S6 GEOGRAPHY

MULTI-PURPOSE RIVER PROJECTS

A multi-purpose river project is one which involves the use of a river as a resource to serve many purposes which lead to the economic development of the areas where they are located. Such aims of river dam projects include;

1. To generate Hydro Electric Power for industries and domestic use.
2. To control floods of the river with an aim of increasing land acreage along the river valley for farming practices.
3. To create manmade lakes or reservoirs behind the dams to provide water for irrigation purposes.
4. To enable fishing on the water reservoirs.
5. To help create employment opportunities for the population.
6. To develop transport and navigation systems on the manmade lakes.
7. To develop tourism on the manmade lakes.

In Africa, such river dam projects include;

1. The Aswan high dam on River Nile in Egypt.
2. Kariba dam on River Zambezi at the cross border between Zambia and Zimbabwe.
3. Inga and N'Zilo dams on River Congo and its tributary the Lualaba.
4. Cabora Bassa dam on River Zambezi in Mozambique.
5. Volta project (Akosombo dam) on River Volta in Ghana.
6. Kainji dam on River Niger in Nigeria.
7. Orange River project on River Orange in South Africa.
8. The Seven Forks Project on River Tana in Kenya.
9. Owen falls dam today known as Nalubaale on River Nile in Uganda.

In North America they include;

1. The Tennessee Valley Authority (T.V.A) on the River Tennessee and its tributaries in U.S.A
2. The St. Lawrence Seaway on River St. Lawrence bordering both U.S.A and Canada.
3. The Central Valley water transfer scheme in California.
4. The Appalachian Regional development Act or Appalachian plan.

In Asia they include;

1. The Yangtze-Kiang river basin project in China
2. Krishna river project in India.

The construction of river dam projects is dependent upon the following factors;

1. The existence of hard basement rocks for providing foundation for dam construction supporting the heavy dam walls against sinking.
2. The presence of a large permanent source of water especially rivers for water supply enough to rotate the turbines for power generation.
3. The presence of a deep narrow gorge offers a good site for construction of dams since it helps in reducing the risk of flooding of the surrounding areas through reducing the speed of the river flow from up stream.
4. The site should have a steep gradient for the river to flow very fast giving it force to be able to turn the turbines during power generation.
5. The area for dam construction must also possess natural waterfalls and rapids to provide enough force to turn the turbines encouraging the establishment of Hydro Electric Power plants.
6. The presence of a broad valley behind the dam wall allows the formation of man-made lakes which act as water reservoirs used for other purposes such as irrigation, fishing and navigation.
7. The presence of extensive land is key in dam construction for not only the site of the dam but also for other project activities such as irrigation, construction of transport routes and administration offices.
8. The presence of gentle relief allows the construction of transport routes, gravitational water flow for irrigation purposes and construction of administrative centres.
9. The presence of a positive government policy towards dam construction through providing the necessary infrastructure, capital and through provision of energy for industrial development such as bauxite at Tema in Ghana and in Egypt it provided electricity for industries and rural electrification as well as water for irrigation.
10. The availability of adequate capital provided either by government or multi-national companies or investors for dam construction, its maintenance and related infrastructure also favoured the establishment of the multi-purpose schemes. The St. Lawrence Seaway was funded by both U.S.A and Canada, the Aswan high dam by Russia, the Volta by the World Bank, U.S.A and United Kingdom; Cabora Bassa by South Africa.
11. The availability of adequate skilled and semi-skilled labour helped in the construction and maintenance of the projects. This was provided by the natives and skilled labour by the multi-national companies for example the Aswan high dam, the Russians provided the technical knowledge while Egyptians provided the semi-skilled labour.

12. Political stability within the countries where the schemes were established favoured their development. This is because it allows easy establishment of the schemes through attracting of investors.
13. The presence of ready market for agricultural produce and the power produced especially industries that consume a lot of power further favoured the establishment of the dams. The Kariba supported copper mining in the Zambian copper belt and Shaba Province in Zaire; Volta supplied the bauxite industries, aluminium at Port Tema and in the oil fields at Salt pond in Ghana. Aswan supplied the phosphate industries and aluminium plants in Cairo free zone; the Kainji led to industrial expansion in the North western part of the country and Niger.
14. The presence of well-developed transport and communication network especially roads and railways further favoured dam construction in that this eased movement of materials for dam construction as well as the labour force.
15. The availability of advanced technology used in dam construction favoured their easy construction and maintenance. In the St. Lawrence Seaway, this is evidenced in the canal construction to bypass rapids and falls such as the Niagara Falls and the building of the lock system to allow large ocean going ships sail through.
16. The research carried out as regards to establishment of best sites for dam construction and further favoured their establishment. This helped in proper planning, dam designs and maintenance of the dams.
17. The presence of fertile soils deposited by the rivers in form of silt supported the growth of a variety of crops necessitating irrigation farming on the schemes such as the Gezira Irrigation Scheme along the Nile in South Sudan.
18. Unfavourable climatic conditions such as hot temperatures in the arid and semi-arid regions necessitate irrigation farming for crop production hence the establishment of the schemes such as the Kainji in Nigeria and Aswan in Egypt.

CONTRIBUTIONS OF RIVER DAM PROJECTS

1. The control of river floods was realized by construction of dams which acted as water reservoirs increasing irrigated land and saving the loss of lives and property. Such dams constructed include the Aswan high dam along the Nile in Egypt, the Akosombo on River Volta reduced flooding in the low lying areas in Ghana, Kainji on the Niger in Nigeria, Inga and N'zilo dam on River Congo in Congo, Kariba on River Zambezi in Zambia and Zimbabwe, Cabora Bassa on River Zambezi in

Mozambique, Kindaruma dam (Seven forks dam) on River Tana in Kenya; Torquay, Kalkfontein on River Orange in South Africa, Norris dam, Fontana and Doughlas on River Tennessee in U.S.A (T.V.A).

2. The river dam projects are used to generate Hydro Electric Power for both industrial and domestic purposes. This saves the valuable foreign exchange which would be used to import other fuel resources such as coal and oil for thermal power. Kentucky dam on River Tennessee has promoted industrial development due to power generated. In Nigeria, it was distributed to the North and Southern parts of the country while some was exported to Benin and Niger; the Niagara Falls along the River St. Lawrence produced a lot of Hydro Electric Power for industries in the Great Lakes Region and along the River St. Lawrence.
3. The construction of river dams ensures permanent flow of water for irrigation purposes from the lakes built behind them. This increases in the area cultivated increasing both food and cash crop production. The countries became self-sufficient in food supply and earned foreign exchange from the export of the cash crops produced such as cotton and sugar in Egypt; sugarcane, maize, groundnuts and vegetables in the North of Volta; sugarcane growing at Bacita in Nigeria.
4. Fishing is carried out on the manmade lakes providing sources of food in form of proteins. Such lakes include Lake Nasser in Egypt, Lake Kariba in Zambia, Lake Volta in Ghana, Cabora Bassa in Mozambique, Lake Jebba (Kainji reservoir) in Nigeria and Fontana dam in U.S.A on the Tennessee Valley Authority.
5. The generated cheap Hydro Electric Power facilitated rapid development of industries which became sources of various industrial products as well as provided employment opportunities. These include the aluminium plants and fertilizers in Cairo free zone in Egypt, copper smelting in Zambia, aluminium smelting industries at Port Tema in Ghana. In Nigeria, they expanded to the North western part of the country and Niger. In Mozambique, iron and steel, textile production, aluminium smelting and cashew nut factories established near Moatize, along St. Lawrence and the Great Lakes, pulp and paper industries, chemical industries, iron and steel; on the Tennessee Valley Authority, chemical industries and fertilizer industries encouraged the growth of agriculture.
6. Employment opportunities were generated for a number of people through agricultural modernisation, construction of industries, production of Hydro Electric Power and in the transport sector earning income with which they improved their standards of living.
7. The construction of the river dam projects also led to improvement in inland waterways where the manmade lakes were used as means of transport, easing

movement of goods and services while river channels were dredged allowing vessels to sail through. Such inland water ways include Lake Nasser in Egypt, Lake Kariba in Zambia and Zimbabwe; in Ghana the Volta created a navigation route called the North-South shipping route between Kete Krachi in the North to Akosombo in the South; in Mozambique, it has improved as far upstream as Tete; in U.S.A, navigation improved from the source of river St. Lawrence to Lake Superior while on the T.V.A, navigation improved with the construction of bridges on the Tennessee River.

8. The projects have also acted as centres of tourism where the dams constructed, manmade lakes, waterfalls and sport fishing form tourist attractions earning the country's foreign exchange used in the development of other sectors of the economy. Lake Kariba is a substantial tourist attraction in both Zambia and Zimbabwe. In U.S.A, the lock system on the St. Lawrence Seaway gave the country a unique scenic feature while on the Tennessee Valley Authority, natural parks, planted forests and wildlife attracted tourists.
9. River dam projects are a source of foreign exchange from tourism and the exportation of agricultural produce such as cotton as well as power produced to neighbouring countries for example Nalubaale power is exported to Kenya, Rwanda and Tanzania; Aswan exports to Sudan; Volta to Benin, Togo, Cote D'ivoire; Kainji power to Benin and Niger; Cabora Bassa to South Africa.
10. They also act as sources of domestic revenue through taxation of workers, industries, the agricultural sector, from tourism, goods transported, electricity boards and ships sailing on the water bodies which is used to develop other sectors of the economy like the transport sector through construction of roads and railways.
11. They facilitate the development of towns and urban centres near and around the dams due to increase in population in search for jobs and the improved infrastructure such as schools and hospitals. Such towns include Aswan in Egypt; Accra, Kpandu, Kete Krachi in Ghana; Yelwa, Bacita, Jebba and Bussa in Nigeria; Cape Town, Oviston, Koffiefontein in South Africa; Tete, Moatize in Mozambique; Kafue in Zambia; Kolwezi and Matadi in Congo; Montreal along the seaway, Toronto, Kingston; Memphis, Knoxville, Nashville on the Tennessee Valley Authority.
12. They have facilitated the utilisation of other resources especially minerals due to improved transport systems and the cheap power produced leading to the growth of the mining industry and industrialization. In Ghana, the Volta project led to the mining of bauxite processed into aluminium; In Egypt, oil, iron ore and phosphates

into fertilizers; In Mozambique, coal at Moatize, iron ore and bauxite at Mt. Mlanje in Malawi; In Zambia, it facilitated copper cobalt, magnese mining and copper mining in the Shaba province in Congo; The Inga and N'Zilo dam encouraged copper mining in the Shaba province. The St. Lawrence Seaway encouraged extraction of iron ore from Mesabi ranges in U.S.A and Labrador in Canada, coal from Pennsylvania, limestone from the southern parts of U.S.A. In the Tennessee Valley Authority, coal was mined in Pittsburgh.

13. The river dams have also led to the development of infrastructure like schools, health centres, roads and railways connecting them to other areas such as in Egypt, a railway line was constructed from Cairo to Aswan; while in South Africa, canals like the Van der Kloof canal system from Kalkfontein dam to Johannesburg down to the Brak River valley and highways were constructed like the one connecting Cape Town to Johannesburg. In Zaire, the railway system connected the coastal areas to the dams and the copper mines. In U.S.A on the Tennessee Valley Authority, bridges were constructed across the Tennessee River and its tributaries while on the St. Lawrence Seaway, canals such as Welland canal to bypass the Niagara Falls and locks were constructed to ease transport.
14. The projects have also to the promotion of international relationships fostering increased trade against the countries especially where projects were jointly funded such as the Kariba dam project set up by Zimbabwe and Zambia; the Cabora Bassa jointly owned by Portugal and Mozambique but financed by South Africa; the St. Lawrence was jointly funded by U.S.A and Canada.
15. They have encouraged research especially into agriculture, industrialization and mining sectors improving the production and the quality of products. The Tennessee Valley Authority became a model for development promoting research, education and initiated other projects like the St. Lawrence Seaway.
16. Rural electrification has been possible encouraging people to engage in various economic activities improving their standards of living such as, on the Tennessee Valley Authority and in Egypt.

SHORTCOMINGS OF RIVER DAM PROJECTS

1. The establishment of river projects created large water reservoirs that left water stagnant in canals which encouraged the breeding of disease causing vectors especially snails causing Bilharzia and mosquitoes for Malaria.

2. The construction of dams led to the displacement of people from formerly inhabited areas. These had to be resettled elsewhere which was very expensive. In Egypt, people were displaced in the area covered by Lake Nasser; in Ghana over 80,000 people; in Mozambique, they were resettled around Moatize and Zobue. On the Tennessee Valley Authority they were displaced in an effort to establish forests and during the construction of Dorris dam.
3. Scenic beauty was destroyed during the construction of dams such as waterfalls, rapids, gorges, forests which affected the tourism industry lowering sources of foreign exchange and government revenue.
4. Environmental pollution of air, water and land was experienced during the construction and from industries established as well as creation of barren areas due to dumping of materials dug during construction of the canals.
5. Rivers which carried large quantities of silt deposited in the lower course of the rivers built up flood plains and deltas offering fertile land for farming and this was lost after dam construction as the silt settled behind the dams, the Kariba affected the delta of the Zambezi and Aswan the Nile Delta.
6. Some towns and villages were submerged during the construction of the river projects displacing a number of people such as the Wada Halfa by Lake Nasser in Egypt, Bussa in Nigeria and along the St. Lawrence River.
7. The construction of the dams further created problems in communication as they became barriers in river transport such as Lake Nasser in Egypt was shallow allowing only light cargo, Volta in Ghana became a communication barrier between the East and West of the country, besides being limited to light cargo due to silting of the river channels. In U.S.A, more than 50km of modern highways were destroyed during the construction of the seaway reducing transport network in the area.
8. Urbanization and industrialization created associated problems such as congestion, poor sanitation and high levels of unemployment due to population growth and mechanization of agriculture.
9. There were serious problems of soil erosion due to loss of silt deposits blocked by the dams leading to loss of farm land to the sea. For example, in the Nile delta, in Ghana, grazing land was lost in the area covered by the Kainji reservoir while on the Tennessee Valley Authority, soils became exhausted due to over use of the land and fertilizers.

NB: The above are general for river dam projects

RIVER DAM PROJECTS IN AFRICA

The Aswan High Dam in Egypt

The Aswan high dam is located on River Nile in Southern Egypt near the country's border with Sudan behind which is Lake Nasser the second largest manmade lake in Africa. It was funded by Russian Government which also provided the necessary skilled labour force. The building of the dam was out of the need to replace the old one which was not adequate in controlling the flow of the Nile as well as to produce enough Hydro Electric Power for use in industries. The Egyptians also provided the necessary labour and work on the dam was completed in 1970.

Problems faced

- Much of Lake Nasser's water is lost through evaporation due to the hot temperatures experienced which also caused the formation of saline soils making them unproductive.
- The brick industry suffered because silt which was used to make them was no longer available on the delta area, as this was deposited behind the dam.
- There was a decline in the fishing industry at the North coast due to silt deposits which no longer reached due to the dam construction. This deprived the Egyptians sources of food in form of protein.

The Volta project in Ghana

The Volta river project was one of the very first multi-purpose river projects in Africa. Two major dams were constructed under this project that is the Kpong and Akosombo dams. Construction of the Akosombo began in 1963 and was completed in 1966. It was the president of Ghana by then, Dr. Nkwame Nkurumah who convinced the World Bank, U.S.A and the United Kingdom to finance the project.

Benefit

- Oil imports for thermal electricity were reduced saving the country's foreign exchange that was used in developing other sectors of the economy.

Problems

- The Hydro Electric Power produced was very expensive both to the locals and power importers due to price agreements which supplied large companies with large uses of power such as the Valco Smelting Company.
- Drought conditions reduced the lake levels hence affecting power output and the usefulness of Lake Volta for navigation.
- The fertile soils carried by River Volta were submerged and this limited available land for agriculture affecting agricultural production.

The Kainji project in Nigeria

The Kainji dam is located on River Niger at a place called Bussa in the North West of Nigeria. The dam was opened in 1969 in the very remote part with sparse population and poorly developed transport network. Behind the dam is the Kainji reservoir which is largely used for fishing. There is now a great degree of flood control together with irrigation facilities.

Problems

- There is a high rate of salination due to high evaporation rates and this has made the soils infertile and the water salty.
- There was loss of grazing land which was covered by the Kainji reservoir.
- Constant dredging is required to remove the silt deposits and this is very expensive.

The Orange River project

This is an extensive scheme established on River Orange and its tributaries in Cape Province in South Africa. It was started in 1962 and was completed in the 1990's. It comprises of several dams where the major ones include Torquay dam, P.K. Le Roux dam, Kalkfontein dam and Verwoerd dam.

The Cabora Bassa project

The Cabora Bassa dam is located on River Zambezi in Mozambique at a place called Quebra Bassa gorge which was narrow and favoured dam construction. The project started in 1969 and the first phase was completed in 1975. It was financed by South Africa although it is jointly owned by Portugal (80%) and Mozambique (20%). At present, South

Africa takes much of the power that is produced. The construction of the dam had political attachments where the involved parties wanted to have a greater influence in the country.

Benefit

- Piped water from the project has been enjoyed by the people and it has also been used in developing cattle ranching and afforestation projects in Malawi.

Problems

- It has political interference from South Africa and Portugal.
- There was loss of power to countries especially South Africa that took much of the power produced.

The Kariba dam project

The Kariba dam is found on River Zambezi at the border of Zambia and Zimbabwe. The site was chosen because it was narrow and had a hard basement rock for dam construction. It was constructed out of the need to control the flood waters of the Zambezi as well as to produce power that was needed in the Zambian copper belt for smelting. Zambia takes 51% while Zimbabwe takes 49%.

The Inga and N'Zilo dam project

The Inga dam produces about 1200 megawatts from the rushing waters of the Inga falls near Matadi on River Zaire. It supplies power to kinshasha and the coastal region. The N'Zilo dam on the other hand is found on River Lualaba, a tributary of River Zaire at Le Marinel in Shaba Province where it mainly produces power for the copper mines.

THE TENNESSEE VALLEY AUTHORITY (T.V.A)

The Tennessee Valley Project was established to rehabilitate the badly damaged hilly landscape as a result of the large population clearing most of the forests for settlement, agriculture and it was established in 1933 to solve the problems affecting people in the Tennessee Valley region of U.S.A. The states covered by the Tennessee basin include; Tennessee, Kentucky, Mississippi, North and South Carolina, Alabama, Georgia and West Virginia.

Problems faced by the people of T.V.A before 1933

1. There was flooding in the river valley due to serious siltation making it shallow destroying buildings, machinery, farmland and people's lives such as River Mississippi and Tennessee.
2. There was severe soil erosion due to deforestation, poor farming methods, flooding, hilly nature of the landscape and heavy rainfall on unprotected lands.
3. The wide spread water-borne diseases such as malaria and bilharzia due to stagnant water that provided breeding grounds for the disease causing vectors i.e. snails and mosquitoes
4. There were poor housing facilities for the local population because people's homes were destroyed during floods
5. There was wide spread poverty and unemployment due to limited economic activities like mining ,agriculture and industrialization
6. Famine was experienced since farmland had been destroyed during floods leading to deaths
7. There was poor transport network due to constant flooding and the area was cut off from others
8. There was limited electricity that put development of the area at a slow pace
9. Deforestation on the steep slopes accelerated soil erosion and increased siltation of the rivers
10. There were also poor methods of farming used like cultivation up and down the slope that increased soil erosion.

ST. LAWRENCE SEAWAY (POWER PROJECT)

St. Lawrence Sea way is part of St. Lawrence River which connects the great lakes region (Lake Superior) to the Atlantic Ocean on the eastern part of North America. It is a sea route which was constructed to ease and accelerate quick transportation of commodities through creation of a deep navigable water between Montreal and Lake Ontario. Due to some problems, the seaway construction was limited not until 1954 when the construction of this joint project was undertaken by both Canada and USA.

Problems /shipping hazards faced before construction of the seaway (conditions which led to the construction of the seaway)

1. Many waterfalls and rapids on river ST. Lawrence like Niagara Falls and Sault St. Marie made navigation impossible.
2. Existence of thousands of small rocky islands restricted smooth flow of large ocean going vessels.
3. The seasonal flooding needed to be controlled using dams and locks to regulate the flow of water
4. Seasonal blockage of the seaway by ice during winter needed to be broken to minimize the piling of goods and navigation delays.
5. Some parts of river St. Lawrence were narrow and needed widening for all vessels to sail through.
6. Some parts of the seaway were shallow therefore needed to be deepened.
7. Silting of the seaway reduced the depth of water on river St. Lawrence.
8. The great lakes were at different altitudinal levels i.e. Lake Superior at 183m, Huron at 174m, and Erie at 177m, and Ontario at 75m above sea level and so the need to regulate the level of water by building locks.
9. Small ships would face the occurrence of fog during summer and this would result into accidents at Kingston and Montreal.
10. There were numerous small lakes between Montreal and Ontario about 22 in number which made navigation difficult.
11. The need to open up the interior of north America by exploiting resources such as extraction of iron ore at Labrador , wheat growing in the prairies of Canada etc.(condition not problem).

Revision Questions

1. Giving specific examples, assess the contribution of river dam projects in the economic development of Africa.
2. Assess the factors which favoured the establishment of the multi-purpose river projects in either Ghana or Egypt.
3. With reference to either the Tennessee Valley Authority project or the Cabora Bassa, evaluate its contributions to the development of the region in which it is located.
4. To what extent have multi-purpose river projects benefited the countries in which they are located?
5. Assess the shortcomings of river dam projects in either Africa or North America.

END