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

SHIFTING CULTIVATION

This is a form of traditional subsistence cultivation carried out mainly in tropical areas. It involves clearing a small piece of land in the forest by cutting and burning after which crops are grown for one or two seasons. When the land loses its fertility, the plot is abandoned and another is cleared.

The major crops grown include; maize, beans, millet, yams, vegetables etc. In Africa it is practiced in Malawi, Zambia, DRC, Tanzania, and Liberia and in the Amazon forest in South America.

Characteristics of shifting cultivation

- Farm plots are cleared through cutting and burning bushes.
- Plots are small and highly scattered.
- Production is for home consumption.
- Simple tools such as machetes, digging sticks are used (Rudimentary tools).
- It is practiced in regions of low and sparse population.
- Annual crops such as beans, maize, yams and vegetables are grown.
- Once the land productivity declines, the plot are abandoned and virgins ones are cleared.
- Family labour is mainly used.

SHIFTING CULTIVATION IN ZAMBIA

Zambia is one of the most African countries where shifting cultivation is highly practiced especially in the Miombo woodland of Northern Zambia. Crops grown include yams, cassava, maize, beans, millet etc. The following are the factors for persistence shifting cultivation.

- Existence of vast tracts of land for farming. In some parts of Zambia there are small population in the vast remote areas where shifting cultivation is practiced more so in the Northern part.
- The limited market for abundant agricultural commodities in rural areas of Zambia does not necessitate commercial production.
- Underdeveloped means in remote areas of Zambia to transport agricultural products to market centers have limited commercial farming but favored shifting cultivation.
- Limited education by some people in remote areas about better farming practices like plantation farming has encouraged the persistence of shifting cultivation.
- Limited capital to engage in commercial farming by buying large quantities of seeds and other farming implements like herbicides have led to persistence of shifting cultivation.
- Limited skilled labour to engage in commercial farming in remote areas of Zambia has led to continued practice of shifting cultivation.
- Low levels of technology to use for farming such as hoes, digging sticks which are still being used in Zambia have limited commercial farming and favored subsistence farming.
- Declining of soil fertility in Northern Zambia has led to reduced crop yields and so has compelled the farmers to abandon their land and get another one in some other location where clearing is done hence persistence of shifting cultivation.
- Unfavorable climatic conditions like prolonged drought has led to crop failures and often has compelled one in some other location where clearing is done and planting is done in anticipation of better yields.
- Natural hazards like floods during the rainy season in Northern Zambia have often destroyed crops and limited cultivation. This has forced farmers to temporally abandon certain areas during the rainy season and only return to use them during the dry season thus persistence of shifting cultivation.

- Dependency on family labour which is readily available i.e. father, mother, children do clearing of the land, burning of the bushes and planting crops discourages commercial farming only favours shifting cultivation.
- The system is flexible because it allows the growing of a number of annual crops to feed the family for example maize, yams, beans, vegetables and millet.
- Cultural factors where people are traditionally inclined to produce for home consumption hence no need to engage in commercial farming thus persistence in shifting cultivation.
- The limited government interference which leaves the shifting cultivators to continue with their activities from one place to another more so in Northern Zambia.

MERITS OF SHIFTING CULTIVATION

- Restoring soil fertility through fallowing and burning.
- It is cheap since family labour is used/ employed.
- It controls soil erosion since a variety of crops is grown e.g. beans, maize, yams etc.
- Low population allows free movement from one area to another.
- Intercropping checks soil erosion and maintain fertility.
- It is flexible compared to plantation farming.
- Allows extra time to attend to other activities e.g fishing, hunting, mining etc.
- It ensures high yields since it involves shifting to new sites.

DE MERITS OF SHIFTING CULTIVATION

- Destruction of soil nutrients through burning.
- Low output and poor quality produce.
- Does not promote agricultural modernization.
- Destruction of natural forests contributing to climatic change.
- Lack of individual ownership of land limits financial assistance.
- Limits research development in both and artificial forest.

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.

<u>Problems facing nomadic pastoralists in Africa</u>

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.

MOVEMENT FROM SUBSISTANCE FARMING TO CASH ECONOMY

Transforming agriculture in Africa has taken different forms or approaches in different countries. It has involved transforming of the farmers from producing for consumption to commercial farming.

For agriculture transformation to take place, a number of things have to be done e.g.

- Farmers need to accumulate capital in order to buy the necessary farm inputs.

- Farmers need to acquire knowledge on new machines, seeds, chemicals etc
- Research into different crops must be carried out because it is only through research that productive and resistant varieties can be developed.
- Cash crop production necessitates processing plants and factories for example cotton ginneries, coffee hullaries hence the need b countries to establish processing plants.
- Introduction of resistant and high yielding varieties.

COCOA GROWING IN GHANA

Cocoa originated from Central America where it is a native plant. In Ghana, it was introduced in 1870 and is the leading producer in Africa, accounting for 80% of the country's exports.

Cocoa is a tropical plant that is grown only in the southern region of Ghana where conditions for its growth exist. Cocoa growing requires the following physical factors;

- Heavy rain fall at least 1500mm of mean annual rain fall which should be fairly or evenly distributed throughout the year.
- It requires hot temperatures throughout the year with a minimum of 21°C.
- It requires shelter from strong winds (dense forests).
- It also requires deep well drained fertile soils.
- It grows in areas of low altitude.
- It also requires high humidity of about 80%.
- Low incidence of pests and diseases for high yields.

Other requirements for cocoa include;

- Sufficient skilled labor to plant and harvest.
- Efficient transport to market and processing centres.
- Adequate capital to buy farm equipment.
- Ready market for the cocoa products.
- Relative political stability to encourage investment.

The main cocoa producing belt stretches from Koforidua in the east to Buyini in the North West. cocoa production is entirely in the hands of the peasants who work less than two hectares of land. Such small holding are managed by family labor. However, some farms are large and therefore care takers have to be employed.

Most of the cocoa farmers also grow some food crops for their own consumption (yams and bananas).

Cocoa is propagated from seedlings that are inter cropped with yams and bananas.

The banana provide shelter to the seedlings and later after maturing, they provide shade from sunlight and strong winds. after 3 to 5 years, the cocoa plants begins to bear fruits. Once mature, harvesting is done for only the ripe fruits. Harvesting is done using knives between September and January and April to august.

The harvested fruit is split open and the beans scooped. The beans are heaped and covered with banana leaves in order to be fermented.

Fermentation is done for six days and it enables to get rid of the white milky substance that covers the seeds. The fermented seeds are then dried on racks for 1-2 weeks. The dry beans are graded and sold according to their quality.

Marketing of cocoa in Ghana is done by the state cocoa marketing board. However, there are also private companies that market cocoa such as cads bury and fly united Africa Company.

Cocoa is used as;

A beverage or drink which is actually called cocoa.

It is used to make chocolate.

It is used to make cocoa butter, cosmetics.
It is used in the manufacture of confectioneries.

It is used in the manufacture of drugs (pharmaceuticals).

PROBLEMS FACING COCOA PRODUCTION INCLUDES

1. A wide range of pests and diseases was a problem e.g. the swollen shoot which prevents upward growth of the plants, the only solution is to cut off the affected part of plant. Another disease is the black pod which is a fungal stage and also destroy the beans, it only cures with application of pesticides.
2. Climate changes. The north of Ghana receives insufficient rain whereas the south receives very heavy rain fall. Both conditions are not favorable for cocoa production i.e.

long drought and too much rain fall.

3. Competition from other producers such as Ivory Coast, the leading producers of cocoa.
4. Hail storms which destroys cocoa plants.
5. Price fluctuation which affects incomes of the farmers.
6. Inadequate storage facilities leading to losses.
7. Transport challenges such as slippery roads which limit marketing.
8. Wild or bush fires destroy cocoa farms.
9. Expensive farm inputs like fertilizers which reduces profit margins.
10. Inadequate land due population increase
11. Soil exhaustion due to monoculture leading to low yields.

BENEFITS OF COCOA GROWING TO GHANA

- It is a source of income to the farmers thus improving the standards of living.
- It is a source of foreign exchange after exporting cocoa and this is important for importing foreign goods thus economic development of the country and improved living standards.
- It is a source of government revenue through taxes charged on the farmers, processing plants and marketing boards. Revenue is used to provide social services.
- It has led to diversification of the economy thus reducing on over reliance on one sector, generating more revenue and jobs.
- It is a source of raw materials for other industries e.g. cosmetics industries which employ many people and generate more revenue and income.
- It has led to development of infrastructures like roads in the area where cocoa is produced thus simplifying movement of people and goods..
- It has promoted international co-operations with outside countries through cocoa exports thus international trade and peace.
- It has stimulated the growth of towns like Kumasi as buying or processing centres for cocoa but also for other necessities.
- Encourage acquisition of skills by the workers through on job training as harvesters, mechanics, etc.
- It has also encouraged the growth of out growers' scheme in the cocoa region thus benefiting the local people through ready market and income.

STEPS TAKEN TO IMPROVE COCOA GROWING IN GHANA

- Spraying to control pests and diseases.
- Planting legumes to improve soil fertility.
- Hiring labor from neighboring countries during harvest period.
- Formation of cooperatives to help in the marketing of cocoa.
- Improving on the roads in the cocoa region to simplify transport.
- Planting more trees to provide shade to the cocoa trees.
- Setting up industries to add value and improve profit margin of the farmers.
- Set up modern storage facilities for the cocoa during times of over production.

PALM OIL GROWING IN NIGERIA

Palm oil is the most important crop grown on large plantations throughout Nigeria. Most of the palm oil plantations are located in the south near Port Harcourt and Onitsha. Today Nigeria is one of the leading producers of palm oil.

However, other crops such as cocoa, cotton, coffee and sugarcane are also grown on plantations. Oil palm is also grown in Ivory Coast, Liberia, Togo, Benin, Ghana and Sierra Leone.

CONDITIONS THAT FAVOUR GROWTH OF PALM OILS

- ❖ Low altitude of not more than 1000 meters above the sea level.
- ❖ Heavy rain fall of above 1500mm per year well distributed throughout the year.
- ❖ Well drained fertile soils.
- ❖ Weeding after it has just been planted.
- ❖ It also requires hot temperatures of above 21°C.
- ❖ High humidity is also needed.
- ❖ Vast land for extensive farms
- ❖ ❖ Gentle landscape for easy working.

Other requirements include;

- ❖ Efficient transport

networks.

- ❖ Sufficient skilled labor to work on the plantations.
- ❖ Adequate capital for buying arm equipment etc.
- ❖ Ready market for palm oil.
- ❖ Supportive government policy.

EXTRACTION OF PALM OIL

One year old seedlings are planted on rows of about 9m apart.

Palm oil is harvested three years after the seedlings have been planted. Six months after flowering, the fruit is ripe and is ready for harvesting by climbing each palm oil tree trunk with the help of long belts which support him as he jerks himself to the tree. The man carries a panga which he uses to cut the ripe bunches.

The Nigerian institute for oil palm research and introduced two other methods of harvesting which are less harm full to the trees because cutting of bunches reduces the yields. These involve use of a harvesting chisel to cut off the bunches while the trees are still short. The other methods is by use of a harvesting hook which is used to hook and pluck off the ripe bunches from the trees.

USES OF PALM OIL

- Used to make margarine.
- It is used to make candles.
- It is used to make soaps.
- Palm oil is also used in making of cosmetics.
- The sap which drains of the trunk of palm oil can be located and fermented into a strong alcoholic drinks.
- It is also used in making of some drugs e.g. pharmaceuticals.
- The leaf ribs are used for local buildings.

PROBLEMS FACED BY PALM OIL FARMERS

- Shortage of labor in the production process which reduces the production margin.
- Political unrest which affects production.
- There is a problem of pests and diseases, diseases include anthracnose, freckle disease, among others which reduces yields.
- The business is carried out on subsistence level and thus cannot easily expand the oil palm farms.

- Disorganized market system which encourages the traders to cheat the farmers on the prices.
- There is a problem of deep rooted weeds such as siams.
- There is competition for market from other oil palm producing areas.
- There is low level of technology used in harvesting e.g. climbing with a panga in order to cut the bunches.
- Soil exhaustion due to mono cropping.
- Fluctuating of palm oil prices on the world market which discourages farmers.
- Occasional droughts which affects production.
    - High costs of production.

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 longterm 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 byproducts 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 1820 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

mediumsized 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.

MARKETING ANIMAL PRODUCTS FOR BOTSWANA

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 byproducts.
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.

CONTRIBUTION OF COOPERATIVE FARMING TO THE DEVELOPMENT OF DAIRY FARMING IN DENMARK

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. Objectives of the Gezira irrigation scheme

- ✦ 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 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 rearrange 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.

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 hydroelectricity. 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.

AGRICULTURAL COMMUNES

A commune is large scale farms created by compulsory grouping of people into large units for improvement of quality and quantity of agricultural produce **OR** A type of farming where government organizes farmers in teams to carry out production. They are mainly found in china, India, Russia, and Indonesia etc. In china examples are Chilliying, Honam, Kiagish, Kweichow, Fwahtung, Yangtan etc. They grow mainly rice, wheat, Soya beans, Maize etc.

Characteristics of communes

- They are state controlled and people work on the farms as employees.
- They are subdivided into teams which then form brigade.
- They are communally owned.

- Each brigade has an inspector approved and responsible to the state.
- Work is labour intensive.
- The state determines the crops to be grown.
- The surplus above the fixed amount is shared depending on the input.
- The state provides technical and financial assistance.
- They undertake processing of the produce.
- Research is carried out by the state.
- Teams decides on how the surplus is used e.g. sharing or save for buying machinery.

FACTORS THAT LED TO THE DEVELOPMENT OF AGRICULTURAL COMMUNES

- Favorable climate such as the heavy monsoon rainfall which is evenly distributed have supported the growth of a variety of crops such as rice, soya bean, wheat etc.
- Fairly fertile alluvial soils in the Manchuria plains and the south East deposited by River Yangtze, Yellow river etc favoring quick growth of crops.
- Availability of extensive land in both the Manchuria region and Yangtze basin suitable for extensive farming under communes.
- Relatively flat land or plains in the Yangtze basin suitable for extensive farming and gravitational flow of water for irrigation which results into high yields of crops for example wheat, rice, soya beans etc.
- Abundant water supplies to farmers mainly from River Yangtze provide water for irrigation which encourages the growth of crops like beans, rice and wheat.
- Relative political stability and security provided by the Chinese armed force and police encourage investment and operation of the communes.
- Availability of large and ready market for commune products like wheat, rice and beef by local population of 1.35 billion people in china encouraged farming on the communes.
- Modern transport network e.g. roads, railways e.g. The Hangzhou-Tianjin canal used for distribution and marketing of commune products.
- Supportive communist government policy that formed and still encourages communes through subsides credit etc.
- Availability of large sums of capital injected by the Chinese government to construct roads, canals and storage facilities as well as provision of farm inputs like seeds, poultry etc.

- High levels of technology such as tractors used in clearing of land such as reclaiming of swamps, harvesting of crops by use of combined harvesters, ploughing and planting of crops in the Manchuria region.
- Intensive research to decide the crops to be grown in a given area depending on the existing conditions, market research has enabled farmers produce high quality crops and animals.

The need to increase food production and food security to feed the big population of over a billion people encouraged the formation of the communes.

EXTENSIVE FARMING

Extensive farming refers to the growing of crops and rearing of animals on very large areas of land. There is specialization in terms of crop grown or animals reared. Examples include wheat growing on the Canadian prairies, Rubber growing in Liberia, sugarcane growing in Natal Province of South Africa, livestock rearing in Argentina, sheep rearing on the veld in South Africa and livestock rearing on the Downs of Australia etc.

The farms are large covering thousands of hectares, many workers are employed, cultivation is highly mechanized,and monoculture is practiced. There is high level output and the system requires good storage facilities. There is usually enough domestic market and foreign market for the farm products.

Extensive farming in the Canadian Prairies

The Canadian prairies are well known for wheat growing in the whole world. Wheat is mainly grown in the provinces of Alberta, Saskatchewan and Manitoba under extensive farming.

The characteristics of the prairie wheat farms include: The farms are very large covering thousands of hectares, Use of extensive farming to maximize profits, High mechanization on the farms because they are extensive, Monoculture practiced and wheat is the major crop, Use of scientific methods of farming such as use fertilizers, improved seeds. Wheat processing plants have been set up in on the prairies in centers like Calgary, Edmonton, Regina and Winnipeg.

The wheat is sold domestically as well as in the foreign markets. The foreign market includes eastern Asian markets like china, Japan, and Russia; Western Europe like Britain, France, and Netherlands. However today some other crops have been introduced on extensive basis such as barley, oats, rye and soya beans.

Factors which have favoured extensive farming on the Canadian prairies

- **Presence of well-drained and deep fertile soils** (with high content of phosphorus and potassium) which support wheat growing. These are fertile black chernozem soils with those essential nutrients to cereals such as wheat.
- The **warm summer temperatures** of about 22^0c which is necessary for ripening and harvesting.
- **Moderate / average rainfall** of about 500mm per year which supports wheat growing.
- The **frost-free growing season** this leads to high quantity of production. The light spring rains assist seed germination.
- **Presence of gently sloping/ generally flat landscape** which allows easy mechanization at every stage of wheat production—like use of tractors to plough , drillers to sow the seeds in spring, and combine harvesters during harvesting; and also easy construction of transport routes. The land rises gently from the east towards the west, and this makes the land well drained, which is vital as wheat cannot tolerate stagnant water.
- **Availability of large/vast/ extensive land** which is also cheap for growing of wheat on large scale and largely using machines. The farm sizes are therefore covering hundreds to thousands of hectares. This is because of the low population hence plenty of land which are unoccupied. Still the original vegetation was grassland which was easy to clear for wheat growing.
- **Availability of large sums of capital to invest** in wheat growing such as buying farm chemicals, fertilizers and machines,
- **Availability of skilledlabour to work** on the wheat farms such as irrigation, application of fertilizers and harvesting. The farmers have long experience in the growing of wheat.
- **Availability of modern technology employed** in wheat farming involving the use of machines such as combine harvesters which harvest and thresh grain, seed discers for sowing the seeds, ploughs, tractors, hence high quality and quantity of output. There are also well established storage facilities called elevators, hence large quantities of grain are stored.
- **Availability of ready market for wheat** in various countries such as European countries, Asian countries, African countries, and South America.
- **Presence of developed / efficient transport network** for transporting wheat to markets such as railway and water transport. The main development of the prairies coincided with the construction of the Canadian Pacific Railway and the

Canadian National Railway with branch lines extending into the prairies. For example in the eastern route the St. Lawrence Seaway id used to export large quantities of wheat to Europe cheaply using water transport.

- **Increased/ intensive research** resulting into improved seed varieties which quick maturing, disease resistant and cold resistant.
- The **development of many processing factories** which provide market for the wheat produced, which encourages further production.
- **Supportive government policy towards wheat growing** such as giving farmers advice and carrying out market research.