities in the area such as trade and insurance; leading to the growth of the conurbation.

Guiding questions

1) (a) Account for the growth of conurbations in either Western Europe or United States of America.

(b) Examine the effects of conurbations on the environment in the region chosen above.

2) Account for the development of either New York or Beijing into a large urban centre.
3) Examine the causes and effects of urbanization in either Germany or republic of South Africa.
4) Examine the causes and effects of the development of conurbations in either the eastern seaboard of North America or China.

UTILIZATION AND CONSERVATION OF NATURAL RESOURCES

Basic concepts

- Reserves

These are resources which are known to exist but not used today.

- Bio-diversity

This means the variety of genetically distinct populations and species of plants, animals and micro-organisms co-existing with man and the variety of eco-systems of which they are functioning parts.

- Environment

This is an aggregate of complex sub-systems within which natural resources respond to human activity. In general the environment is categorized as the natural environment and artificial environment. The components of the (natural) environment include: lithosphere (solids-soils and rocks), hydrosphere (liquids-water resources), biosphere (plants and animals) ,and the atmosphere(gases) .

NATURAL RESOURCES

A resource is anything that is beneficial or essentially beneficial to satisfy human needs. Resources expand and contract in response to human wants and actions. An object is originally neutral staff but when human value is attached to it, it becomes a resource.

Natural resources refer to anything provided by nature /gift of the nature capable of satisfying human needs. Examples include: vegetation, soils, rocks, air, water resources, animals, insects, human beings etc

CLASSIFICATION OF NATURAL RESOURCES

Renewable natural resources

These are resources capable of self-reproduction. They are resources that can be regenerated once deteriorated and put back to use. If used with care, these resources are inexhaustible. Examples include: soils, climate, water resources, scenic beauty, natural vegetation, animals.

Non-renewable resources

These are resources which lack the capacity to regenerate themselves after deterioration. They diminish and get exhausted when used. They form slowly and from the human perspective their supply tends to be fixed especially mineral resources.

NB: Renewable natural resources should always be organized and sustainably utilized in a way that humans can yield the greatest for the longest possible time. Non-renewable resources need to be sustainably utilized emphasizing conservation through optimal use.

SOILS

Soil constitutes the upper most layer of the earth's crust. It is composed of minerals, organic matter, water, and air. The soil supports plants with nutrients .soils degradation arises from the removal of natural vegetation by man and his animals, which produces non-productive soils (impoverished soils).

This is attributed to the activities of man like bush burning, deforestation, and pastoralism. Other activities leading to reduced soli productivity include use of fertilizers which, pollute the soil, cultivation along steep slopes carelessly, dumping of polythene papers which take years to decompose, monoculture etc

Possible remedies of soil degradation:

- Use of crop rotation
- Improving the use of organic matter
- Proper use of fertilizers
- Proper disposal of polythene material
- Sensitization o the masses
- Restricting settlement and agricultural practices in fragile zones such as along steep slopes.
- Use of soil erosion control measures such terracing, contour, strip bands of grass, control of livestock.
- Proper land use planning.

CLIMATE

Climate is a resource that growth of crops and rearing of livestock. It supports vegetation growth, wind to produce wind energy etc. Many activities have been responsible for the deterioration or changes in climatic conditions such as deforestation, swamp reclamation, pollution, and increased industrialization. Many areas are increasingly characterized by low and unreliable rainfall, and the dry season is long, yet the occurrence drought is frequent.

WATER RESOURCES

This combines the surface and ground water resources i.e., the lakes, rivers, streams, oceans, and swamps /wetlands. These sources are important for domestic and industrial use, irrigation, fisheries, H. E. P generation, transport etc. the water-related environmental problems include: water shortage, and deterioration of

water quality through pollution and contamination. Whereas some areas receive enormous amounts of water, other areas receive hardly any or very little.

Regarding the quality, there is evident pollution of fresh water sources. Rivers and lakes have been polluted by agricultural chemicals, sewage and industrial waste disposals-which affects aquatic life makes the water unsafe for consumption. There is also overfishing and indiscriminate fishing leading to depletion of fish stocks, construction of many bore holes, which affects underground water sources. For oceans /seas, the international dumping of toxic chemicals and nuclear substances by industrialized countries is a problem of major concern.

Principles of management of water resources:

- Encouraging afforestation and reforestation
- Legislation of waste discharge
- Careful licensing of fishermen to minimize over fishing.
- Setting standard net sizes
- Restocking the overfished waters
- Encouraging fish farming
- Protection of catchment areas
- Emphasizing community participation such in conserving wetlands
- Treatment of industrial wastes before dumping water bodies
- Carrying out environmental impact assessment(EIA) for all projects

NATURAL VEGETATION

This includes forests, grasslands, scrub, thickets, and woodlands. For example the forests are useful for timber, rubber; protect water resources, wildlife conservation, recreation, soil erosion control etc. it is noted that much of tropical vegetation is being lost especially in west Africa, DRC, etc the savanna vegetation is continuously threatened by the ever growing population requiring land for settlement and farming . Other activities for vegetation are: lumbering, charcoal, political etc

Possible solutions to vegetation degradation:

- Encourage afforestation and reforestation
- Control of lumbering activities by government
- Encourage the use of alternative sources of energy

- Use of energy saving stoves
- Prohibiting bush burning
- Creation of forest reserves
- Education/sensitization of the masses about vegetation conservation
- Enforce the laws involving of agricultural encroachers.
- Train more environmental management manpower
- Emphasize population control measures

WILDLIFE

This comprises of a combination of undomesticated plants and animals (flora and fauna) found in their natural found in their natural habitat and forming part of natural resources. Wildlife is basically restricted to national parks, sanctuaries, wildlife research centres among others. Wild life is more crucial as a tourist attraction and hence generates foreign exchange.

Wildlife is threatened by increased population settlement, poaching, uncontrolled cropping, bushfires etc a number measures can be taken to conserve wild life such as controlling agricultural encroachment, massive education about the value of the environment among others.

SCENIC BEAUTY

This includes the general natural features of an area such as mountains, valleys, drainage features (e.g. waterfalls, rapids), vegetation etc. the scenic beauty is degraded /destroyed through mining and quarrying, construction, deforestation, garbage, and waste disposal etc.

Guiding Questions

1. (a)Differentiate between renewable and non-renewable resources.

(b) With specific examples from either a developed or a developing country, examine the measures being taken conserve renewable natural resources.

2. (a) Giving specific examples ,assess the extent which the renewable natural resources of Africa have been deteriorated .

(b) Discuss the steps being taken to ensure sustainable utilization of natural resources.

3. Account for the deteriorating of renewable resources in Africa and suggest ways how the concerned government can combat these problems.

ENVIRONMENTAL DEGRADATION

This refers to fall in the biological productivity of environmental resources. Or It is the decline productive value of the components of the environment.

Environmental degradation/deterioration is characterized by desertification, pollution and global warming, deforestation, soil erosion, landslides and mass wasting, leaching, and loss of biodiversity.

Causes of environmental degradation in Africa

Recent studies in Africa have all found progressive environmental deterioration over the last decades, and this can be explained by both natural and man-made causes.

1. Rapid population growth which has over strained the natural resources and environmental systems such as the hydrological cycle. It has created imbalance between people and natural resources due to exceeding the carrying capacity. This has increased the clearing of natural vegetation for settlement, land fragmentation and reduced soil productivity.
2. Poor farming methods /unsound agricultural practices which include overgrazing, bush burning, monoculture, over cropping, cultivation along steep slopes, and river banks among others.

a) Overgrazing resulting from over stocking mainly in the pastoral communities such as the Fulani in the Sahel region (northern Nigeria), the Maasai of Kenya and Tanzania among others. The soils are left bare and hence exposed to severe soil erosion. This in turn reduces soil productivity /crop yields and also contributes to increased drought.

b) Bush burning mainly done by shifting cultivators, other peasant farmers and nomadic pastoralists, for example when clearing farming land, preparing for fresh pastures at the beginning of the wet season among other reasons. This also exposes the soils to the agents of erosion, destroys the useful living organisms and humus that contribute to soil formation. It also leads to the development of resistant grasses-not good for livestock.

c) Monoculture due to growing of especially perennial crops year after year and this also leads to deterioration of soil productivity.

d) Over cropping—continuous cultivation of land without giving it ample time regenerate, also makes the land to lose fertility and consequently reduced yields.

3. Poor lumbering methods and increased deforestation without selective cutting and failure to replace the cut down trees. Much of the tropical forests are being lost especially in West Africa (such as southeast guinea, Cameroon, Ghana, southern Nigeria). In Southern Nigeria there has been rapid deforestation in the Yoruba and Ibo states. Deforestation leads to increased soil erosion, loss of soil fertility, reduced evapotranspiration /reduced rainfall, and unreliable water supply—hence general environmental degradation.
4. Reclamation of swamps /wetlands caused by land shortage and the desire to grow certain crops that require a lot of water (such as rice). Many swamps have been drained for crop farming coupled with industrialization and bricklaying. This leads to insufficient water for both livestock and man. It also affects the water table and the drained areas soon become arid and unproductive. More so the habitat of birds and animals is lost which negatively affects the tourism industry.
5. Increased infrastructural development which leads to destruction of vegetation such as clearing the forests to set up roads, railways, schools, health centres. There is destruction of the soil structure such as by leveling the ground to set up various infrastructures. This leads to soil erosion, mass wasting, and reduced evapo-transpiration.
6. Over fishing due to the growing demand for fish year after year and the increased use of modern fishing gargets leads to over fishing and depletion of fisheries resources such as the disappearance of certain fish species.
7. Poaching and this involves illegal hunting of wild animals especially in game parks and game reserves. Poaching leads to the reduction in the wild game, hence negatively affecting the tourism industry.
8. Mining and quarrying activities which leads to gradual depletion /exhaustion of deposits, leads to pollution of the environment (both air and water pollution),destroying of scenic beauty/ disfiguring of the landscape by leaving large quantities of waste rock and abandoned mining pits. There is also increased noise pollution through blasting of rocks. In fact many environmental

problems in the Niger delta of Nigeria are associated with the oil mining industry such as oil spills due to leaking oil pipes ,and fires due to sabotage by certain groups. Oil spillage leads to contamination of underground water, affects aquatic life, and people in the surrounding areas.

9. Increased industrialization in many parts of Africa and this increases the exploitation of various resources such as minerals, forest resources, and water resources. Industrialization also leads to the destruction of grasslands, forests, wetlands, to provide room for industrial sites. It is still associated with pollution through the release of toxic substances and industrial fumes, which affect the ozone layer gradually leading to global warming. Industrial wastes are also disposed into water sources which affect urban water supplies and endanger aquatic life –hence increased environmental degradation.
10. Rampant political instabilities in Africa such as the West African countries (Liberia, Ivory Coast), DRC, Somalia, and Rwanda. These conflicts accelerate the cutting down of trees, burning of bushes and bombing of forests by rebel and government forces. This leads to reduced evapo-transpiration, increased soil erosion and resource degradation. The weapons used also increase the rate of environmental pollution.
11. Insufficient technical knowledge about the environment/ Limited knowledge about the value of environmental resource. Most people do not know much about ecosystems and other life support systems. This explains the increased overstocking and over grazing, over fishing and indiscriminate fishing, charcoal burning, cultivation along riverbanks etc. The effects of human activities cannot be predicted with reasonable certainty. There is much gambling with survival than caring for life support systems or environmental resources.
12. Increasing poverty and failure to understand the wealth of nature. This leads to over using of natural resources such as fishing, forest cutting, illegal hunting of wildlife etc in attempt to look for survival/livelihood.
13. Poor patterns of resource tenure and control since in many cases the user rights are not specified which escalates degradation. For example the communal ownership of land among the pastoral communities (Maasai, kikuyu, Fulani) and shifting cultivators (such as Bemba of northern Zambia). This leads to over

stocking, careless bush burning, and cutting down of trees—resulting into soil erosion, loss of soil fertility, reduced evapo-transpiration.

14. Weak and conflicting government policies on environmental protection. More effort is put on industrialization and agriculture at the expense of sustainable utilization of resources. For example there are policies targeting the conserving of wetlands yet at the same time other policies focus on modernizing of agriculture by draining wetlands such as rice schemes. Still many laws fail to focus on the causes of environmental mismanagement for example laws against poaching of wild animals.

Natural causes

1. Climatic hazards:
    - Influence of prevailing dry winds and cold ocean currents for example the North East trades from the Arabian Desert are causing arid conditions over areas of northern Kenya and northeastern Uganda. The dry Harmattan winds affect northern Mali and Senegal negatively leading to desertification. The cold Benguela current has affected the coastal areas of south west Africa by creating aridity due to pre –mature condensation. This also explains the desertification effect such as the Kalahari and Namib Desert.
    - There is also flooding due to excessively heavy rainfall in many parts of Africa such as Malawi, Mozambique, Ethiopia, and Sudan. Flooding leads to the destruction of agricultural land, loss of property, loss of life, contaminating drinking water.
    - Leeward /rain shadow effect. This leeward side of a mountain has dry descending winds and lies in a rain shadow characterized by limited rainfall, limited/stunted vegetation growth, and it is here that arid conditions start.
2. Absence of large water bodies which would otherwise be recharging sources for winds, but their absence makes the areas dry lands, with reduced rainfall.
3. Presence of thin infertile soils/ sandy soils not capable of sustaining plant growth. It is noted that desertification starts in such areas, leading to resource degradation. The absence of moisture conservation techniques in such areas

to manage dry soil agriculture forces people to degrade even other areas/resources such as woodland and forest lands.

4. The occurrence of locusts and other pests. Locusts have greatly affected the irrigated fields of dry lands such as in Senegal, northern Nigeria, and Mali. Locusts have also destroyed large areas of vegetation in West Africa, north and north eastern Africa. This affects evapo-transipiration, leading to reduced rainfall totals and vegetation destruction further accelerates soil erosion. Other plant pests include: aphids, caterpillars, also coupled with livestock pests.
5. Other natural disasters/hazards such as volcanic eruptions, earth quakes, and landslides. These also affect slope stability; soil structure and in turn affect vegetation growth. Earth quakes also increase the incidence of landslides especially in highland areas, which degrade the environment further.

Research question

a) Account for the occurrence of environmental deterioration in Nigeria
b) What steps are being taken to solve the above problem in Nigeria?

ENVIRONMENTAL CONSERVATION

This is involves management of human use of environmental resources so that they may yield the greatest sustainable benefit to the present generations while maintaining their potential to meet the needs and aspirations of future generations.

The environmental conservation strategies include the following:

1) Adopting population control measures such as family planning; since population pressure is both a cause and symptom of environmental crisis. This should be coupled with resettlement of excessive populations.
2) Using forest resource management programmes such as afforestation and reforestation programmes. It should also involve planting of fast growing trees as well as agro forestry.
3) Emphasizing alternative energy sources to reduce the careless cutting down of trees .there should be a wide range of choices such as natural gas, HEP, biogas, use of coffee husks, and use of energy saving stoves.
4) Improving the farming systems for example encouraging agro forestry, crop rotation, mixed farming, intensive farming, ranching etc

5) Establishment of irrigation projects in specific areas and the use of moisture conservation techniques.
6) Enforcing strict laws on environmental resource management such as wetland protection/protection of forest reserves. This also calls for laws reforms coupled with their assessed impact on the environment.
7) Reforming resource ownership /tenure rights to return responsibility for management of natural resources such as the local forest reserves, bush lands.
8) Improving solid waste management such as by burning, burying, land filling, recycling, and re-use of solid wastes to reduce environmental degradation.
9) Soil management strategies such as terracing, planting cover crops, use of ridges, contour ploughing. There is also need for land consolidation.
10) Strengthening education and awareness campaigns about environmental management. This includes use of the media, local community, NGOs, wildlife clubs among others.
11) Encouraging community participation in environmental management and this empowers the local people to mobilize their own capacities to be social actors rather than passive subjects. It also involves sharing of social and economic benefits with the local populations.
12) Campaigns for political stability in various parts to reduce insecurity such as through peace talks, enhancing political and economic democracy.
13) Effective coordination of natural resources management agencies such as game departments, wildlife authorities, ministry of natural resources to avoid conflicting interests. There should be good policy formulation and implementation.
14) Avoiding wastage at the industrial level, that is, ensure total use of resources. For example parts not suitable for pulp can give paper boards, fiber, and the remaining for fuel. In addition, the re-use of waste paper for news print among others.
15) Environmental impact assessment (EIA)—this is a systematic examination conducted to determine whether or not a project will have any adverse impacts on the environment.

<u>Guiding questions:</u>

1. Man is responsible for environmental degradation in Africa. Justify the statement.
2. 'Environmental degradation is not only man-made but also natural' explain using specific example from Africa.
3. To what extent is environmental degradation a consequence of man's misuse of the environment?
4. (a) What do you understand by the term environmental degradation?

(b) To what extent have human activities contributed to environmental degradation in the Sahel region of Africa?

Desertification

Qn. (a) Account for the extensive desertification in Africa

- define desertification
- Identify the characteristics/ indicators of desertification and identify areas experiencing desertification in Africa.
- Explain with specific examples the causes of extensive desertification in Africa

Desertification refers to the extension of the desert conditions to areas where it has not been experienced.

Desertification involves reduction of the biological productivity of land to low levels. The land becomes unproductive, and incapable of supporting livestock and crops.

The characteristics/ indicators of desertification include: desert-like conditions (such as low and unreliable rainfall, very hot temperatures, low humidity ,high evaporation rates); reduction in rainfall amounts and frequent occurrence of drought; reduced vegetation cover, reduced diversity of plants and animals; reduced resource productivity; increased areas of bare land; reduced water level in water bodies; reduced surface water(lakes, rivers, streams, swamps) reduced soil moisture , rising levels of salination in irrigated fields among others.

In Africa it is noted that the Sahara desert and Kalahari Desert are extending into the nearby marginal lands, thereby there destroying the productivity of the land. The Sahel region (margins of the Sahara desert) has been the most seriously

affected area. Areas experiencing desertification therefore include the Sahel (northern Nigeria, Somalia, Sudan, Ethiopia, Chad, Mali, Senegal, etc); Botswana, southern Zimbabwe, northeastern Uganda, northern Kenya, central Tanzania among others.

The reasons for extensive desertification in Africa

1) Lack/absence of large water bodies, which otherwise would be recharging sources for winds .this results into dry conditions and reduced rainfall totals. More so water bodies are reducing in size due to high rates of evaporation and this adversely affects the climate of the surrounding areas.
2) Poor sandy soils in the fragile zones which are not capable of sustaining plant growth since they do not retain moisture. This leads to poor vegetation growth and hence reduced evapo-transipiration.
3) The influence of dry winds such as the North East trade winds from the Arabian desert which causes continuous dryness in northern Kenya and Somalia, the dry Harmattan winds which contribute to the dry conditions of north west Africa.
4) Influence of cold ocean currents such as cold Benguela current and the cold Canary current which induce aridity over the nearby coastal areas. This is because their coldness induces pre-mature condensation in the on-shore winds near the cold currents, reducing the rainfall totals such as the Kalahari desert extended into the interior partly explained by the cold Benguela current which blows along the western coast of southern Africa.
5) Lee ward/rain shadow effect. Some areas are located on the leeward sides of mountains such as Northern Kenya and North Eastern Uganda situated on the leeward side of the Ethiopian highlands , the Maasai lands found on the leeward side of the Kilimanjaro mountain. Such areas are dry for most parts of the year due to dry descending winds.
1) Influence of pests such as Locusts which have particularly invaded the Sahel region destroying the green vegetation, resulting into reduced evapo-transpiration, and hence low rainfall totals.
6) Rampant deforestation by man, especially in Central Tanzania, West Africa, Namibia, Malawi. This has mainly affected the savanna woodlands and savanna grasslands due to increased demand for fuel wood, charcoal, building materials,

and cultivation land. The removal of vegetation results into reduced rainfall and increased temperatures.

7) Poor farming methods such as nomadic pastoralism characterized by over grazing and destruction of pastures ; cultivation on steep slopes, monoculture, shifting cultivation, over cultivation, bush burning, and careless clearing for cultivation like in the Sahel (Mali , Somalia , northern Nigeria, northern Kenya) and Kalahari Desert margins, thus extension of dry conditions such as severe soil erosion, hard grasses and reduced rainfall totals.

   (Over stocking and overgrazing such as in northern Nigeria by the Fulani cattle keepers, northern Kenya by the Turkana, Maasai land of Kenya and Tanzania. This leads to increased soil erosion since the soils are left bare).

8) Reclamation of swamps / draining of wetlands for cultivation reduces the water table and supply of water vapour into the atmosphere hence desert conditions—increased temperatures and reduced rainfall totals. This is one of the major causes of desertification in Senegal.

9) Increased sinking/ drilling of bore holes and construction of valley dams, which also lowers the water table and results into loss of soil moisture which could sustain vegetation growth—hence leading to natural drying of vegetation.

10) Rapid population growth/population pressure hence increased need for land for cultivation and settlement leading over use of the land, clearing of vegetation, swamp reclamation, land fragmentation and soils deterioration. This in turn lowers the water table leading to dry conditions since the carrying capacity of land is exceeded.

11) Increased industrialization and urbanization, which explains the destruction of the ozone layer by emitting carbons, methane and other pollutants into the atmosphere resulting into global warming. The ozone layer is gradually losing its natural ability to absorb the ultraviolet B radiation from the sun. Hence, the amount of heat reaching the earth's surface is higher than the expected normal amount.

12) Inadequate environmental awareness among the population.

13) Weak government policy implementation, regarding environmental resources such as laws against deforestation and swamp reclamation.

(b) Explain the effects of desertification in Africa

1. Famine results due to reduced rainfall totals and increased temperatures plus prolonged drought. There is scarcity of food since the land becomes becomes too dry to support crop cultivation and livestock farming. There are changes in the planting seasons due to climatic changes.
2. Results into shortage of surface and underground water, which limits the survival of man and livestock. For example, Lake Chad has greatly reduced in the water level, almost drying out in the last three decades.
3. It accelerates the rate of soil erosion by both wind and running water. This reduces land productivity and also destroys the nature of the land by creating depressions and gullies.
4. Results into shortage of pastures and hence reduction in the livestock especially cattle. This is common in the Sahel region of Africa where the Fulani have lost large numbers of cattle. The same experience is in Somalia due to prolonged drought.
5. Results into further encroachment on marginal lands such as mountain slopes, wetlands for cultivation, hence further environmental degradation.
6. Worsens poverty and standard of living due to loss of wild life, loss of domestic livestock, reduced soil productivity, and reduced fisheries among others.
7. Results into loss of biodiversity—animal, bird and plant species which are not adopted to the arid conditions. It is only the drought resistant plant species that remain yet many animal species either die or migrate to other areas.
8. Results into shortage of fuel wood and other wood products since many forests and woodlands are destroyed.
9. Limits human settlement to only a few areas where surface water can be got, and this increases population pressure in such areas and thus further environmental degradation.

(c) Outline the steps being taken to control (combat) desertification in the Sahel region.

Examples should be cited from the Sahel region (such as northern Nigeria, Senegal, Algeria, Mali, Chad, southern Sudan etc).

1. Adopting population control measures since population pressure is both a cause and symptom of environmental crisis. This is coupled with resettlement of excessive populations.

2. Using forest resource management programmes such as afforestation and reforestation programmes.
3. Emphasizing alternative energy sources to reduce the careless cutting down of trees such as natural gas, Hydro electricity, biogas, use of coffee husks, and use of energy saving stoves.
4. Improving the farming systems for example encouraging agro forestry, crop rotation, mixed farming, intensive farming, ranching etc
5. Establishment of irrigation projects in specific areas and the use of moisture conservation techniques.
6. Enforcing strict laws on environmental resource management such as wetland protection/protection of forest reserves. There also law reforms coupled with their assessed impact on the environment.
7. Reforming resource ownership /tenure rights to promote responsibility for management of natural resources such as the local forest reserves, bush lands.
8. Improving solid waste management such as by burning, burying, land filling, recycling, and re-use of solid wastes to reduce environmental degradation.
9. Emphasis on Soil management strategies such as terracing, planting cover crops, use of ridges, contour ploughing.
10. Strengthening education and awareness campaigns about environmental management. This includes use of the media, local community, NGOs, wildlife clubs among others.
11. Encouraging community participation in environmental management, which empowers the local people to mobilize their own capacities to be social actors rather than passive subjects. It also involves sharing of social and economic benefits with the local populations.
12. Campaigns for political stability in various parts to reduce insecurity and this also involves the use of peace talks, enhancing political and economic democracy.
13. Effective coordination of natural resources management agencies such as game departments, wildlife authorities, ministry of natural resources to avoid conflicting interests. There is improvement in policy formulation and implementation.

14. Avoiding wastage at the industrial level, that is, ensure total use of resources. For example tree parts not suitable for pulp can give paper boards, fiber and the remaining for fuel. Also the re-use / recycling of waste material.
15. Environmental impact assessment (EIA). This is a systematic examination conducted to determine whether or not a project will have any adverse/ negative impacts on the environment.

Other guiding questions:

1(a) Examine the causes of desertification in east Africa.

(b) What steps are being taken to combat the spread of the desert?

2. Examine the causes and effects of desertification the Sahel region of Africa.

3. "The increasing desertification in Africa in mainly a consequence of man's activities." Discuss

<u>Famine</u>

Question (a) "The famine problem in Africa is primarily a result of human factors". Discuss.

(b) Suggest possible solutions to the above problem.

Solution (a)

- Define famine
- Identify the countries in affected by famine in Africa /locate the areas.
- Explain using specific examples how human factors have caused famine in Africa
- Explain how other factors (natural factors) are also responsible for famine in Africa

Famine is the state of extreme food scarcity characterized by extreme hunger and starvation for a relatively long period of time. OR Famine is the acute food shortages leading hunger, starvation and death.

The counties in Africa greatly affected by famine include: Ethiopia, Somalia, Sudan, Eritrea, Zimbabwe, Malawi, Chad, Burkina Faso, Senegal, Mali, Mauritania, Niger, northern Kenya, north eastern Uganda, and Tanzania. Some areas suffer from periodic famine, yet other areas are experiencing persistent famine. Famine results into starvation, malnutrition, epidemics, fall in standard of living and even death.

Human factors to a bigger/greater extent:

1) Political instabilities and conflicts in many parts of Africa which disrupt settlement, cultivation and food distribution such as prolonged wars in southern Sudan, Somalia, Ethiopia, Chad, Rwanda, Angola, northern Uganda, and Liberia. Wars are associated with attacks on land, burning of farmlands and also preventing people from settling down to grow food crops and rearing of livestock-hence leading to famine.
2) Rural-urban migration (in search for white collar jobs). Many people move into the rapidly growing towns like Lagos, Kampala, Nairobi, Cairo, and Yaoundé, Dakar; which also leads to movement of energetic labour away from rural areas, leaving agriculture for the old folk, women, and children who are less/not very productive, leading to acute food shortage.

   Poor attitude towards agriculture as an occupation when compared to other occupations. Many people leave the rural areas to look for better paying employment in urban areas yet they continue depending on the farming community for food supplies.
3) Cultural ways of life (conservatism in many areas) such as nomadic pastoralists who do not practice food crop production like the Fulani of West Africa, Tuaregs of the Sahara desert, Maasai of Kenya and Tanzania. Other practices are extended funerals, traditional taboos and other cultural beliefs which limit food crop production as more time is spent on such activities instead of farming, causing famine. (Some ethnic groups have long-honoured staple foods and consumption habits, hence reluctant to change to new foods).
4) Poor land tenure system such absentee landlordism-denies many people access to land (land is in the hands of few people who do not use the land for sufficient food production), communal ownership of land-which denies exclusive rights over land and leads to irresponsible use of land and, limits the initiative to introduce modern methods of farming –all of which limit food crop production. Also the inheritance of land leads to land fragmentation since land is divided among sons and daughters-hence reducing yields due to over use of land.
5) Poor farming methods such as bush burning, over grazing, monoculture—which lead to soil exhaustion-loss of soil fertility and consequently reduced food production. Many farmers produce for subsistence /home consumption and thus producing less food—with no surplus for other people. Many farmers

cultivate small pieces of land which cannot produce enough food to meet the requirements of the population.

6) Poor post-harvest management of foods /poor storage facilities which leads to loss of the produced food such as in Senegal, Nigeria, Mali, and Rwanda. During the peak harvests there is a lot of food wastage. There are storage pests which affect some cereals such as beans, maize; that could help during periods of disaster (such as prolonged drought) .Also the perishable foods are not properly handled/ preserved such as fruits, milk, and meat.
7) Extreme poverty in many African countries /limited capital. This also reinforces the production of cash crops and therefore inability to produce more food crops. It limits accessibility to modern technology and loans since they lack the required security. Limited capital has also forced farmers to cultivate small pieces of land and hence cannot produce enough food crops to meet the requirements of their families and other people.
8) Low level of technology used in many countries of Africa (such as Sudan, Eritrea, Sudan) involving poor like hand hoes, panga, sickles,shovels,; which lead to low food production. There is a little day's work per person and of course small harvests. More so, farming is highly dependent on nature and hence limited use of irrigation facilities.
9) Over reliance on food aid such as from World Food Program (WFP) and other countries. This has also promoted laziness among the people of Africa-with limited engagement in productive farming and thus causing famine. They always expect assistance from outside sources.
10) Emphasis on cash crop production for export in many countries and the crops include coffee, cotton, rubber, tea among others at the expense of food crops. This implies that more land has been used for cash crops and thus less land available for production of food crops, leading to food shortages. Some countries even export large quantities of their staple food crops.
11) Poor transport systems ,with many remote areas inaccessible. Most production areas do not have good feeder roads linking them to markets/ consumption areas. The roads become impassable during the wet season which affects food distribution and thus surplus output cannot easily be marketed.

This limits the transportation of food from areas of plenty to areas of food scarcity.

12) Unfavourable government policy /poor government planning for the agricultural sector; which otherwise would ensure food security. The governments inject less money in farming, yet commercial farmland is offered for forestry, industry, or even putting more effort put on cash crops. The government in Zimbabwe has undertaken a controversial land re-distribution program.

13) Limited research and education of the farmers, hence limited innovation in the agricultural sector leading to low yields and continued growth of traditional crops. Agriculture is dominated by traditional varieties which are slow growing, prone to pests and diseases and yielding low output. Farming is mainly carried out by peasant farmers who are used to traditional methods of farming; leading to low output and acute food shortages.

14) High/rapid population growth rates in Africa, generally over 3% per annum. This exceeds food production leading to food shortages. There is also over use of land leading to the decline in crops yields. More so the population structure is characterized by very many young ones who are not agriculturally productive.

However look at other factors (physical factors) causing famine:

2) Adverse climatic conditions:
   - Heavy rainfall, floods and hailstorms. Heavy torrential rainfall leads to the destruction of food crops. Some areas often receive bad and destructive rains characterized by hailstones and floods. People living within the river valleys such as Niger, and Senegal have occasionally been disturbed by floods. Large areas of farmland have often been submerged—hence low food production, leading to food shortages.
   - Unreliable rainfall. Low and unreliable rainfall also greatly limits food crop production. There are many cases of late rains, rain failure or limited amounts of rainfall far below the normal. This is common in many areas of the Sahel.
   - Prolonged drought—there is abnormal shortage of rainfall below that required for food crop production. The countries greatly affected by drought include; Somalia, Sudan, Ethiopia, Kenya, Tanzania, Zimbabwe, Niger,

Zambia, Chad, Mali, Mauritania, and Botswana. This discourages cultivation and also results into low crop yields.

3) Pests and diseases also limit food production. Locusts have particularly invaded the Sahel region destroying the green vegetation including the planted food crops. There are also other crop pests and diseases such as cassava mosaic, maize rust, groundnut rosette, banana wilt, bean anthracnose, halo blight (affecting tomatoes). This leads to low quality and quantity of output from farmlands leading to famine.
4) Poor soil conditions such as infertile, sandy or skeletal soils. This also limits food crop production, for example some parts have rocky, skeletal soils especially in the deserts of Sahara and Namibia, semi-desert areas.
5) Rugged relief of some areas, where farming cannot easily taken place. This also influences the rain shadow effect in northern Kenya, Ethiopia—where low rainfall is received leading to low farm output. Rugged relief also limits mechanization and thus limiting food crop production.
6) Other natural calamities which include: volcanic eruptions displacing many people like in eastern DRC (Nyirangongo), earthquakes along the fault zones, landslides
7) Effect of natural vegetation for example the thick forests of the Congo basin (DRC), Gabon; swamp vegetation which cannot easily be cleared to allow crop farming.

(b) Possible solutions to the above problem

1. Ensure political stability in all parts of the country such as through regional cooperation and peace talks.
2. Adopt /emphasize population control measures
3. Emphasize / intensify research in agricultural sector such as control of pests and diseases, soil improvement.
4. Development of technology used in agriculture
5. Establishment of irrigation projects/schemes
6. Land reform policies such as land consolidation and removal of unfair land tenure systems.
7. Development of transport infrastructure

8. Education to the farmers be encouraged such as about soils, fertilizer use, new breeds, new varieties.
9. Provision of agricultural extension services
10. Encourage production of food crops rather than cash crops.
11. Encourage large-scale farming in food crops / increase land under food crop production.
12. Encourage cooperative farming and other farming groups.
13. Improving storage and preservation facilities
14. Set up a national food policy and effective regional agricultural planning.
15. Seeking aid from relief organizations as a temporary solution.